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THE CANADIAN JOURNAL.

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NARCOTIC USAGES AND SUPERSTITIONS OF THE OLD AND NEW WORLD.

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Read before the Canadian Institute, 31st January, 1857.

In attempting to determine the elements on which to base a system of classification of the diverse types or varieties of man, there are frequently one or two prominent characteristics which, alike among ancient and modern races, appear to supply at least convenient tests of classification, while some are deserving of special consideration as indicators of more comprehensive and far-reaching principles. The ancient epithet "barbarian," had its origin in the recognition of this idea; and we still apply that of "woad-died" to the old Briton as the fittest which our knowledge of him supplies. With the Jew and his semitic congeners, the rite of circumcision is a peculiarly distinctive element of isolation, though carried by Islamism, with the Arabic tongue, far beyond their ethnic pale. Brahminism, Buddhism, Parseeism, Sabaism, Fetisism, and even Thuggism, each suffice to supply some elements of classification. The cannibal New Zealander, the large footed Patagonian, the big lipped Babeen, the flat-headed Chinook, the woolly-haired Negro, the clucking Hottentot, and the boomerang-armed Australian, has each his special feature, or peculiar symbol, more or less fitly assigned to him; and not less, but more distinctly characteristic than any of these

are the scalp war-trophy, and the peace-pipe of the American Indian, —the characteristics not of a tribe, or a nation, but of a whole continent. Of the indigenous uniqueness of the former of these there is no question. It may not be altogether unprofitable to reconsider the purely American origin of the usages connected with the latter, on which doubts have been repeatedly cast, and more especially by recent writers, when considering the inquiry from very diverse points of view.

Among the native products of the American continent, there is none which so strikingly distinguishes it as the tobacco plant, and the purposes to which its leaf is applied; for even were it proved that the use of it as a narcotic, and the practise of smoking its burning leaf, had originated independently in the old world, the sacred institution of the peace-pipe must still remain as the peculiar characteristic of the Red Indian of America. Professor Johnston, in his "Chemistry of Common Life," remarks with reference to this and others of the narcotics peculiar to the new world:—"The Aborigines of Central America rolled up the tobacco leaf, and dreamed away their lives in smoky reveries, ages before Columbus was born, or the colonists of Sir Walter Raleigh brought it within the precincts of the Elizabethean Court. The cocoa leaf, now the comfort and strength of the Peruvian muletero, was chewed as he does it, in far remote times, and among the same mountains, by the Indian natives whose blood he inherits." The former of these narcotics, however, it is scarcely necessary to say, was not confined, within any period known to us, to central America, though its name of tobacco, —derived by some from the Haïtian *tambaku*, and by others from *Tabaco*, a province of Yucatan, where the Spaniards are affirmed to have first met with it,—appears to have been the native term for the pipe, and not for the plant, which was called *kohiba*.

So far as we can now infer from the evidence furnished by native arts and relics connected with the use of the tobacco plant, it seems to have been as familiar to most of the ancient tribes of the north west, and the Aborigines of our Canadian forests, as to those of the American tropics, of which the *Nicotiana Tabacum* is believed to be a native. No such remarkable depositories indeed have been found to the north of the great chain of lakes, as those disclosed to the explorers of the tumuli of "Mound City," in the Scioto valley, Ohio, from a single one of which, nearly two hundred pipes were taken; most of them composed of a hard red porphyritic stone, with their bowls elaborately carved in miniature figures of animals, birds,

reptiles, &c., executed with great skill and fidelity to nature.* But though not found in such numbers, sufficient examples of this class of relics occur within the Canadian frontier to show the contemporaneous practice of the same arts and customs in this northern region, or to prove such an intercourse with the pipe-sculptors of more southern latitudes, as is assumed in the case of the "Mound Builders," by writers to whom any remote and undefined source ever seems more probable than the one under consideration. Among various examples of such Canadian relics in my own possession are two stone pipe-heads found on the shores of Lake Simcoe. One of these, formed of a dark steatite, though imperfect, exhibits in its carving—a lizard climbing up the bowl of the pipe, with the underside of its lower-jaw ingeniously cut into a human countenance peering over the pipe bowl at the face of the smoker—the same curious imitative art of the native sculptor, as those engraved by Messrs. Squire and Davis, from the ancient mounds of the Mississippi valley. The other is decorated with a human head, marked by broad cheek-bones, and large ears, and wearing a flat and slightly projecting head dress. The material in which the latter is carved is worthy of notice, as suggestive of its pertaining to the locality where it was found. It is a highly silicious limestone, such as abounds on the shores of the neighbouring Lake Couchiching, and which from its great hardness was little likely to be chosen by the pipe sculptor as the material on which to exercise his artistic skill, unless in such a locality as this, where his choice lay between the hard, but close grained limestone, and the still more intractable crystalline rocks of the same region. Canadian examples of pipe-sculpture, in a great variety of forms, executed in the favorite and easily wrought red pipe-stone of the *Coteau des Prairies*, also occur; but these are generally supposed to belong to a more recent period, and differ essentially in their style of art from the pipes of the mound builders, worked in granite, porphyry, and limestone, as well as in the steatites, and other varieties of the more easily wrought stones which admit, like the red pipe stone, of the elaborate carving and high degree of finish most frequently aimed at by them. In addition to those, another class of pipes, of ruder workmanship in clay, and ornamented for the most part, only with incised chevron and other conventional patterns, exhibiting no traces of imitative art, are of frequent occurrence within the Canadian frontiers; and to these I propose to refer more minutely before closing this paper, as objects

*Smithsonian Contributions to Knowledge. Vol. I. p. 152.

possessing some value in relation to the history of the singular native custom for which such implements were constructed, and to its early practice in Europe. Meanwhile it may be noted that the terms existing in the widely diversified native vocabularies are irreconcileable with the idea of the introduction of tobacco among the northern tribes of the American continent as a recently borrowed novelty. We learn from the narative of Father Francisco Creuxio, that the Jesuit missionaries of the 17th century, found tobacco in abundant use among the Indians of Canada. So early as 1629 he describes the Hurons as smoking immoderately the dried leaves and stalks of the nicotian plant commonly called *tobacco* or *petune;* and such was their addiction to the practice that one of their tribes in Upper Canada, received the designation of the *Petunians*, or smokers, from the latter name for the favourite weed.* This term appears to be of Floridian origin, and was perhaps introduced by the missionaries themselves from the southern vocabulary. But the the Chippeway name for tobacco is *asamah*, seemingly, as Dr. O'Meara—now, and for many years resident missionary among the Indians of the Manitouanin Islands,—assures me, a native radical having no other significance or application. So also the Chippeways have the word *butta* to express smoke, as the smoke of a fire; but for tobacco fumes they employ a distinct term: *bucwanay*, literally: "it smokes," the *puckwana* of Longfellow's "Hiawatha." *Pwahgun* is a "tobacco pipe;" and with the peculiar power of compound words and inflection, so remarkable in the languages of tribes so rude as those of the American forests, we have from this root: *nipwahguneka*: "I make pipes," *kipwahguneka:* "thou makest pipes," *pwahgunea:* "he makes pipes, &c.," so also, *nisuggaswa:* "I smoke a pipe," *kisuggaswa:* "thou smokest," *suggaswa:* "he smokes." While therefore. Europe has borrowed the name of the Indian weed from that portion of the new world first visited by its Genoese discoverer, the language of the great Algonquin nation exhibits an ancient and entirely independent northern vocabulary associated with the use of tobacco, betraying none of the traces of compounded descriptive terms so discernible in all those applied to objects of European

*"Ad insaniam quoque adamant Fumum ex siccatis foliis stirpis superiore seculo in galliam illatæ: (ab eius qui intulit nomine *nicotiam* placuit appellare: nunc *tabacum* seu *petunum* vulgo vocant: atque inde nomen apud Gallos invenit, quæ inter Canadenses populos Natio Petuniorum dicitur) eo, quod cerebri exsiccandi vim miram habet, uti per navigationes Europæi consueverant primum, nunc vel ab eis vel a Canadensibus res translata ad crapulam. Hi certe ne passum quidem progrediantur sine tubo longiusculo, quo ejusmodi fumos hauriunt, ac fere ad temulentiam; pertentant enim cerebrum, ebrietatemque demum inducunt, vini instar." "*Historiæ Canadensis, seu Novæ Franciæ.*" Paris: 1664. Page 78.

origin. The practice of smoking narcotics, is interwoven with all their habits, so that they even reckon time by pipes, using such word sentences as *ningopwahgun*, "I was one pipe [of time] about it".

In the Old World most of the ideas connected with the tobacco pipe are homely and prosaic enough: and though we associate the chibouk with the poetical reveries of the oriental day-dreamer, and the hookah with the pleasant fancies of the Anglo-Indian reposing in the shade of his bungaloose: nevertheless, the tobacco pipe constitutes the peculiar and most characteristic symbol of America, intimately interwoven with the rites and superstitions, and with the relics of ancient customs and historical traditions of the Aborigines of this New World. If Europe borrowed from it the first knowledge of its prized narcotic, the gift was received unaccompanied by any of the sacred or peculiar virtues which the Red Indian still attaches to it as the symbol of hospitality and amicable intercourse; and Longfellow, accordingly, with no less poetic vigor, than fitness, opens his "Song of Hiawatha" with the institution of "the peace-pipe," by the Great Spirit, the master of life. With all the unpoetical associations which are inseparable from the modern uses of the nicotian weed, it required the inspiration of true poetry to redeem it from its base ideal. But this the American poet has accomplished fully, and with the boldest figures. The Master of Life descends on the mountains of the Prairie, breaks a fragment from the red stone of the quarry, and fashioning it with curious art into a figured pipe-head, he fills it with the bark of the red willow, chafes the forest into flame with the tempest of his breath, and kindling it:

Erect upon the mountains
Gitche Manito, the mighty,
Smoked the calumet, the peace-pipe,
As a signal to the nations.
And the smoke rose slowly, slowly,
Through the tranquil air of morning,
First a single line of darkness,
Then a denser, bluer vapor,
Then a snow-white cloud unfolding,
Like the tree tops of the forest,
Ever rising, rising, rising,
Till it touched the top of heaven,
Till it broke against the heaven
And rolled onward all around it.

And the tribes of the ancient Aborigines gathering from river, lake, and prairie, assemble at the divine summons, listen to the warnings and promises with which the Great Spirit seeks to guide them;

and this done, and the warriors having buried their war clubs, they *smoke their first peace-pipe, and depart:*

> While the Master of Life, ascending,
> Through the opening of cloud-curtains,
> Through the doorways of the heaven,
> Vanished from before their faces,
> In the smoke that rolled around him,
> The pukwana of the peace pipe!

It is no mean triumph of the poet thus to redeem from associations, not only prosaic, but even offensive, a custom which so peculiarly pertains to the usages and the rites of this continent from the remotest times of which its historic memorials furnish any trace; and which was no sooner practically introduced to the knowledge of the old world, than that royal pedant, king James, directed against it his world-famous "Counterblast to Tobacco," *describing its use as "a custom loathesome to the eye, hateful to* the nose, harmful to the brain, dangerous to the lungs, and in the black stinking fume thereof, nearest resembling the horrible stygian smoke of the pit that is bottomless!"

The history of the custom thus dignified by the assaults of royalty, and against certain uses of which the supreme pontiff, Urban, VIII., fulminated the thunders of the church, has attracted considerable attention in modern times on various grounds. In their relations to physiology the use and effects of narcotics claim an important consideration; and the almost universal diffusion of tobacco in modern times, accompanied with its peculiar mode of enjoyment, so generally adopted by the most diverse tribes and nations in every quarter of the globe, give its history a preeminence in any such inquiry. The questions as to whether the practice of smoking narcotics, or even the use and peculiar properties of tobacco, were known to the old world prior to the discovery of America, have accordingly repeatedly excited discussion; though it has not been always remembered that the inquiry as to the indigenous character of certain varieties of the tobacco plant in the old world, and even as to the use of such a narcotic, involve questions quite distinct from that of the origin of the very peculiar mode of partaking of the exhilerating or intoxicating effects of various narcotics by inhaling their burning fumes through a pipe.

The green tobacco, *nicotiana rustica*, cultivated in Thibet, western China, northern India, and Syria, is a different species from the American plant; and while it is affirmed by some to have been

brought from America, and even the precise date of 1570, is assigned for its importation into Britain, high authorities in Botany are still found to maintain the indigenous character of the *nicotiana rustica*, in some parts of the old world, as in northern India, where it is stated to grow wild. DuWalde, (1793.) speaks of tobacco as one of the natural productions of Formosa, whence it was largely imported by the Chinese; and Savary, Olearius, Chardin, and other writers, are all quoted* to show that the *nicotiana Persica*, which furnishes the famous shiraz tobacco, is not only indigenous to Persia, (an opinion favoured by high authorities in botany,) but that it was used for smoking from very early times. That all the varieties of the *Nicotiana* are not confined to the new world is unquestionable. Of some fifty-eight admitted species, the great majority are indeed American, but a few belong to the newer world of Australia, besides those believed to be indigenous to Asia. It is not surprising therefore, that after all the attention which this subject has latterly, on various accounts, attracted, writers should be found to maintain the opinion that the use of tobacco as a narcotic was known and practised by the Asiatics, prior to the discovery of America. The oriental use of tobacco may indeed be carried back to an era old enough to satisfy the keenest stickler for the antiquity of the practice, if he is not too nice as to his authorities. Dr. Yates in his *Travels in Egypt*, describes a painting which he saw on one of the tombs at Thebes, containing the representation of a smoking party. But this is modern compared with a record said to exist in the works of the early fathers, and, at any rate, preserved as an old tradition of the Greek Church, which ascribes the inebriation of the patriarch Noah to the temptation of the Devil by means of tobacco; so that King James was not, after all, without authority for the black stygian parentage he assigns to its fumes! Professor Johnston—who marshalls various authorities on the Asiatic use of tobacco for smoking, prior to the discovery of America, without venturing on any very definite opinion of his own,—quotes Pallas as arguing in favour of the antiquity of the practice from its extensive prevalence in Asia, and especially in China. "Amongst the Chinese," says this writer, "and among the Mongol tribes who had the most intercourse with them, the custom of smoking is so general, so frequent, and has become so indispensable a luxury; the tobacco-purse affixed to their belt so necessary an article of dress; the form of the pipes, from which the Dutch seem to have taken the model of theirs, so original;

* A. C. M. Exeter. Notes and Queries. Vol. II. p. 154.

and lastly, the preparation of the yellow leaves, which are merely rubbed to pieces, and then put into the pipe, so peculiar, that they could not possibly derive all this from America by way of Europe, especially as India, where the practice is not so general, intervenes between Persia and China." But the opinions of Dr. Meyen, formerly Professor of Botany in the University of Berlin, are worthy of still greater weight, set forth as they are, alike on Archæological and Botanical grounds. In his "*Grundriss der Pflanzengeographie*," or "Outlines of the Geography of Plants," recently translated for the Ray Society, he observes: "It has long been the opinion, that the use of tobacco, as well as its culture, was peculiar to the people of America, but this is now proved to be incorrect by our present more exact acquaintance with China and India The consumption of tobacco in the Chinese empire is of immense extent, and the practice seems to be of great antiquity, for on very old sculptures I have observed the very same tobacco pipes which are still used. Besides we now know the plant which furnishes the Chinese tobacco, it is even said to grow wild in the East Indies. It is certain that this tobacco plant of eastern Asia is quite different from the American species. The genus Nicotiana, generally speaking, belongs to the warmer zones, yet a few species of it have a very extensive area, and a great power of resisting the influence of climate, for they can be grown under the equator, and in the temperate zone, even far above 55° north latitude, where the mean summer heat is equal to 15.87° Cels. The southern polar limit for the culture of tobacco is not exactly known, but it seems to extend to the 40th degree of latitude, for in south America tobacco is cultivated at Conception, and in New Zealand enough is grown for the consumption there."*

To India, then, Dr. Meyen inclines, with others, to refer the native habitat of an Asiatic tobacco, which he thus affirms to have been in use by the Chinese as a narcotic, and consumed by inhaling its smoke through a pipe, altogether independent of the introduction of this luxury to Europe by the discoverers of America in the fifteenth century. While the Turk still chews the opium in which he so freely indulges, the Chinese, and also the Malays smoke it, most frequently using as a pipe a bamboo, which serves also for a walking stick, and requires a very slight operation to convert it into an opium pipe. The Chinese opium smoker secures the utmost effects of that powerful narcotic by swallowing the smoke; and notwithstanding this mode of using the narcotic derived from the poppy is

* Meyen's Outlines of the Geography of Plants. Ray Society. Page 361.

acknowledged to be of comparatively recent introduction, when we call to remembrance that that strange people preceeded Europe in wood engraving, printing, the compass, and others of the most important of modern discoveries, there would be no just cause of surprise should it be proved that to them also we must ascribe such merit as pertains to the initiative in the uses to which tobacco is applied. Such evidence, however, must not be too hastily accepted; for a profoundly scientific botanist, though an altogether trustworthy authority in relation to the habitat of the plant, may be very little qualified to pronounce an opinion on the value of such Chinese monumental evidence as Dr. Meyen loosely refers to under the designation of "very old sculptures."

The Koran has been appealed to, and its modern versions even furnish the American name. A traditional prophecy of Mahomet is also quoted by Sale, which while it contradicts the assumed existence of tobacco in his time, foretells that: "in the latter days there shall be men bearing the name of moslem, but not really such, and they shall smoke a certain weed which shall be called tobacco!"* If the prophecy did not bear on the face of it such unmistakeable evidence of being the invention of some moslem ascetic of later times, it would furnish no bad proof of Mahomet's right to the title of "the false prophet," for Sale quotes in the same preliminary discourse to his edition of the Koran, the Persian proverb "coffee without tobacco is meat without salt." An appeal to the graphic pictures of eastern social habits in the "Arabian Nights' Entertainments," furnishes strong evidence against the ancient knowledge of a custom now so universal; and in so far as such negative evidence may be esteemed of any value, the pages of our own Shakespeare seem equally conclusive, though, as will be seen, the practice had not only been introduced into England, but was becoming familiarily known before his death.

The "drinking tobacco," as smoking was at first termed, from the mode of partaking of its fumes then practiced, finds apt illustration in the language of our great dramatist. The poet, in "Timon," speaks of the sycophantish followers of the noble Athenian "through him drinking free air;" in the "Tempest" Ariel, eager in her master's service, exclaims: "I drink the air before me," and in "Antony and Cleopatra," the Egyptian Queen thus wrathfully pictures the indignities of a Roman triumph:—

* Sale's Koran 8vo. Lond. 1812. p. 164.

"Mechanic slaves
With greasy aprons, rules, and hammers shall
Uplift us to the view; in their thick breaths,
Rank of g. ss diet, shall we be enclouded,
And forced to *drink their vapour*."

The references to drinking usages, moreover, are scattered plentifully through all his dramas, and intensified by the most homely and familiar illustrations, but without a single reference indicative of smoking usages; though various passages occur strikingly suggestive of such allusions, had the practice been as familiar as it became in those of younger contemporaries who survived him. In "Much Ado About Nothing," Borachio tells Don John: "being entertained for a perfumer, as I was smoking a musty room, comes in the Prince and Claudio hand in hand, in sad conference." (Act I. Scene III.) Again in "Romeo and Juliet," Romeo thus speaks of brawling love:—

"O anything, of nothing first created!
O heavy lightness! Serious vanity!
Mis-shapen chaos of well seeming forms!
Feather of lead, *bright smoke, cold fire*, sick health!"

And again in the same scene he exclaims:—

"Love is a smoke made with the fume of sighs."

If, as Malone infers from a satire of Sir John Davis, and other early notices, tobacco was smoked by the wits and gallants on the English stage, before the close of the sixteenth century, it is difficult to evade the conclusion that such similes may have derived their force from the tobacco fumes which rose visibly in sight of the audience. These allusions and similes, however, have perhaps more resemblance in verbal form, than in embodied fancy, to the ideas now suggested; and may be deemed, after all, sufficiently independent of the smoker's "cloud" to involve no necessary association with it, even had such been familiar to the poet; but it seems to me scarcely possible that Shakespeare could have retained unmodified the language of Lady Macbeth, in the conclusion of the first act of "Macbeth,"—one of the productions of his later years,—had the fumes of tobacco been so associated with wine and wassail, as they were within a very few years after the date of that wonderful drama. Encouraging her husband to "screw his courage to the sticking place," she says:—

"His two chamberlains
Will I with wine and wassail so convince,
That memory, the warder of the brain,
Shall be a fume, and the receipt of reason
A limbeck only."

It may be, indeed, that the recently acquired knowledge of tobacco and its *fumes*, in Europe, sufficed to prevent the poet introducing such an anachronism amid scenes of ancient Scottish story. Nevertheless, a hypercritical adherence to archæological proprieties never interferes with the graphic touches which give life to every scene of the Shakespearean drama; and that the mere anachronism would not of itself have deterred Shakespeare from an allusion to tobacco, if its unfamiliar novelty did not render it unsuitable for his purpose, may be inferred from liberties of a like kind which have proved fertile texts to many a verbal critic. The soldier's simile i the same tragedy, (Act I., Scene II.,) where he compares the roy.l captains, Macbeth and Banquo, to "*cannon*: overcharged with double cracks;" or Sweno of Norway, disbursing his ten thousand *dollars* at Saint Colmes Inch; (Act I., Scene III.,) or Menenius, in "Coriolanus," (Act V., Scene I.,) with his:—

> "Pair of tribunes that have rack'd for Rome
> To make *coals* cheap;"

or a hundred similar instances, familiar to the readers of our great dramatist, would all seem equally inadmissible were they not already there. It seems to me, however, that the association of tobacco "fumes" with "wine and wassail," a very few years later than the production of "Macbeth," would have prevented the use of the former term, in such an association in its less popular sense, as is done in that drama. The allusion there is to the rising of *fumes* of vapour, in distillation; but Bacon, who, in his thirty-third essay: "Of Plantations," speaks of the tobacco of Virginia as one of the "commodities which the soil where the plantation is, doth naturally yield," elsewhere recommends "that it were good to try *the taking of fumes by pipes, as they do in tobacco*, of other things to dry and comfort." Here therefore, we perceive the adoption of Shakespear's term "*fumes*," for the smoke of tobacco within a very few years after the production of "Macbeth," a work assigned by nearly all his best editors to the reign of James I.

It is curious indeed to note how nearly we can approximate to a precise date for the literary recognition of the "Indian weed," which has been such a favourite of the student in later times. Warner, who wrote his once popular "Albion's England," in 1586, added to it three additional books in 1606, in the first of which (Book XIV. chap. 91.), a critical imp inveighs against the decline of the manners of the good old times; and among other symptoms of decay, misses the smoke of the old manor-chimney, which once gave evidence of

the hospitable hearth within But, in lieu of this he notes a more perplexing smoke which "proceeds from nostrils and from throats of ladies, lords, and silly grooms," and exclaims astonished:—

"Great Belzabub! can all spit fire as well as thine?"

But his fellow Incubus allays his fears by telling him that this novelty:—

"Was an Indian weed,
That fumed away more wealth than would a many thousands feed."

Tobacco, therefore, was not only in use, but already indulged in to an extravagant excess, in Shakespeare's later years. Though unnamed in his works, it repeatedly occurs in those of Decker, Middleton, and others of the early minor dramatists; and still more familiarily in those of Ben Jonson, Beaumont and Fletcher, and others of later date. In Middleton's "Roaring Girl," produced in 1611, five years before the death of Shakespeare, and peculiarly valuable from the lively, though sufficiently coarse picture it furnishes of London manners in his day, we learn that "a pipe of smoak" was to be purchased for sixpence. In Ben Jonson's "Alchemist," of the same date, "Drugger, the tobacco man," plays a part; and a similar character figures among the *dramatis personæ* of Beaumont and Fletcher's "Scornful Lady." Moreover, the earliest of these notices not only refers to the costliness of the luxurious weed, with a pipe of which, Drugger bribes the Alchemist; but the allusions are no less distinct to the adulterations practised even at so early a date, and which were no doubt hinted at by Jonson in the name of his tobacconist. "Doctor" exclaims Face, the servitor, to Subtle the Alchemist, when introducing Abel Drugger to his favourable notice, (Act. I., Scene I.):—

"Doctor, do you hear!
This is my friend Abel, an honest fellow;
He lets me have good tobacco, and he does not
Sophisticate it with sack-lees or oil,
Nor washes it in muscadel and grains,
Nor buries it in gravel under ground,
Wrapp'd up in greasy leather, or piss'd clouts,
But keeps it in fine lily pots, that open'd
Smell like conserves of roses, or French beans."

It is obvious here that, even thus early, Ben Jonson's allusions to the favourite "weed" are not to an unfamiliar novelty; though both with him, and in the later works of Beaumont and Fletcher, it is referred to invariably as a costly luxury. "Tis' good tobacco, this!" exclaims Subtle, "what is't an ounce?" and Savil, the steward, in

"The Scornful Lady" speaks ironically of "wealthy tobacco-merchants, that set up with one ounce, and break for three!" It shares indeed, with gambling, drinking, and other vices, in helping on the young spendthrifts of the drama to speedy ruin. In "Bartholomew Fair," (Act II., Scene VI,) the puritan Justice, Overdo, warns against "lusting after that tawny weed tobacco, whose complexion is like the Indian's that vents it!" and after berating it in terms scarcely quotable, he reckons the novice's outlay at "thirty pounds a week in bottle-ale, forty in tobacco!" So, too, in Beaumont and Fletcher's "Wit without Money," Valentine "a gallant that will not be persuaded to keep his estate," picturing to his faithless rivals in his love suit, the beggary that awaits them, sums up a list of the slights of fortune with: "English tobacco, with half-pipes, nor in half a year once burnt." More quaint is the allusion with which Robin Goodfellow, in "the Shepherd's Dream." (1612.) fixes the introduction of the novel luxury, where reluctantly admitting the benefits of the Reformation, he bewails the exit of popery and the introduction of tobacco as concurrent events!

From this date the allusions to the use and abuse of the Indian weed abound, and leave no room to question the wide diffusion of the practice of smoking in the seventeenth century. Burton, in his "Anatomy of Melancholy," (1621), prescribes tobacco as "a sovereign remedy to all diseases, but one commonly abused by most men;" while in Zacharie Boyd's "Last Battell of the Soule in Death," printed at Edinburgh in 1629, the quaint old divine speaks of the backslider as one with whom "the wyne pint and tobacca pype with sneesing pouder, provoking sneuele, were his heartes delight!"

The term employed by Zacharie Boyd for snuff, is still in the abreviated form of "*sneeshin*," the popular Scottish name for this preparation of tobacco. There are not wanting, however, abundant proofs of the ancient use of aromatic powders as snuff, long before the introduction of tobacco to Europe. One familiar passage from Shakespeare will occur to all; where Hotspur describing the fopling lord "perfumed like a milliner," adds:—

> "And 'twixt his finger and his thumb he held
> A pouncet-box, which ever and anon
> He gave his nose, and took't away again;
> Who, therewith angry, when it next came there
> Took it in snuff."

The illustration which this passage affords of the ancient use of pungent and aromatic powders in one manner in which tobacco has been so extensively employed since its introduction into Europe,

adds greatly to the force of the argument against any older employment of narcotics in the way of inhaling their fumes, based on the absence of earlier notices of so remarkable a custom. The use indeed of various narcotics, such as opium, bang: the leaf of the hemp plant, and the betel-nut, the fruit of the Areca palm, by the south-eastern Asiatics appears to be traceable to a remote antiquity. Northern Europe has, in like manner, had its ledum and hop, and in Siberia, its *amanita muscaria*, or narcotic fungus. But the evidence fails us which should prove that in the case of the pipe, as in that of the pouncet-box, the tobacco only came as a substitute for older aromatics, or narcotics similarily employed. Nor when the evidence is looked into more carefully, are such direct proofs wanting, as suggest a comparatively recent origin, in so far as both Europe and Asia are concerned, to the peculiar mode of enjoying such narcotics by inhaling their fumes through a pipe attached to the bowl in which they are subjected to a slow process of combustion.

When engaged, some years since, in the preparation of a work on Scottish Archæology, my attention was directed, among various minor antiquities of the British Islands, to a curious class of relics popularly known in Scotland by the name of *Celtic* or *Elfin pipes*, in the north of England as *Fairy pipes*, and in Ireland where they are more abundant, as *Danes' pipes*. These are formed of white clay, with some resemblance to the form of the modern clay pipe, but variously ornamented, and invariably of a very small size compared with any tobacco-pipe in modern use. Similar relics have since been observed in England, found under circumstances calculated, like those attending the discovery of some of the Scottish examples to suggest an antiquity for them long anterior to the introduction of America's favourite narcotic, with what King James, on finding its taxability, learned to designate its "precious stink!' The most remarkable of such discoveries are those in which pipes of this primitive form have been found on Roman sites along side of genuine Roman remains. Such was the case, on the exposure, in 1852, of part of the ancient Roman wall of London, at the Tower postern; and, along with masonry and tiles, of undoubted Roman workmanship, a mutilated sepulchral inscription was found possessed of peculiar interest from supplying the only example, so far as I am aware, in Britain, of a Christian date of the second century:—

PO ANNO + C $\overset{\text{I}}{\text{L}}$XX*

In the summer of 1853, only a few months after this London dis-

* M.S. Letter J. W. Archer, Esq., London, April, 1853.

covery of "Fairy Pipes" along with Anglo-Roman remains of the second century, similar discoveries were made on the site of the Roman Town of Bremenium, and at one of the Forts on the wall of Hadrian, in Northumberland. The learned author of "The Roman Wall," thus refers to the discovery in the second edition of that work.* "Shall we enumerate smoking pipes, such as those shewn in the cut, [which precisely correspond to many similar examples of the smallest size of the so called *Fairy* or *Danes' Pipes*,] among the articles belonging to the Roman period? Some of them indeed, have a medieval aspect; but the fact of their being frequently found in Roman stations, along with the pottery and other remains, undoubtedly Roman, ought not to be overlooked." After some further remarks in detail, Dr. Bruce proceeds to quote the following passage from the "Prehistoric Annals of Scotland:"—

"Another class of relics found in considerable numbers in North Berwick, as well as in various other districts, are small tobacco-pipes, popularly known in Scotland by the names of *Celtic* or *Elfin pipes*, and in Ireland, where they are even more abundant, as *Danes' pipes*. To what period these curious relics belong I am at a loss to determine. The popular names attached to them, manifestly point to an era long prior to that of Sir Walter Raleigh and the maiden queen, or of the royal author of 'A Counterblast to Tobacco,' and the objects along with which they have been discovered, would also seem occasionally to lead to similar conclusions, in which case we shall be forced to assume that the American weed was only introduced as a superior substitute for older narcotics. Hemp may, in all probability, have formed one of these; it is still largely used in the east for this purpose."

When preparing the notices of miscellaneous minor Scottish antiquities, from which the above passage is abstracted, my attention had been directed, for the first time, to these relics of the old smokers' nicotian indulgences. The discovery of miniature pipes, under peculiar circumstances, had been noted in the Statistical Accounts and elsewhere, from time to time; but so far as I am aware, they had not been subjected to special notice or investigation by any previous Scottish antiquary; and finding evidence, then quoted†—of the discovery of the miniature *Elfin Pipe*, in "British encampments;" in the vicinity of a primitive monolithic monument, with flint arrow heads, stone celts, &c.; in an ancient cemetery, alongside of medieval pottery, at North Berwick; and at considerable depths in various localities; as for example, six feet in a moss between Scalloway and

* The Roman Wall, an historical and topographical description of the Barrier of the Lower Isthmus, extending from the Tyne to the Solway; by the Rev. J. C. Bruce, M. A. Second Edition, 1853, p. 441.

† Archæology and Prehistoric Annals of Scotland, 1851, p. 680.

Lerwick, in the Orkneys; I remarked in reference to such notices that some of them were certainly suggestive of the little Elfin pipes belonging to a remote era. When, however, my esteemed friend Dr. Bruce, quoted me in seeming confirmation of, at least the possibility that the old Roman Legionary of Hadrian or Severus occasionally solaced himself with a pipe, as he kept watch and ward on the ancient barrier which in the first centuries of our era marked the outer verge of the Roman world, he took from the page just as much as sufficed to give a delicate flavor of possibility to the fancy, so pleasant to the mind of a genuine devotee of the luxurious weed, that the tobacco-pipe is a classic institution!

I doubt not but the learned Roman Antiquary of Pons Ælia, in his zeal to provide the Tungrian Legionaries of old Borcovicus, or the Spanish Varduli of Bremenium, with the consolations of a pipe, to beguile their dreary outlook from that bleak Northumbrian outpost of Imperial civilzation, most honestly and unwittingly overlooked whatever failed to square with the manifest fitness of so pleasant a conceit; nor did it ever occur to me to think of putting the old Tungrians' pipe out, by continuing the quotation, until now when, in the tardy access to British periodicals, I find myself quoted as an authority for the antiquity of the tobacco-pipe,—not only by those who, favouring such an opinion, are willing to count even the most lukewarm adherent on their side, but by others who treat me as Oliver Proudfoot, the bonnet maker, did his wooden soldan, which he set up merely for the pleasure of knocking it down; or as the gallant Bailie and bonnet maker of Saint Johnstoune says: "Marry, and sometimes I will place you a bonnet (an old one most likely,) on my soldan's head, and cleave it with such a downright blow, that in troth, the infidel has but little of his skull remaining to hit at!" Far be it from me to interfere with the practice of those who, like the valiant bonnet maker, wish to make themselves familiar with the use of their weapon on such easy terms, even though, perforce, made the wooden soldan on which it is applied; but I must confess to a decided objection to being held responsible for opinions quoted only for the purpose of refutation, when as it would seem, these are read through such a refracting medium as the Roman spectacles of an antiquary, who may be assumed without any disparagement to be a little *wall-eyed*.

Quotations at second hand are never very trustworthy, and it seems difficult to credit with more direct knowledge than such as may be derived from the partial quotation in the "Roman Wall," such

writers as one in the *Archæological Journal*,* who, after referring to Mr. Crofton Croker's signal refutation of "this absurd notion," couples me with Dr. Bruce as "inclined to assign such pipes to an age long prior to that of Elizabeth and Sir Walter Raleigh." It might be unreasonable to blame a contributor of editorial notes to the *Archæological Journal* for overlooking a paragraph in the *Proceedings of the Scottish Antiquaries*, of date a year earlier than his note,† which records that "Dr. Wilson communicated a notice of the discovery of various of the small tobacco-pipes popularly termed 'Celtic' or 'Elfin pipes,' in digging the foundation of a new school house at Bonnington, in the immediate vicinity of Edinburgh. Along with these were found a quantity of bodles or placks of James VI., which he exhibited with the pipes, and at the same time expressed his belief that they probably supplied a very trustworthy clue to the date of this somewhat curious class of minor antiquities." This more matured opinion of 1853 lay out of the way, and might not be noticed by the Archæological Journalist, as it would assuredly have been overlooked by the zealous Roman, quite as much as the following continuation of the original quotation so aptly abridged to the proportions of his classic tunic. But any writer who looked in its own pages, for the opinions set forth on this subject, in the "Prehistoric Annals of Scotland," would have found that the abbreviated quotations in the "Roman Wall" and elsewhere, only give one side of the statement, and that, after referring to an article in the Dublin Penny Magazine, the inquiry is thus summed up:—

"The conclusion arrived at by the writer in that magazine is, that these Danes' pipes are neither more nor less than tobacco pipes, the smallest of them pertaining to the earliest years of Queen Elizabeth's reign, when the rarity and value of tobacco rendered the most diminutive bowl sufficiently ample for the enjoyment of so costly a luxury. From this he traces them down to the reign of Charles II. by the increasing dimensions of the bowl. *It is not improbable that these conclusions may be correct, notwithstanding the apparent indications of a much earlier origin, which circumstances attendant on their occasional discovery have seemed to suggest.*

The following description of a curious Scottish memorial of the luxury would, however, seem at least to prove that we must trace the introduction of tobacco into this country to a date much nearer the discovery of the new world by Columbus than the era of Raleigh's colonization of Virginia. The grim old keep of Cawdor Castle, associated in defiance of chronology with King Duncan and Macbeth, is augmented like the majority of such Scottish fortalices, by additions of the sixteenth century. In one of the apartments of this latter erection, is a stone

* Archæological Journal, Vol. XI, p. 182.
† Proceedings S. A. Scot. Vol. I. p. 182.

chimney, richly carved with armorial bearings and the grotesque devices common on works of the period. Among these are a mermaid playing the harp, a monkey blowing a horn, a cat playing a fiddle, and *a fox smoking a tobacco pipe*. There can be no mistake as to the meaning of the last lively representation, and on the same stone is the date 1510, the year in which the wing of the castle is ascertained to have been built,"* and in which it may be added, Jamaica was settled by the Spaniards.

Having thus even at the very first,—while "at a loss to determine to what period the curious relics called Dane's or Elfin pipes belonged," and consequently avoiding a dogmatic assertion on a subject "left for further investigation,"—furnished a tolerably significant indication of my inclination to assign to such nicotian relics a post-Columbian introduction to Britain; and having, moreover, at a later period given unequivocal expression of a confirmed opinion of their modern origin: I was somewhat surprised to find myself, not very long since, figuring alongside of a singularly creditable array of chivalrous archæologists, all knights of the ancient tobacco pipe, and ready to shiver a lance with any puny modern heretic who ventured to question that Julius Cæsar smoked his merchaum at the passage of the Rhine, or that Herodotus partook of a Scythian peace-pipe when gathering the materials for the birth of History! Here is the array of learned authorities, clipped out of a recent English periodical, produced as it will be seen, to answer in the affirmative, that *the ancients did smoke:* Scythian and Roman, Celt, Frank, and Norman!

DID THE ANCIENTS SMOKE?—The question as to whether smoking was known to the ancients has just been started in Germany by the publication of a drawing contained in the *Recueil des Antiquités Suisses* of Baron de Bonstetten, which represents two objects in clay, which the author expressly declares to be smoking pipes. The authors of the "History of the Canton of the Grisons" had already spoken of these objects, but classified them among the instruments made use of by the soothsayers. The Abbé Cochet, in his work on Subterranean Normandy, mentions having found similar articles either whole or in fragments, in the Roman necropolis near Dieppe, which he at first considered as belonging to the seventeenth century, or perhaps to the time of Henri III. and Henri IV. The Abbé, however, afterwards changed his opinion on reading the work of Dr. Collingwood Bruce, entitled "The Roman Wall," in which the author asks the question whether the pipes discovered at Pierce Bridge, in Northumberland, and in London, at places where Roman stations were known to have existed, belonged to the Romans? Dr. Wilson, in his Archæology of Scotland, states that tobacco was only introduced as a superior kind of narcotic, and that hemp was already known to the ancients as a sedative. The pipes found in Scotland by Dr. Wilson might have served for using this latter substance. M. Wœchter, in his "Celtic Monuments of Hanover," says that clay pipes from 6 to 8 inches in length had been found in tombs at

* Archæology and Prehistoric Annals of Scotland, p. 681. The Cawdor sculpture and date are described on the authority of Mr. Caruthers, a very trustworthy observer.

Osnabruck, which proved that the ancients smoked. M. Kefersteiu, in his "Celtic Antiquities," boldly declares that the Celts smoked. Klemm, in his "History of Christian Europe," states that the smoking of intoxicating plants was known to the Scythians and Africans long before the introduction of tobacco into Europe. Herodotus, in speaking of the Scythians, does not go quite so far, but mentions that the people spread hemp seed on red-hot stones and inhaled the vapour sent forth. It is therefore thought by Baron de Bonstetten that the pipes of which he gives the drawing were used before the introduction of tobacco into Europe.*

This is by no means the first time that classic authorities have been quoted in proof of the antiquity of smoking. In the *Anthologia Hibernica*,† for example, a learned treatise aims to prove, on the authority of Herdotus (lib. I. Sec. 36,) Strabo, (lib. vii. 296), Pomponius Mela,(2.) and Solinus (c. 15,) that the northern nations of Europe were acquainted with tobacco, or an herb of similar properties, long before the discovery of America, and that they smoked it through small tubes. Pliny has also been produced to show that Coltsfoot (*tussilago farfara*, a mucilagenous and bitter herbaceous plant, the leaves of which were once in great favor for their supposed medicinal qualities,) furnished a substitute for the American plant which superseded this and other fancied supplies of the ancients' pipes. Speaking of that plant as a remedy for a cough, (Nat. Hist. xxvi. 16.) Pliny says:—"Hujus aridæ cum radice fumus per arundinem, haustus et devoratus, veterem sanare dicitur tussim; sed in singulos haustus passum gustandum est." This, however, is nothing more than a proof of the antiquity of a process of applying the fumes or steam of certain plants, for medicinal purposes, which is recommended in a treatise on "the Vertues of Colefoot" in the *Historie of Plantes*, by Rembert Dodoens, translated and published in England in 1578. "The parfume of the dryed leaves" says he, "layde upon quicke coles, taken into the mouth through the pipe of a funnell, or tunnell, helpeth suche as are troubled with the shortness of winde, and fetche their breath thicke or often." So far, how-

* Quoted in the North British *Daily Mail*, July 24th, 1856, but without naming the original source. It was copied into the *Illustrated Times*, of July 26th, and by other periodicals, but there also without reference to the original authority. In this case I cannot doubt that the writer who thus loosely quotes, or misquotes, the "Archæology of Scotland" does it at second hand, from Dr. Bruce.

† Vol. I., p. 352 quoted in *Notes and Queries*, X. 48. The subject has been handled in all lights, and each view of the questions it involves has found its defenders in this useful periodical,—doubly useful to those who are cut off from the great public libraries. In N. and Q., vol. II., p. 154, much curious information is concisely given relative to the assumed use of tobacco, anciently, and in the East. Ibid p. 150. Its Eastern antiquity finds a contradiction on the authority of Lane, and still more of Dr. Meyer of Konigsberg, who discovered in the works of an old Hindostanee physician, a passage in which tobacco is distinctly stated to have been introduced into India, by the Frank nations, in the year 1609.

ever, is this ancient process from indicating a mode of inhaling herbs, in any sense equivalent to the American luxury by which it may be supposed to have been superseded, that it is by no means banished, even now, from the practise of ancient female herbalists and domestic mediciners, whom I have known recommend the inhalation of the fumes or steam of various plants, not by means of a tobacco pipe, but through the spout of a teapot!

There is no question, however, that many plants have been employed as substitutes for tobacco, since the introduction of the practice of smoking. The slight astringency and diuretic qualities of *polytrichum* and other *Bryaceæ*, led to their use formerly in medicines, and the practice was once common, as I have been assured, in Annandale, and other border districts of Scotland, and is not even now wholly obsolete, of smoking the dried *sphagnum latifolium*, or the *obtusifolium* and others of the mosses which abound in the marshy bogs. So also the *millefolium* or yarrow, one of the various species of the genus *Achillea*, and several of the herbs which from their shape and the velvet surface of the leaves, are popularly known by the name of *mouse ear*, have long supplied to the English rustic an economic substitute for tobacco; just as the sloe, hawthorn, sage, and other leaves have furnished a native apology for the tea plant. But the "time immemorial" to which such practice extends probably falls far short of well ascertained dates when tobacco and the tobacco pipe were both recognized as gifts of the new world to the old. But it is curious to note, that one of the most anciently accredited substitutes for tobacco: the coltsfoot, appears to have been employed to adulterate it almost as soon as it came into use in England. Dame Ursla, in Ben Jonson's "Bartholomew Fair," (1614,) thus addresses her dull tapster:—"I can but hold life and soul together with this, and a whiff of tobacco at most, where's my pipe now? not filled, thou errant incubee! · · · Look too't sirrah, you were best; threepence a pipe full, I will ha' made, of all my whole half-pound of tobacco, and a quarter of a-pound of *coltsfoot* mix't with it too, to itch [eke] it out. I that have dealt so long in the fire will not be to seek in smoke now."

The libraries of Canada furnish very slender means for dallying with the Bibliography of the nicotian art. But some of the references made above may be thought to bear on the subject, and the very terms in which the royal author of the "Counterblaste" assails it as a novelty of such recent origin "as this present age can very well remember both the first author and forms of its introduction," seem

sufficiently clear evidence that smoking was unknown to Europe before the discovery of this continent. Spain doubtless first enjoyed the novel luxury; probably—at the latest,—not long after the commencement of the sixteenth century. The year 1560 is assigned for its introduction into France, and most commonly that of 1586,—in which Admiral Drake's fleet returned from the attack on the west Indian Islands—for its reaching England. But though in all probability only beginning at these dates to attract special attention, the custom of smoking tobacco can scarcely be supposed to have remained unknown to the Spaniards before the close of the fifteenth century, or to have failed to have come under the notice both of French and Englishmen at an early period thereafter. When at length fairly introduced into England, it met with a ready welcome. So early as 1615, we find the popular poet, Joshua Sylvester following in the wake of the royal counterblast, with his:—"tobacco battered, and the pipes shattered about their ears that idly idolize so base and barbarous a weed, or at leastwise overlove so loathsome a vanity, by a volley of holy shot thundered from Mount Helicon."—tolerable proof of the growing favour for the "weed." The plant itself was speedily brought over and cultivated in various districts, till prohibited by an act of Parliament; and Pepys, in his Diary,—referring to Winchcombe, in Gloucestershire, where tobacco is affirmed to have been first raised in England,—under the date, September 19th, 1667, mentions the information communicated to him by his cozen, Kate Joyce: "now the life-guard, which we thought a little while since was sent down into the country about some insurrection, was sent to Winchcombe, to spoil the tobacco there, which it seems the people there do plant contrary to law, and have always done, and still been under force and danger of having it spoiled, as it hath been oftentimes, and yet they will continue to plant it."*

Another entry of the same indefatigable diarist, furnishes evidence not only of the early faith in the anti-contagious virtues of tobacco, but also of the no less early mode of using it in England according to a fashion which is now more frequently regarded as a special prerogative of young America. On the 7th of June, 1665, Pepys notes that the first sight of the plague-cross, with its accompanying solemn formula of prayer, moved him, not to a devotional ejaculation, as might perhaps seem most fitting, but only to chew tobacco! "The hottest day," he writes, "that ever I felt in my life. This day, much against my will, I did in Drury Lane, see two or three houses marked

* Pepys' Diary, 4th Edition. Vol. III., p. 252.

with a red cross upon the doors, and 'Lord have mercy upon us!' writ there; which was a sad sight to me, being the first of the kind that, to my remembrance I ever saw. It put me in an ill conception of myself and my smell, so that I was forced to buy some roll-tobacco to smell to and chaw, which took away the apprehension."*

The costly nature of the luxury has been assumed as furnishing ample explanation alike of the minute size of the original tobacco pipe,—which in all probability secured for it in later times its designation of "Elfin" or "Fairy Pipe."—and of the early substitution of native pungent and fragrant herbs for the high priced foreign weed. The circumstances, however, which render the rarer English literature of the sixteenth and seventeenth centuries inaccessible here, have furnished resources of another kind which may perhaps be thought to account for this on other, and no less probable grounds. During a visit to part of the Minnesota Territory, at the head of Lake Superior, in 1855, it was my good fortune to fall in with a party of the Sault-aux Indians,—as the Chippeways of the far west are most frequently designated,—and to see them engage in their native dances, in foot-races, and other sports, and among the rest: in the luxury of the pipe. It is scarcely necessary to remark that the Indian carries his pipe-stem in his hand, along with his bow, tomahawk, or other weapon, while the pipe itself is kept in the tobacco pouch, generally formed of the skin of some small animal, dressed with the fur, and hung at his belt. But what struck me as most noticeable was that the Indians in smoking, did not exhale the smoke from the mouth, but from the nostrils; and this, Mr. Paul Kane assures me is the universal custom of the Indians of the north west, among whom he has travelled from the Red River settlement to the shores of the Pacific. By this means the narcotic effects of the tobacco are greatly increased, in so much so that a single pipe of strong tobacco smoked by an Indian in this manner, will frequently produce complete giddiness and intoxication. The Indians accordingly make use of various herbs to mix with and dilute the tobacco, such as the leaf of the cranberry, and the inner bark of the red willow, to both of which the Indian word *kinikinik* is generally applied, and the leaves of the winterberry, which receives the name of *pahgezegun*.† The cranberry

* Pepy's Diary, 4th Edition. Vol. II., p. 242.

† I am informed by the Rev. Dr. O'Meara, the translator of the Bible in the Chippeway tongue, that the literal significance of *kinikinik* is "he mixes." *kinikangun* is "a mixture," and the words are applied by the Indians not to the diluent alone, but to the tobacco and diluents when mixed and prepared for use. So also *pahgezegun* is "anything mixed," and may be rendered: something to mix with tobacco.

Fig. 1.
BABEEN PIPE.

Fig. 2
CHIPPEWAY PIPE.

Ackermann lith. 379 Broadway N.Y.

INDIAN PIPES

and winterberry leaves are prepared by passing them through the top of the flame, or more leisurely drying them over the fire, without allowing them to burn. Among the Creeks, the Chocktaws, and other Indians in the south, the leaves of the sumach, prepared in a similar manner, answer the like purpose. The leaf of the winterberry, or tea berry, (*coltheria procumbens*,) has a pleasant aroma, which may have had some influence on its selection. The Indians of the north west ascribe to it the further property of giving them wind, and enabling them to hold on longer in running; but the main object of all such additions appears to be to dilute the tobacco, and thereby admit of its prolonged enjoyment. Having both chewed and smoked the winterberry leaf prepared by the Indians, I am able to speak positively as to the absence of any narcotic qualities, and I presume that with it and all the other additions to the tobacco, the main object is to provide a diluent, so as to moderate the effects, and prolong the enjoyment of the luxury. The same mode is employed with ardent spirits. Mr. Kane remarks of the Chinook Indians: it is a matter of astonishment how very small a quantity of whisky suffices to intoxicate them, although they always dilute it largely in order to prolong the pleasure they derive from drinking.

The custom of increasing the action of the tobacco fumes on the nervous system, by expelling them through the nostrils, though now chiefly confined to the Indians of this continent, appears to have been universally practised when the smoking of tobacco was introduced into the old world. It has been perpetuated in Europe by those who had the earliest opportunities of acquiring the native custom. The Spaniard still expels the smoke through his nostrils, though using a light tobacco, and in such moderation as to render the influence of the narcotic sufficiently innocuous. The Greek sailors in the Levant very frequently retain the same practice, and with less moderation in its use. Melville also describes the Sandwich Islanders, among whom tobacco is of such recent introduction, as having adopted the Indian custom, whether from imitation or by a natural savage instinct towards excess; and evidence is not wanting to prove that such was the original practice of the English smoker. Paul Hentzner, in his "Journey into England." in 1598,* among other novelties describes witnessing at the playhouse, the practice, as then newly borrowed from the Indians of Virginia. "Here," he says, "and everywhere else, the English are

*Malone quotes from epigrams and satires of the same date,—eighteen years before the death of Shakespear,—to prove that playgoers, even at so early a date, were attended by pages, with pipes and tobacco, which they smoked on the stage, where the wits were then wont to sit. Vide *Notes and Queries*, vol. X., p. 49.

constantly smoking of tobacco, and in this manner: they have pipes on purpose made of clay, into the further end of which they put the herb, so dry that it may be rubbed into powder, and putting fire to it, they draw the smoke into their mouths, which they puff out again through their nostrils, like funnels, along with it plenty of phlegm, and defluxion of the head."

To this it is, that Justice Overdoo refers in Ben Jonson's "Bartholomew Fair." (Act II, Scene VI.) "Nay, the hole in the nose here, of some tobacco-takers, or the third nostril, if I may so call it, which makes that they can vent the tobacco out, like the ace of clubs, or rather the flower-de-lice, is caused from the tobacco, the mere tobacco!" and so also, in a passage already referred to, in Warner's "Albion's England," the "Indian weed fumes away from nostrils and from throats" of ladies, as well as lords and grooms.

The minute size of the most ancient of the British tobacco pipes which has led to their designation as those of the Elves or Fairies, may therefore be much more certainly ascribed to the mode of using the tobacco, which rendered the contents of the smallest of them a sufficient dose, than to any economic habits in those who indulged in the novel luxury. In this opinion I am further confirmed by observing the same miniature characteristics mark various specimens of antique native pipes of a peculiar class to which I have already referred as found in Canada, and which appear to be such as, in all probability were in use, and furnished the models of the English clay pipes of the sixteenth century. But if the date thus assigned for the earliest English clay pipes be the true one, it has an important bearing on a much wider question; and as a test of the value to be attached to popular traditions, may suggest the revision of more than one archæological theory based on the trustworthiness of such evidence. A contributor to "Notes and Queries,"* quotes some dogrel lines printed in the "Harleian Miscellany" in 1624, where speaking of the good old times of King Harry the Eighth, smoking is thus ludicrously described as a recent novelty:—

"Nor did that time know
To puff and to blow,
In a piece of white clay
As you do at this day,
With fier and coale
And a leafe in a hole!"

These lines are ascribed in the original to Skelton, who died in 1529, and by a course of reasoning which seems to run somewhat in

*Notes and Queries. Vol. VII., p. 230.

a circle, it is assumed that they cannot be his, *because* tobacco was not introduced into England "till 1565 or thereabouts." Brand in his "Popular Antiquities," ascribes its introduction to Drake in 1586; while the old keep at Cawdor, already referred to, with its sculptured reynard and his pipe, would carry it back to 1510, and by implication still nearer the fifteenth century. So peculiar a custom as smoking, would no doubt, at first be chiefly confined to such as had acquired a taste for it in the countries from whence it was borrowed, and until its more general diffusion had created a demand for tobacco, as well as for the pipe required for its use, the smoker who had not acquired an Indian pipe along with the "Indian weed," would have to depend on chance, or his own ingenuity, for the materials requisite for its enjoyment. Hence an old diarist writing about 1680, tells us of the tobacco smokers:—"They first had silver pipes, but the ordinary sort made use of a walnut shell and a straw. I have heard my grandfather say that one pipe was handed from man to man round the table. Within these thirty-five years 'twas scandalous for a divine to take tobacco. It was then sold for its weight in silver. I have heard some of our old yeomen neighbours say, that when they went to market they culled out their biggest shillings to lay in the scales against the tobacco; now the customs of it are the greatest his majestie hath." In the interval between the primitive walnut-shell pipe, or the single clay pipe for a whole company to partake of the costly luxury, and this later era of its abundant use, the supply of pipes had, no doubt, kept pace with that of the tobacco, and they had undergone such alterations in form as were requisite to adapt them to its later mode of use. Their material also had become so uniform, and so well recognised, that a clay pipe appears to have been regarded, in the seventeenth century as the sole implement applicable to the smoker's art. An old string of rhymed interogatories, printed in *Wit's Recreations*, a rare miscellany of 1640, thus quaintly sets forth this idea:—

"If all the world were sand,
Oh, then what should we lack'o;
If as they say there were no clay,
How should we take tobacco?"

Towards the latter end of the sixteenth, and in the early years of the seventeenth century, under any view of the case, small clay pipes, such as Teniers and Ostade put into the mouths of their Boors, must have been in common use throughout the British Islands. They have been dredged in numbers from the bed of the Thames, found in

abundance on various sites in England and Ireland, where the soldiers of the parliament and revolution encamped; and in Scotland in divers localities from the border, northward, even to the Orkneys. They have been repeatedly met with in old Churchyards, and turned up in places of public resort. Occasionally too, to the bewilderment of the antiquary, they are discovered in strange propinquity to primitive, Roman, and medieval relics,—but in a sufficient number of cases with such potters' stamps on them as suffice to assign these also to the sixteenth and seventeenth centuries. At a date so comparatively recent as that of the revolution of 1688, they must have been nearly as familiar throughout Britain and Ireland, as the larger clay pipe of the present day: and yet towards the end of the eighteenth century we find them described in Scottish statistical reports as "Elfin pipes;" and when at a later date, they attract a wider attention, it is found that, in total independence of each other, the peasantry of England, Scotland, and Ireland, have concurred in ascribing these modern antiques to the Danes, the Elves and the Fairies! I must confess that the full consideration of all the bearings of this disclosure of the sources of modern popular belief has greatly modified the faith I once attached to such forms of tradition as memorials of the past. The same people who, by means of Welsh *triads*, genealogical poems, like the *Duan Albannach* and *Eireannach*, and historical traditions, like the memory of the elder home of the Saxons in the *Gleeman's song*, could transmit, by oral tradition alone, the chronicles of many generations, now depend so entirely on the chroniclings of the printing press, that they cannot be trusted with the most familiar traditions of a single century. This no doubt only applies to very modern centuries; but the treacherousness of the historical memory of a rude savage people is sufficiently illustrated be the fact that we search in vain among the Indians of this continent for any tradition of the first intrusion of the white man.

A few general remarks on the varying characteristics of the pipes anciently constructed, or now in use among the Indian tribes of North America will not be out of place here, as a means of illustrating the customs and ideas associated at various times, and among different tribes, with the peculiar rites and usages of the pipe as the special characteristic of the new world. For some of the facts relating to the Indians of the north west, I am indebted to the Rev. Dr. O'Meara, missionary among the Chippeways; to Dr. George Beattie, formerly United States Indian Agent of the Winnebagos, —*who have since been driven to desert their old hunting grounds in*

Wisconsin for the far west, and from their rapidly diminishing numbers, cannot long survive as a distinct tribe,—and also, in special reference to those of the remote north west, and on the shores of the Pacific, to Mr. Paul Kane, along with the information derived from inspecting a fine collection of Indian relics secured by him during three years travel in the Hudson Bay Company's Territory, and among the neighbouring tribes within the territories of the United States. A comparison of the facts thus obtained with some of the conclusions arrived at by others from the examination of the older traces of the custom and usages of smoking, appear calculated to throw some additional light on the latter, and especially to modify the opinion derived from the investigation of examples of the ancient arts of the Mound Builders, and other aboriginal traces of this continent.

Insignificant, and even puerile, as the subject of the tobacco pipe appears, it assumes an importance in many respects only second to that of the osteological remains of the ancient races of this continent when viewed as part of the materials of its unwritten history. In Messrs. Squier and Davis' valuable "Contribution to Knowledge"* the tobacco pipes found in the ancient sepulchral mounds of the Mississippi Valley are specially noted as constituting not only a numerous, but a highly interesting class of remains, on the construction of which the artistic skill of their makers seems to have been lavished with a degree of care and ingenuity bestowed on no other works. "They are sculptured into singular devices: figures of the human head, and of various beasts, birds, and reptiles. These figures are all executed in miniature, but with great fidelity to nature." Thus, for example, the authors remark in reference to one pipe-head (Fig. 183, p. 268,) carved in the shape of a toad: the knotted, corrugated skin is well represented, and the sculpture is so very truthful that if placed in the grass before an unsuspecting observer, it would probably be mistaken for the natural object; and they further add: "those who deem expression in sculpture the grand essential, will find something to amuse as well as to admire, in the lugubrious expression of the mouths of these specimens of the toad." The same writers again remark, in describing the immense deposit of pipes found on the "altar" of one of the great mounds in the Scioto Valley, some of them calcined, and all more or less affected by the fires of the ancient ceremonial of cremation or sacrifice:—"The bowls of most of the pipes are carved in miniature figures of animals,

*Ancient Monuments of the Mississippi Valley, pages 228, 229.

birds, reptiles, &c. Not only are the features of the various objects represented faithfully, but their peculiarities and habits are in some degree exhibited. The otter is shewn in a characteristic attitude, holding a fish in his mouth; the heron also holds a fish; and the hawk grasps a small bird in its talons, which it tears with its beak. The panther, the bear, the wolf, the beaver, the otter, the squirrel, the racoon, the hawk, the heron, crow, swallow, buzzard, the paroquet, toucan, and other indigenous and southern birds; the turtle, the frog, toad, rattlesnake, etc., are recognised at first glance."* To this comprehensive list Mr. Squier makes further additions in a work of later date. Contrasting the truthfulness of the carvings from the mounds with the monstrosities or caricatures of nature usually produced by the savage sculptor, he remarks: "they display not only the general form and features of the objects sought to be represented, but to a surprising degree their characteristic expression and attitude. In some instances their very habits are indicated. Hardly a beast, bird, or reptile, indigenous to the country is omitted from the list;" and in addition to those named above, he specifies the elk, the opossum, the owl, vulture, raven, duck, and goose, and also the alligator.† Of no less interest are the numerous examples of sculptured human heads, some of them presenting striking traits of individual portraiture, and which are assumed, from the minute accuracy of many of the accompanying sculptures of animals, to furnish faithful representations of the predominant physical features of the ancient people by whom they were made.

Compared with the monuments of Central and Southern America, the sculplured façades of the temples and palaces of Mexico and Peru, the friezes adorned with hieroglyphics, the kalendars, and colossal statues of gods and heroes, of Yucatan: the art which found its highest object in the decoration of a pipe-bowl is apt to appear insignificant enough. Nevertheless, the simplicity, variety, and expression of these miniature works of art, their evidence of great imitative skill, as well as of delicacy of execution, all render them just objects of interest and careful study. But high as is the value which attaches to them as examples of the primitive æsthetic arts of this continent, they have a still higher significance in relation to ethnological inquiries. By the fidelity of their representations of so great a variety of objects derived from the animal kingdom, they furnish evidence of a knowledge, possessed by these ancient artists of the

* Ancient Monuments of the Mississippi Valley. Page 152.

† Antiquities of the State of New York. Page 338.

Mississippi Valley, of the fauna peculiar not only to southern, but to tropical latitudes, suggestive either of arts derived from a foreign source, and of an intimate intercourse maintained with the central regions where the civilization of ancient America attained its highest development, or else indicative of a migration from the south, and an intrusion into the northern area of the continent, of the race of the ancient graves of Central America, bringing with them into their new area the arts of the tropics, and models derived from the animals familiar to their fathers in the parent-land of the race.

That such a migration,— rather than a contemporaneous existence of the same race over the whole area thus indicated, and maintaining intimate intercommunication and commercial intercourse, is the more probable inference, is suggested on various grounds. If the Mound Builders had some of the arts and models, not only of Central America, but of Peru, they had also the native copper of Lake Superior, and mica believed to be traceable to the Alleghanies, while the gigantic tropical shells of the Gulf of Mexico have been found alike in these ancient mounds and in the graves along the shores of Lake Huron and Georgian Bay. The fact indeed that among the specimens of their most elaborate carving, some of the objects represent birds and quadrupeds belonging to latitudes so far to the south, naturally tends to suggest the idea of a central region where the arts were cultivated to an extent unknown in the Mississippi regions, and that those objects manufactured in the localities where such models are furnished by the native fauna, remain only as the evidences of ancient commercial relations maintained between these latitudes and the localities where now alone such are known to abound. But in opposition to this, full value must be given to the fact that neither the relics, nor the customs which they indicate, appear to pertain exclusively to southern latitudes, nor are such found to predominate among the singular evidences of ancient and more matured civilization either in Central or Southern America, while the varied nature of the materials employed in the arts of the Mound Builders, indicate a very wide range of relations; though it cannot be assumed that these were maintained in every case by direct intercourse.

The earlier students of American Archæology, like the older Celtic Antiquaries of Britain; gave full scope to a system of theorising which built up comprehensive ethnological schemes on the very smallest premises; but in the more judicious caution of later writers there is a tendency to run to the opposite extreme. Dr. Schoolcraft

certainly manifests a disposition to underrate the artistic skill unmistakably discernable in some of the works of the Mound Builders; while Mr. Haven solves the difficulty by referring such evidences of art to an undetermined foreign source. After describing the weapons, pottery, and personal ornaments obtained from the mounds, the latter writer adds, "and, with these were found sculptured figures of animals and the human head, in the form of pipes, wrought with great delicacy and spirit from some of the hardest stones. The last-named are relics that imply a very considerable degree of art, and if believed to be the work of the people with whose remains they are found, would tend greatly to increase the wonder that the art of sculpture among them was not manifested in other objects and places. The fact that nearly all the finer specimens of workmanship represent birds or land and marine animals belonging to a different latitude, while the pearls, the knives of obsidian, the marine shells, and the copper, equally testify to a distant, though not extra-continental origin, may however exclude these from being received as proofs of local industry and skill."* A reconsideration of the list already given of animals sculptured by the ancient pipe-makers of the mounds, as quoted from the narrative of Messrs. Squier and Davis, along with the later additions of the former, set forth in a form still less in accordance with such deductions, will, I conceive, satisfy the inquirer that it is quite an over statement of the case to say that nearly all represent animals belonging to a different latitude. The real interest, and difficulty of the question lies in the fact of discovering, along with so many spirited sculptures of animals pertaining to the locality, others represented with equal spirit and fidelity, though belonging to different latitudes. On this subject, familiarity with early British antiquities induces me to regard such an assignment of all the sculptures of the mounds to a foreign origin, on account of their models being in part derived from distant latitudes, as a needless assumption which only shifts without lessening the difficulty. On the sculptured standing stones of Scotland—belonging apparently to the closing era of paganism, and the first introduction of christianity there,—may be seen the elephant, the camel, the tiger or leopard, the ape, the serpent, and other representations or symbols, borrowed, not like the models of the Mound Builders, from a locality so near as readily to admit of the theory of direct commercial intercourse, but some of them from the remote extreme of Asia. The only difference between the imitations of the foreign

* Haven's Archæology of the United States. Page 122.

fauna of the Scottish and the ancient American monuments, is that the former occasionally betray, as might be expected, the conventional characteristics of a traditional type,* while the latter, if they furnish evidence of migration, prove it to have been recent, and to a locality not so distant as to preclude all renewal of intercourse with their ancestral birth-land.† Notwithstanding the great spirit displayed in many of the miniature sculptures of the Mound Builders, however, the difference in point of fidelity of imitation between them and the carvings of foreign subjects on the Scottish standing stones though unmistakeable, is not so great as the descriptions of American Archæologists would suggest; while both are alike accompanied by the representations of monstrosities or ideal creations of the fancy, which abundantly prove that the ancient sculptors could work without a model. Some of the human heads of the American sculptures for example, if regarded as portraits, must be supposed to be designed in the style of *Punch*!‡ and several of the animals figured in "The Ancient Monuments of the Mississippi Valley," e. g. the wild cat, Fig. 158; the "very spirited, though not minutely accurate head of the Elk," Fig. 161, and the supposed "cherry birds," Figs. 174, 175, of one of which it is remarked: "nothing can exceed the life-like expression of the original;" fall far short of the fidelity of imitation ascribed to them in the accompanying text.

It has been noted by more than one American Archæologist as a singular fact that no relics obviously designed as idols, or objects of worship, have been dug up in the mounds, or found in such circumstances as to connect them with the religious practices of the Mound Builders. But the very remarkable characteristics of their elaborately sculptured pipes, and the obviously important part they appear to have played in the services accompanying the rites of sacrifice or cremation, and the final construction of the gigantic earth-pyramids

* It is worthy of note that the objects least truthfully represented among the sculptures of the Mound Builders, also, in some cases at least, appear to be those of animals foreign to the region, e. g. the Toucan (?) "Ancient Monuments of the Mississippi Valley," Fig. 169, page 260; which might have been better described as a Raven; and Fig. 178, also a Toucan, but much more of a traditional than truthful portraiture.

† Vide Archæology and Prehistoric Annals of Scotland. Page 501, and Dr. Wise's Notes on Buddhist Opinions and Monuments. Transactions of R.S.E. Vol. XXI. Page 255.

‡ Vide Davis and Squier's Ancient Monuments. Fig. 145, described as the most beautiful of the series, and a head, the workmanship of which is unsurpassed by any specimen of ancient American Art, not excepting the best productions of Mexico and Peru,—fully bears out these remarks. But in contrast with it may be placed Figs. 143, 146 and 148; and as a still stronger illustration of how far the enthusiasm of the most careful observers may lead them compare Fig. 75, page 193, with the description which says of it: "the attitude is alike natural and spirited!"

which have given the name to the race that furnished the artists by whom they were wrought, all tend to suggest very different associations with the pipe of those ancient centuries from such as now pertain to its familiar descendant. It has accordingly been supposed that the elaborate employment of the imitative arts on the pipe-heads found deposited in the mounds, indicate their having played an important part in the religious solemnities of the ancient race, among whom the number of such relics proves that the practice of smoking was no less universal than among the modern Indians. The conjecture that this practice was more or less interwoven with the primitive civil and religious observances of America is thus illustrated by the authors already quoted,* from the more modern customs and ideas connected with it: "the use of tobacco was known to nearly all the American nations, and the pipe was their grand diplomatist. In making war and in concluding peace it performed an important part. Their deliberations, domestic as well as public, were conducted under its influences, and no treaty was ever made unsignalized by the passage of the calumet. The transfer of the pipe from the lips of one individual to those of another was the token of amity and friendship, a gage of honor with the chivalry of the forest which was seldom violated. In their religious ceremonies, it was also introduced with various degrees of solemnity. The custom extended to Mexico, where, however, it does not seem to have been invested with any of those singular conventionalities observed in the higher latitudes. It prevailed in South America and the Caribbean Islands."

To be continued.

ON THE OCCURRENCE OF THE GENUS CRYPTOCERAS IN SILURIAN ROCKS.

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Read before the Canadian Institute, 18th April, 1857.

But one living genus of the chamber-shelled cephalopods being known, the classification of the numerous fossil types met with more particularly in the Palæozoic and Secondary rocks, is of necessity

* Ancient Monuments of the Mississippi Valley. Page 229.

based on characters derived immediately from the shell itself. For the purpose of classification, four characters, of more or less value, are especially available. These comprise:—(1) the character of the aperture; (2) the form of the septa; (3) the position and character of the siphuncle; and (4) the form and mode of growth of the shell.

The aperture may be: (*a*) open; (*b*) contracted. The septa: (*a*) simple; (*b*) angular or lobed. The position of the siphuncle: (*a*) central or sub-central; (*b*) internal or "ventral;" (*c*) external or "dorsal." The siphuncle itself: (*a*) simple; (*b*) complicated. The form of the shell: (*a*) straight or conical; (*b*) arched or "horned" in various ways; (*c*) discoidal, with or without contiguous volutions; and (*d*) spiral.

By means of these characters, all the trustworthy genera of the chambered cephalopods may be arranged, conveniently at least, if not naturally, in ten sections or families*: as shewn in the following tabular view:—

1. GOMPHOCERATIDÆ:—Aperture contracted. *Gomphoceras* (including Hall's *Orthoceras fusiforme;*) *Phragmoceras; Oncoceras; Lituites.*

2. HETEROSIPHONIDÆ:—Aperture unknown, perhaps contracted. Siphuncle more or less complicated, or otherwise marginal; with conical orthoceras-like shell. Septa simple or slightly wavy. (See remarks below.) *Endoceras; Cameroceras?; Gonioceras; Ormoceras; Ascoceras.*

3. NAUTILIDÆ: Aperture open. Septa simple. Siphuncle central or sub-central: *Orthoceras; Nautilus; Lituites; Hortolus; Aploceras* (including Hall's *Cyrtoceras Annulatum?*) *Nautiloceras; Trochoceras.*

4. TROCHOLITIDÆ:—Aperture open. Septa simple. Siphuncle internal or "ventral." *Trocholites.*

5. CYRTOCERATIDÆ:—Aperture open. Septa simple. Siphuncle external or "dorsal":—*Cyrtoceras; Gyroceras; Cryptoceras.*

6. CLYMENIDÆ:—Aperture open. Septa lobed. Siphuncle internal. *Clymenia; Sub-clymenia.*

* Many palæontologists will, no doubt, think an extended sub-division of this kind very unnecessary, and prefer to group these forms in two, or at the most, in three families; but in adopting this plan, the characters of the respective families become ill-defined, and the appreciation of transition groups much weakened; whilst, at the same time, a necessity is occasioned for the creation of sub-families or tribes. A classification which does not shew upon its face a greater distinction between *Goniatites, Ceratites,* and *Ammonites,* than between the last named genus and *Hamites* or *Baculites* for example, assuredly has no claim to be considered a natural grouping. In the arrangement given in the text, the second family is merely a provisional one, rendered necessary by our still imperfect knowledge of its included forms.—E. J. C.

7. Aturidæ:—Aperture open. Septa lobed. Siphuncle internal or nearly so, and very large. *Aturia* (*Megasiphonia*)—a Tertiary form.

8. Goniatidæ:—Aperture open. Septa with angular lobes. Siphuncle external. *Goniatites* (*Aganides;*) *Bactrites.*

9. Ceratidæ:—Aperture open. Septa with denticulated lobes. Siphuncle external. *Ceratites; Baculina.*

10. Ammonitidæ:—Aperture open. Septa foliated. Siphuncle external *Ammonites; Crioceras*; *Scaphites; Ancyloceras; Toxoceras? Hamites; Ptycoceras; Baculites; Turrilites; Hellicoceras; Heteroceras.*

Under the name of Heterosiphonidæ, we have separated from the Nautilidæ, all of those more or less imperfectly known forms (commonly classed with *Orthoceras*) which possess a large complicated siphon, or in which with other related characters, the siphon is marginal. We are fully aware that many objections may be urged against this view, but until a true nautilus be discovered with the peculiar character of siphuncle exhibited by Ormoceras for example, we feel justified in holding to the separation of this latter form, with Endoceras, &c., from the normal Orthoceratites. The external ridges on the siphuncle of Endoceras, although so distinctly pointed out by Hall, appear to be forgotten altogether in the descriptions of many European palæontologists. Ormoceras, notwithstanding the central position of its siphuncle, is evidently closely related to Gonioceras; and through that genus, though less closely, to Endoceras.

If the separation of the Goniatites and Ceratites from the Ammonitidæ be disapproved of, they may be placed in that family as separate tribes. Our present object, however, is not to discuss the classification of the chambered cephalopods, but to point out the occurrence in our Silurian rocks of a type hitherto unannounced below the Devonian formation.

In the fifth of the above families, that of the Cyrtoceratidæ, characterised by the presence of simple septa with external or so-called "dorsal" siphuncle, we have three genera: *Cyrtoceras*, a simply "horned" form, exceedingly abundant; Gyroceras, a discoidal or "rolled-up" cyrtoceras, but without contiguous volutions; and *Cryptoceras*, likewise a discoidal form, but with contiguous whorls. Of the last named genus, founded by D'Orbigny, but two species appear to have been hitherto recognised: the *C. subtuberculatus* (*Nautilus subtuberculatus*) from the Devonian beds of Nassau; and the *C. dorsalis* (*Nautilus dorsalis* Phil.) from the carboniferous

limestone of Yorkshire. Quite recently, however, in a specimen from the Black River limestone of Lorette in Eastern Canada, submitted to us by Mr. Head of the Canadian Institute, we have remarked the cryptoceras type of structure, viz: simple septa and an unmistakably "dorsal" siphuncle, combined with a nautiloidal form of shell. Hall, in the first volume of his "Palæontology of the State of New York" figures and describes under the name of *Lituites undatus* a fossil that may perhaps be identical with the one now under review; but if so, the generic term "Lituites" should certainly give place to that of "Cryptoceras." The siphuncle is said to be *dorsal;* and Professor Hall describes the only examples known to him, as occurring in the Black River limestone of Watertown, in Jefferson County. This same *Lituites undatus*, is quoted by D'Orbigny in his "Prodrome" and also by, Pictet in the last edition of his "Traité de Paléontologie;" but these paleontologists appear to ignore completely the dorsal position of the siphuncle as described by Hall. D'Orbigny indeed, places it immediately under the following generic definition "LITUITES, Breynius: coquille spirale, à tours contigus, siphon central;" and this central position of the siphuncle as an essential characteristic of *Lituites*, is also recognized by McCoy in his recent work on the British Palæozoic Fossils of the Cambridge Museum, as well as by all modern palæontologists. One thing therefore is certain, that whether or not our specimen be identical with that of Professor Hall, it has evidently no claims to be considered a Lituites. In the present note, however, we are unable to do more than announce the occurrence of the genus Cryptoceras in our Canadian rocks: the characters of the solitary specimen before us being too imperfect to warrant the bestowal of a specific name.

*** Since the above was written, we have learned that several examples of this fossil type, under the name of *Lituites undatus*, have been obtained by the Geological Survey of Canada from the Black River limestone of Lorette. It is very probable that many of the Silurian "Lituites" will prove when more closely examined, to belong to Cryptoceras, or to Barrande's new genus, Nothoceras: a notice of which (Bulletin de la Société Géol. de France, T. XII. p. 380,) has only just reached us. Although stated to have been read before the Society on the third of March, 1856, the Bulletin containing the notice was not issued until March in the present year.

In Nothoceras, the bent edges of the Septa (the *goulot* of the French palæontologists) protecting the Siphuncle, instead of being deflected backwards as in Nautilus, Cyrtoceras, &c., are deflected forwards, or towards the opening of the shell, as in the Ammonites.

ON SIR DAVID BREWSTER'S SUPPOSED LAW OF VISIBLE DIRECTION.

BY THE REV. GEORGE PAXTON YOUNG, M. A.,
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Read before the Canadian Institute, March 7th, 1857.

Sir David Brewster claims to have proved experimentally, that, in monocular vision, whatever be the direction in which a ray strikes the retina, it gives the sensation of vision in a direction perpendicular to the retina at the point of excitement. This is his Law of Visible Direction. A careful examination of the eye has shewn that the retina and the cornea have a common centre (which may, therefore, be conveniently termed the centre of the eye), and that a normal to the retina at the point where the picture of a small visible object is formed, almost exactly coincides (at least in pencils of moderate inclination to the axis of the eye) with the line joining the centre of the eye and the object; so that according to the Law of Visible Direction, a small object is seen in the direction (nearly) of a line drawn from it to the centre of the eye. From this law of visible direction in monocular vision, has been derived a corresponding Law of Visible Position in binocular vision; which is, that a small object seen with both eyes, appears at the point where the lines of visible direction for the two eyes meet; the meeting of these lines being a condition indispensable in order that the object may be seen single.

These laws, while admitted by some philosophers of high authority, have been called in question by others, though I have never seen any thing like a satisfactory refutation of the arguments advanced by Sir David Brewster in support of his theory. I agree with those who deny that Sir David's reasoning is valid; and I propose in the present communication to shew that the experiments on which he relies are quite inconclusive; in doing which, it will be sufficient to discuss the case of monocular vision; for, since the law of visible

position in binocular vision is professedly derived from that of visible direction in monocular vision, it follows that if the latter be destitute of evidence, the former must be given up likewise.

Sir David Brewster has no where formally explained what he means by visible direction; at least he has not done this in those papers in the Philosophical Magazine, which are expressly devoted to the proof and illustration of his Law; in consequence of which, the real import of the Law is involved in considerable doubt. But probably Sir David would accept the following as a true statement of what he holds, viz: that the mind, being mysteriously united with the retina as part of the living organism of the body, is immediately cognizant of the affections excited in the retina; and that it refers the affections of which it is thus cognizant to a stimulus situated in the direction of a normal to the retinal surface. A writer in the Athenæum for February 7th, of the present year, thus states what he supposes to be Sir David's theory: "The mind, residing as it were in every point of "the retina, refers the impression made upon it to a direction coin- "ciding with the last portion of the ray that conveys the impression.' This is undoubtedly a mistake. Instead of: *refers the impression to a direction coinciding with the last portion of the ray that conveys the the impression*, the statement should have at least been: *refers the impression to a direction perpendicular to the retina at the point where the refracted ray falls upon its surface.* With this alteration, the sentence quoted would substantially agree with what I have expressed. Now it is important to observe at the outset, that, even if it be true that the mind "residing as it were in every point of the retina," or, to use a less objectionable mode of expression, mysteriously united with the retina as part of the living organism of the body, is immediately cognizant of the retinal affections, this is a metaphysical truth, which does not admit of being experimentally demonstrated. It must be established by its proper evidence: and this is of itself enough to shew that Sir David Brewster, in fancying that he has experimentally proved his law of visible direction, must be labouring under some delusion. From the nature of the case, physical experiments are inadequate to establish a law whose necessary basis is a metaphysical principle.

Passing this, however, let us proceed to examine Sir David Brewster's experiments. The following is perhaps the most beautiful and plausible of the *direct* experiments on which he relies in support of his Law: "Having expanded the pupil by belladonna, look directly "at a point in the axis of the eye. Its image will be formed by a

" cone of rays variously inclined from 85° to 90° to the surface of " the retina. While the point is distinctly seen, intercept all these " different rays in succession, and it will be found that each ray gives " vision in the same direction, the visible point retaining its position. " Hence it follows, that on the part of the retina in the axis of vision, " all rays, however obliquely incident, give the same visible direction " perpendicular to the surface of the membrane." Now, I admit that a very interesting fact in vision is here proved: and let Sir David Brewster have the credit of having established it. But what is the fact proved? It is, that all rays falling upon the part of the retina which lies in the axis of vision, *give rise to the same subjective affections*, whatever be the inclination at which they impinge upon the retina. Nothing else than this is made out. Sir David Brewster indeed thinks, that, because the visible point retains its position while the different rays in succession are intercepted, we are warranted in affirming that "each ray gives visible position in the same direction." But what is meant by the visible point retaining its position? There does not exist any visible point, or image, to which position in absolute space, apart from the mind, can be ascribed. When a visible point, therefore, is said (popularly) to retain its position, the idea really intended to be conveyed, must be, that no appreciable alteration is experienced in the subjective affections of which we are conscious. If we refer (as we are under no necessity of doing) our subjective affections to a remote stimulus, it is of course to be expected, that, while no appreciable change takes place in the subjective affections, no wavering or variation shall occur in the estimate which the mind forms of the direction of the stimulus. But the circumstance of "the visible point retaining its position" indicates nothing whatever regarding such reference, whether determinate or variable. A visible point is a subjective phenomenon. A change in its position is a change occurring in a subjective sphere. The absence of any change in its position is the absence of (appreciable) change, in a certain respect, in our subjective affections. The experiment described merely shews, therefore, that all rays falling upon the part of the retina in the axis of vision give rise to the same subjective affections; and hence it has no weight in demonstrating the law in support of which it is adduced.

But besides failing to observe that the circumstance of the visible point retaining its position while the different rays in succession are intercepted, amounts to no more than this, that rays incident upon the same part of the retina at different obliquities give rise to

the same subjective affections, Sir David Brewster has committed the glaring impropriety of assuming that an object in the axis of vision is seen in the direction of the axis. For how does he argue? "Each ray gives vision in the same direction, the visible point retaining its position." Let this sentence pass, dubious as it is; and what next? "It follows, that, on the part of the retina in the axis "of vision, all rays, however obliquely incident, give the same "visible direction, *perpendicular to the surface of the membrane.*" Indeed! How does this follow? Grant that the rays in question all give the same visible direction (though the only thing proved, is, that they give rise to the same subjective affection); *how does the idea of a direction perpendicular to the surface of the membrane creep in?* The cone of light through which vision is produced, contains a line of rays, no doubt, which fall perpendicularly upon the eye, and pass to the retina without refraction; and it may be fancied that these at least "give visible direction" in the axis of vision. But how can such a thing be proved? How does it appear, that, when rays come to the eye along the axis of vision, the mind determinately refers the subjective affections occasioned by such rays to a remote stimulus, situated somewhere in the axis? Let E represent the eye, and O an object towards which the axis of the eye is turned. It may perhaps be said, that, if you ask the observer, he will tell you that he refers, and cannot help referring, his sensation to a stimulus in the line E O. But he means nothing more by this, than that he is unable, while his eye is turned towards O, to alter the character of the perception realized. That nothing more than this can be intended, and that there is not, in truth, any intuitive or instinctive reference to the direction E O, is rendered certain by a consideration which shall afterwards be more fully brought out, viz: that the object O is not an object of intuitive knowledge at all. Distant objects can only be known mediately or inferentially. And if the object O be not immediately known even as existing, it follows, *a fortiori*, that the direction E O is not immediately known; so that an instinctive, intuitive or immediate reference of a visual impression to the direction E O, is an absurdity.

This may suffice, as regards *direct* demonstration. *Ex uno disce omnes.* No direct demonstration can possibly indicate any thing else than the similarity or dis-similarity (as the case may be) of the subjective affections produced by rays impinging upon particular parts of the retina. Let us proceed to consider next whether Sir David receives any more effectual support for his doctrine from the *indirect*

method of proof—the method which, beginning with a certain hypothesis, and deducing the results to which it leads, concludes from the harmony between these results and actual fact, that the hypothesis is correct. And here again, as I intend to limit myself to a single example, I shall choose the most elegant and specious that I can find.

Many writers on vision have perplexed themselves with the enquiry: why are obj .. seen erect, when their pictures on the retina are inverted? Sir David Brewster tells us that this is a necessary consequence, and therefore a confirmation, of his Law of Visible Direction. "The phenomenon," he writes, "of an erect object from an "inverted picture on the retina, which has so unnecessarily perplexed "metaphysicians and physiologists, is a demonstrable corollary from "the law of visible direction for points. The only difficulty," he adds, "which I have ever experienced in studying this subject, is, "to discover where any difficulty lay."

In examining this statement, I would repeat the remark previously made, that the image or "phenomenon" of an object has no existence in absolute space, apart from the mind. No doubt, the language familiarly employed in treatises on vision tends to suggest a contrary idea to careless and unreflective readers; and few philosophers are at less pains to avoid phraseology liable to be misunderstood, than Sir David Brewster himself. He not only at one time, tells us of an image being formed in front of a wall, or behind a wall, according to the circumstances of the experiment; and, at another time, speaks of images floating in the air at a distance of so many feet from the eye; but he even accuses certain images of assuming a position in space different from "their right position" But, of course, such language—whatever be its meaning—cannot signify that images do ever actually exist in space, apart from the mind. I do not affirm that images are *purely* subjective states: modes of the *ego* considered *per se*, and out of all relation to matter: modes in which the *ego* might have existed, though matter had never been. Most metaphysicians take this view. A different opinion, however, may be maintained. It may be held that an image is *not* a *purely* subjective state, but is constituted by the mind's immediate apprehension of the *non-ego;* that it is a product of two factors, the mental and the material, mysteriously united with, or existing in relation to, one another. Being desirous to avoid metaphysical discussion as far as possible, I shall not attempt here to judge betwixt these two opposite theories. But, whether the one or the other be correct; whether an image be purely subjective, or partake partly of the subjective and partly of the objective; this

at least is certain, that it is subjective in such a sense that it has no existence in absolute space, apart from the mind.

This explanation being made, we are now able to estimate aright Sir David Brewster's reasoning. Suppose rays from an object X Y to fall upon the retinal surface $y\,x$; the rays from X being brought to a focus at x: and those from y being brought to a focus at y.—Sir David argues, that, according to his law, an impulse on the retina at x gives vision in a direction perpendicular to the retina at x; and that an impulse on the retina at y gives vision in a direction perpendicular to the retina at y; and that, therefore, the phenomenon of an erect object is produced, though the picture on the retina is an inverted one. But "the phenomenon of an erect object," it must be kept in view, is not any thing having existence in space apart from the mind, and standing in an erect posture. It is a subjective (I do not say, *purely* subjective) representation. Now I presume that Sir David Brewster does not wish us to believe that *this subjective representation itself* is a corollary from the law of visible direction. He cannot mean more than that the mind's instinctive and determinate reference of the affections of which it is conscious to an erect exterior stimulus, is a corollary from the law of visible direction. And undoubtedly this reference is a demonstrable corollary from the law. But is it not plain, that, to assume that there is such a reference, instinctive and determinate, involved in, or connected with, the phenomenon of an erect object, is to assume the very thing about which there is any controversy? For what is it which those demand, who ask proof of the law of visible direction? They demand proof of the assertion, that the mind instinctively refers its visual affections to a remote stimulus lying in any determinate direction whatever from the point of the retina excited.

Should the above criticisms be well founded, they are applicable to the whole of Sir David Brewster's reasoning; so that it is unnecessary to examine the details of other experiments to which he appeals. Our conclusion, therefore, is, that both his direct and his indirect proofs are entirely destitute of weight. *The sole fact which he has established, is, that the subjective affections to which rays impinging on the retina give rise, are the same, whatever be the obliquity at which the rays strike the retina.*

It is a curious circumstance that Sir David Brewster was anticipated in his Law of Visible Direction by a conjecture of D'Alembert, founded upon the idea that the stimulus proximately affecting the retina, acts, conformably to ordinary mechanical principles, in a

direction perpendicular to the retinal surface. "The celebrated D'Alembert," Sir David himself writes, in an article published in the Philosophical Magazine for May, 1844, "maintains that the action of "light upon the retina is conformable to the laws of mechanics; "and he adds that it is difficult to conceive how an object could be "seen in any other direction than that of a line perpendicular "to the curvature of the retina at the point of excitement."— The opinion here expressed was abandoned by D'Alembert in consequence of conclusions to which he was led from the erroneous data with which he was furnished as to the structure of the eye; but, as the consideration which seemed to him to give an *a priori* likelihood to a law of visible direction identical with that which Sir David Brewster supposes himself to have experimentally established, may perhaps be thought by some to possess a measure of weight, I would observe that neither D'Alembert's conjecture, nor the inference which he drew from it, is in the least degree warrantable. On the one hand, it is by no means to be admitted that the action of light upon the living nerve, where the objective and subjective meet together, must, as a matter of course, take place according to the ordinary mechanical laws that prevail within a strictly objective sphere. And, on the other hand, even were that allowed, it would furnish no presumption in favour of the idea that we see objects in a direction pependicular to the surface of the retina at the point of excitement. For who does not perceive that the question as to the direction to which the mind refers the stimulus that produces vision remains entirely undetermined, whatever be the conclusion we adopt as to the direction in which the retina is impressed?

Not only has Sir David Brewster failed in proving his law of visible direction, but it may without difficulty be shewn that the mind does not instinctively refer its visual affections to a remote stimulus lying in any determinate direction whatever from the point of the retina excited, so that *no definite Law of Visible Direction exists*. This view, and also the ground on which it rests, were hinted at in a previous part of the paper; but it may be proper to bring it out more fully. It is based on the elementary metaphysical distinction between immediate and mediate knowledge: immediate knowledge being realised, when a thing is known in itself; and mediate, when a thing is known inferentially, through means of something else. Now, when the mind refers an affection of which it is immediately cognizant, to a remote stimulus, the judgment of the mind assigning a perpendicular direction or position to the stimulus, is mediate. No immediate,

intuitive knowledge of the position of any remote stimulus is realised: we only infer its position from the particular consciousness of which the mind is the subject. Suppose, for instance, that the eyes are directed to a small luminous object at a little distance. A remote stimulus is not intuitively known *even to exist*. Dr. Reid, indeed, the founder of the Scottish School of Philosophy, taught that distant objects are immediately perceived: but this doctrine will no longer find a single intelligent defender. As Sir William Hamilton has pointed out, Reid here fell into a fatal inconsistency. Those metaphysicians who believe that material objects have an existence at all, apart from the mind, are now unanimous in admitting that distant material objects, like the luminous point referred to, are not immediately perceived; and I presume that Sir David Brewster would himself subscribe to this view, when formally presented to him. This leads at once to the result, that the visible position of a distant object is indefinite; for, the estimate which we form of the position, or of any of the relations, of a thing not immediately known, is liable to variation. Different persons, and even the same person at different times, may form extremely different estimates of the position of a point. But if visible direction be thus indefinite, it cannot be capable of being expressed by a definite law, either that of Sir David Brewster, or any other.

It might be thought, indeed, from a superficial view of the subject, that, in opposition to what has been said, impressions made upon the retina *are* determinately referred to particular directions. Is not every one, it may be asked, familiar with the fact that objects often appear where the observer knows them not to be, and where, nevertheless, he cannot help fancying them to be? An object is known to be at A. The sense of touch assures us that it is so. Yet it appears to be at B. We are obliged, in spite of ourselves, to refer the visual impression to a stimulus in the position B, though our reason is satisfied that such reference is erroneous. No effort, as Sir David Brewster says, in describing a case of the kind, is sufficient "to dispel the illusion." Does not this prove that impressions made upon the retina *are* instinctively referred to particular definite directions? I answer: no. Take the simplest of all examples. To an observer looking at an object reflected from a plane mirror, the image appears (to speak popularly) behind the mirror. Now here undoubtedly a determinate effect is produced; an effect which no knowledge possessed by the observer, nor any effort of his will, can modify. But what is this determinate effect? It is *the image formed;*

and (as was previously pointed out) an image is a subjective phenomenon—not, perhaps, purely so, but subjective at least in this sense, that it has no existence in space, apart from the mind. In granting, however; that the observer cannot by any effort modify *the image*, or subjective phenomenon, connected with a particular impression made upon the retina—which is just granting, in other words, that he cannot make his perception any thing else than it is—we by no means grant that experience does not enable him to modify *his reference of the visual impression to a remote stimulus*. A child, or a savage, who had never seen a mirror before, would naturally refer the sensation of which he was the subject, to the influence of an object actually existing behind the mirror: but when a very little knowledge was obtained, such reference would no longer be made. And here let me remark that it is not true that, in matters of vision, we ever labour under illusions which refuse to be dispelled. When a child or savage sees an object reflected from a mirror, and concludes that the remote stimulus of vision is behind the mirror, two things must be distinguished: first, the image formed, in other words, the subjective phenomenon produced, or the consciousness realized; and secondly, the inference drawn, viz: that an object exists behind the mirror.—As far as the former of these is concerned, there is no illusion. The image is apprehended as it really is. To deny this, would be to say that a perception might be what it is not. In the latter point—the inference drawn—there is certainly room for mistake or illusion; but the erroneous inferences of an uninstructed observer are capable of being corrected.

I shall only add, that, should the views advanced in this paper prove to be well founded, they must materially affect the conclusions at which we arrive on some questions which have recently excited considerable discussion. I refer to the principles involved in the construction of the Stereoscope; to our (so-called) perception of relief; to the curious changes which often seem to take place in the solids represented by plane outline figures; and to other matters of like description, into the particular discussion of which it would be beyond our present purpose to enter.

NEW TRAVERSING STAGE FOR THE MICROSCOPE.

BY PATRICK FREELAND,
REGISTRAR, TORONTO UNIVERSITY.

Read before the Canadian Institute, 21st February, 1857.

The high position now occupied by the microscope, both as an instrument of scientific research and as a means of obtaining useful recreation, as well as the great attention given to it, in order to bring it as near as possible to perfection, render unnecessary any apology from me in bringing under the notice of the Canadian Institute what I conceive to be an improvement in the construction of the stage, or the apparatus used for holding the object while under examination, and for moving it about so as to bring at pleasure any portion of it into the centre of the field of view. The importance of being able to move the stage plate of the microscope in every direction easily and with precision, is well known to every microscopist, and many methods of doing so, each having its own peculiar merits or defects, have been adopted.

In 1831, Mr. Cornelius Varley constructed the first microscope with a lever stage movement, for which he subsequently received the gold Isis medal, awarded to him by the Society of Arts of London.—But the application of the lever in Mr. Varley's microscope was soon found to be objectionable, its fulcrum was attached to the stage itself, and the lever projected downwards under it, thus removing the hand to a considerable distance from the focus adjustment, while the whole arrangement was complicated. It was however, subsequently much improved by Mr. Alfred White, who simplified very much the whole stage movement, and entirely dispensed with a great deal of what encumbered Mr. Varley's. Instead of having it below the stage, Mr. White brought the lever above, and placed its fulcrum on a stout arm projecting from the upright which carried the compound body; and in this form the lever stage is still mostly used—this stage is described by Mr. White in the first volume of the Transactions of the Microscopical Society. It consists like almost all traversing stages, of three plates of brass laid one above the other, the lowest one being fixed and the other two provided with dovetailed guides and slides, so that each may be

easily moved by the lever either in the same or in parallel planes, but at right angles to each other; while if both be moved at the same time, a diagonal motion is obtained at the pleasure of the operator.

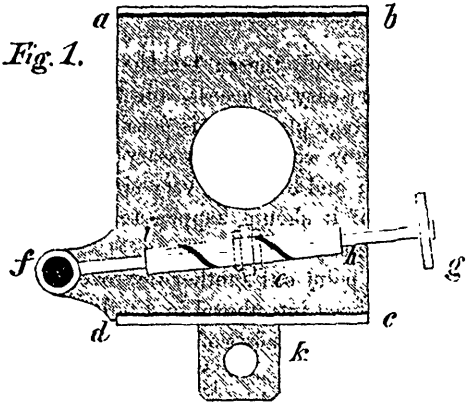
This plan of a traversing stage has many advantages, it is in the first place simple in its construction, and is very easily managed—and as the end of the lever to which the hand is applied moves in all cases in exactly the opposite direction to that in which the stage is moved by it; and as the compound microscope always inverts the image of the object under examination, the object will appear to move in the direction of the hand. But the great objections to this form of the traversing stage, are that the lever is very much in the way, and being attached to one of the extreme angles of the stage, when, it is in use, the strain is thrown more upon those parts of the stage in the vicinity of the lever, which wear away more rapidly than the others, and soon impair the correct working of the instrument.

The next mode of producing a traversing motion, is that usually known as Turrell's plan, and is described by that gentleman in the 49th volume of the transactions of the Society of Arts. In this mode the lever is entirely dispensed with, and the different motions are communicated to the stage plate, by two milled heads placed together, at the right hand side of the stage, and turning upon concentric axes. The motion of one of the plates of the stage is produced by turning one of the milled heads attracted to a pinion which works in a rack attached to the under side of the plate. The motion of the other plate is produced by the other milled head which works a screw, in a thread attached to the under side of the second plate; and by working the two milled heads at the same time, a diagonal motion is given to the stage. But apart from the complexity of this arrangement and its great liability to get out of order, it has several very serious defects, the greatest one being that in order to produce a diagonal motion in some directions it is necessary to use both hands, an objection which this form of stage was expressly designed to meet, but which it only partially removes.

In the microscope which I have now the honor to bring under the notice of the Canadian Institute, this difficulty is entirely overcome, and by a combination of the lever and the screw, the advantages, without the defects, of both Mr. White's and Mr. Turrell's plans are secured.

I have placed immediately under, and running the whole way across the stage, the lever *f g* *Fig.* 1. on which for about two inches

Fig. 1.



of its length, at an equal distance from either end of it, is cut a spiral groove, *h i*. The fulcrum is at *f* on the left side of the stage in a small pillar rising out of a slight projection from the lowest plate of it, and is so contrived, that the lever can be easily turned on its own axis. On the other end of this lever at *g* a milled head is fixed, by which the different motions are given to the lever. An enlarged representation of the adjustment for the fulcrum is given at *Fig.* 2., representing a small brass pillar, which passing through the under plate of the stage, is held down by a forked piece of brass screwed to the under side of the plate, and accurately fitting the neck cut in the pillar at *o*, so that the pillar can readily be turned on its own axis while firmly held in its place. The end of the lever having a similar neck, is shown at *m*; this fits into the pillar and is held in its place by a small forked piece of iron, *n*, passing down over the neck, and secured by the small screw *p*. The grooved part of the lever passes through a short brass tube, *e* (*Fig.* 1.,) (an enlarged representation of which is given at *Fig.* 3.) to this tube a small stem *r* is attached, which screws into the under side of the upper stage plate by a left handed screw, a small steel screw *s* passes through the tube, the point of which fits into the spiral groove *h i* of the lever. The upper stage plate slides in dove-tailed grooves made in a frame of brass, and this frame slides in the dove-tailed grooves at *a b* and *d c* but at right angles to the former. The arm which carries the compound body rises from the projection shown at *k*; by turning the milled head *g* the action of the spiral groove on the pin in the tube *e* moves it, and with it the stage to which it is attached, to or from the hand; while by moving the milled head backward or forward, a transverse motion is produced, and by com-

Fig. 2.

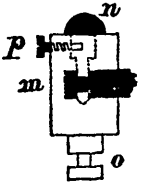
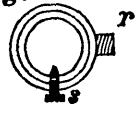


Fig. 3.



bining the two, a diagonal movement at the will of the operator is secured.

The advantages of this plan are simply these: 1st, the lever is not in the way of the operator, yet very easy of access, and the power is applied as near the centre of the stage plate as it is possible for it to be. 2nd, only one hand can in any case be necessary to produce every motion that may be desired; and 3rd, it is very simple, is not liable to get out of order, and if it should happen to get out of repair can readily be set right again.

I may perhaps be permitted to point out another improvement in this instrument, which has lately been introduced in England, and I believe also in the United States. This consists of a new arrangement for the coarse adjustment of focus.

The rack and pinion movement which is always unsteady and works by jerks even when most carefully constructed, is here dispensed with, and instead of it a chain movement is substituted, which has the advantage of being much smoother, and more sensitive, of being less likely to become unequal by wear, and of being easily tightened if it should cease to act, or "loose time" as it is technically called, while its delicacy and smoothness admit of an exact adjustment being made by its means alone, even when using high powers.

REVIEWS.

Gales in the Atlantic: By Lieutenant Maury, U. S. N., Washington Observatory, May, 1857.

In extending a knowledge of the physical phenomena of the Atlantic Ocean, the publications of the Washington Observatory under the able superintendence of the author of the "Physical Geography of the Sea," stand deservedly pre-eminent. Lieutenant Maury's *Wind and Current Charts*—an annual volume of over nine hundred quarto pages accompanied by a large number of ingenious and elaborately executed maps—are universally allowed to have contributed the most essential aid to navigation. As Humboldt truly states, the shortening of many a dreary voyage may be cited as one of their results. In that valuable publication, the gales of the Atlantic are especially discussed; and various explanatory

diagrams are given in illustration of their peculiarities of occurrence. In the publication now under notice, this subject is still further elaborated; and we are presented with a chart of the North and South Atlantic Oceans, for each month of the year, shewing by an ingenious arrangement of colours, the comparative frequency of gales, over given areas, in the different months. Three facts are brought strikingly before us by an inspection of these gale-charts. First, the marked preponderance of stormy weather generally in the North, as contrasted with the South Atlantic, at least for the winter months; secondly, the scarcity of gales between the parallels of 30° north and south; and thirdly, the remarkable difference between the frequency of gales in the winter, as compared with the summer months, over that region of the North Atlantic lying more especially in the track of ocean travel between the United States and Europe. Whilst in the October, November, December, January, February, March, and April charts, an extended and unbroken line of colour stretches from the British Isles to the Atlantic sea-board of the States only varying somewhat in intensity and breadth—in the June, July, and August charts, merely a few limited patches meet the eye. In his brief explanation of these charts, Lieutenant Maury states that they were principally worked out with a view to ascertain the most tranquil and favorable time for laying the sub-Atlantic telegraph. This time, and necessarily also the most favorable season for passenger travel across the Atlantic, he shews to be about the end of July, or the beginning of August. "At no season of the year," writes Lieutenant Maury, "can the passage around either of the 'Stormy Capes,' as poets call them, vie for storms with the winter passage between England and America." And again, "this part of the ocean is most tranquil in summer. Taking averages, we have in it fewer gales but more fogs and ice in June than in July or August; but fewer fogs and least ice in August. The last of July and first of August appears to be the most favorable time for laying the sub-Atlantic telegraph. This information may be useful to invalids and others crossing the Atlantic, as well as to those engaged in this enterprize."

Although these gale-charts are intended to be considered in the light of approximations merely, some idea may be formed of the care bestowed on their compilation, when we state that they embody the results of no less than 265,292 days of observations.

E. J. C.

Journal de l'Instruction Publique : Montreal, (Bas-Canada,) 1857.—Nos. 1, 2, 3 and 4.

Journal of Education: Montreal, (Lower Canada,) 1857. Nos. 1, 2, and 3.

We notice with great satisfaction the nearly simultaneous appearance of the two educational journals of Lower Canada: each, as we trust, and fully believe, the *avant courier* of a new era for educational progress in that part of the Province. They appear as the organs of the improved Common School system of Lower Canada, now established with its twin Normal Schools at Montreal, the McGill and the Jacques Cartier Schools; and at Quebec the Laval Normal School; all under the efficient control of the Hon. Pierre J O. Chauveau, Chief Superintendent of Education for that part of the United Province.

It argues well for the success of the newly inaugurated system that an honest attempt is thus being made to adapt the educational system, not only to the wants, but also to the opinions and prejudices of the two very diverse elements which constitute the combined population of that portion of British North America, instead of attempting any forced and unattainable theoretic uniformity. The two journals thus addressed to different sections of the population, who are being trained under systems diverse in some important respects, and with different languages, historical associations, and aims: are designed each with a view to their own special readers; while, nevertheless, they have much ground in common, and cannot fail to exercise a beneficial and stimulating influence on each other. That they are to move in harmonious combination is the present purpose of their editors, and in this worthy aim we wish them all success. The editor of the English journal, after detailing the design and objects of the work, and stating the varied contents with which it is purposed to fill its pages, thus concludes his first leading article, speaking in part for both journals:

Every thing congenial with public instruction will find its place in our columns, varied we hope. in the most pleasing manner. Poetry will now and then lend us its harmonious accents. Science in its innumerable departments will afford us amusement and instruction. History, and more especially that of Canada, will frequently unfold an interesting page to our young readers. The passing events of our day, without any allusion to local politics will teach us many a lesson, and finally Religion that aromat (as a great English chancellor had it,) without which all science would be putrified, religion we hope will pervade all our writings, and by its sacred influence will exclude from our columns anything that might offend the eye even of the most scrupulous of our readers. With the help of these powerful elements, and we hope, with the assistance of all the friends of education, "Le

Journal de l'Instruction Publique," and the " Lower Canada Journal of Education." will be enabled to accomplish the all important mission confided to them.

That mission, difficult in any country, is rendered more so in ours, by the complications which difference of language, origin and creed, bring with them in every public undertaking. These, however, we hope not only to surmount, but we are sanguine enough to see in them if properly attended to, new elements of success. Amidst the furious struggles of the political world, all sections of the population require a neutral ground where they can meet for one common object, with one common accord. This can no where be found but in education, in science, and in literature, and presents little difficulty with us in Lower Canada, from the fact, that through mutual forbearance, education has never been the cause of either political or religious dissension.

It will be one of our chief objects to make each section of the population better known to the other, and to spread useful information through the means of each of these journals, on the educational progress not only of its own class of readers but equally of those of the other. Having at our disposal a large supply of English and of French newspapers and periodicals, as well from the old world as from our own continent, we shall be enabled, with the aid of appropriate translations to offer to the readers of each of our papers, matter that is not generally within their reach. We will endeavour from these sources to diversify the columns of both publications and render them entertaining to all; and we may add, that to our knowledge, a great number of families who are acquainted with the two languages will become subscribers to both. This fact will of course increase our responsibility and stimulate our exertions in relation to each of the two journals.

Under two different names, clothed in two different languages, but both harbingers of peace, both advocates of the same cause, we send forth these two papers, and with care, with fondness, with anxiety alike for both, for both we ask—and to both, we trust the public will say—success.

To this desire we heartily respond. Education universally diffused among the people of Canada is an indispensable element to its true progress; and the rapid advances we are now making in agricultural and commercial prosperity, render such not less, but more indispensable, if we would not sink into mere trading and labouring drudges with no higher ambition or nobler aim in life than that of Bunyan's " Man of this World," shown to Christiana and the boys in the " Significant Rooms" of the Interpreter's House. The quaint fancy of the glorious old Dreamer's parable is replete with lessons for all of us in these days and this land, where the one object of life so often seems the mere haste to get riches. " The Interpreter takes them apart, and leads them into a room where was a man that could look no way but downwards, with a muck-rake in his hand; there stood one also over his head with a celestial crown in his hand, and proffered him that crown for his muck-rake: but the man did neither look up nor regard, but rake to himself the straws, the small sticks, and dust of the floor."

Some such *significance* both the Educational Journals of Lower

Canada seek to set forth in the teaching they inaugurate. The "Celestial Crown" which he who is engrossed by the raking together of the world's dust and straws cannot discern, is not indeed mere intellectual culture, though that unquestionably has an elevating tendency. It raises men's thoughts, uplifts their aspirations, and precludes in some degree the all absorbing sovereignty of mammon's worship.

The motto of the English Journal is: "*Labor vincit omnia*," that of the French Journal: "*Rendre le Peuple meilleur*," but both exhibit their chosen *cri de guerre* encircled by the Canadian emblems of the beaver and the maple-wreath; within which, and resting against the symbol of our common christian faith, is the open volume, inscribed: "religion, science, liberty, progress," as the means which—notwithstanding the differences separating those of English and French language and origin from each other,—they thus acknowledge to be, each and all of them, indispensable as the allies and coadjutors of national education, by which all difficulties must be overcome, and all obstacles removed which would hinder the making of the people better. That these, the true elements of a people's greatness and prosperity, may advance simultaneously as the fruits of the great blessing of a wise national education throughout every section of our Province, is, and must be the earnest desire of every one who believes that the "people are destroyed for lack of knowledge;" but that "righteousness exalteth a nation, and sin is a reproach to any people."

We would gladly see both of these Journals obtain an extensive circulation in our upper section of the province. The more we learn to take an interest in all which pertains to the welfare of each other, the better will it be for our common country and the success of all in the progress of which we have a mutual advantage to reap, and we gladly cherish the belief that the common ground on which we can meet and exchange sympathy is neither narrow nor straightened. Views of the Jacques Cartier Normal School, illustrate the first number of the one Journal, and of the McGill Normal School the other. Already papers are introduced as the first of a series, on questions interesting to all engaged in education; while another series devoted to "the Colleges of Canada," begins with the history of Laval University, and with a view of the extensive but singularly unacademic looking range of buildings which furnish accomodation for that Institution at Quebec. This will be followed by similar notices of the other educational institutions of the Province, and is

not to be confined exclusively to Lower Canada. Incidents of early Canadian history are also introduced in a pleasing style, and addressed as these are in the *Journal de L'Instruction Publique* to those of French origin, they are presented in a form calculated to give piquancy and interest to us, who, when considering them at all, are apt to overlook some of the minuter points best calculated to awaken an interest in our historic past. Altogether we gladly welcome these Education Journals as most useful and acceptable additions to the periodical literature of the Province.

D. W.

Reid's Works, (Essays on the Human Mind, &c., ;) with selections from his unpublished letters; with a Preface, Notes, and Supplementary Dissertations, by Sir William Hamilton, Bart. Edinburgh : 1854.

The following article is not a *criticism*, but simply an *exposition* of the late Sir William Hamilton's doctrine of Sensitive Perception; and it is designed to supply what has hitherto been felt by many, and especially by those entering on the study of philosophy, to be a great desideratum : an accurate, and yet not very technical statement of the only consistent and plausible system of natural realism which is before the world. It is necessary to explain that the writer of the article considers Sir William's doctrine to be in several important respects erroneous. But without bringing forward the grounds of this opinion, he has limited himself at present to the task of exposition. The only exceptions to this, are, the foot note on the subject of the extension of body, and the reference made in the note at page 295, to a former article in this journal, on Sir William Hamilton's doctrine of consciousness.

Under the general title of Sensitive Perception, Sir Wm. Hamilton includes sensation proper and perception proper; or more simply, without the addition of the epithet *proper*, sensation and perception.

Each of these forms of sensitive perception is held to be an act of the mind in which an object is known. Sensation is allowed indeed to be a lower exercise of intelligence than perception; because, as will afterwards appear, it is merely the knowledge of a fact, while perception is moreover the knowledge of a relation : but still both are acts of intelligence. The mind in sensation, as well as in perception, is cognizing an object. This is not the universally received

doctrine of philosophers; for some have thought that sensations, as mental states, are capable of being distinguished from the acts of intelligence by which a knowledge of them is realised. In fact, it has been held, and by no mean authorities, that sensations may exist in the mind, without ever becoming known at all. But according to Hamilton such opinions are untenable. He denies that sense, either in its lower or in its higher form, can be discriminated from intelligence. "Quid erit sensus," he asks with Tertullian, "nisi ejus rei quæ sentitur intellectus?"

Sensation is not only an act of knowledge, but more particularly, one of immediate knowledge or consciousness. As we shall have frequent occasion to use these expressions, *immediate knowledge*, and *consciousness*, it may be well to define them formally. An object is said to be known immediately, when it is apprehended in itself; in contradistinction to mediate knowledge, which takes place when an object is apprehended through something else. Thus, a blind man, made sensible through means of his staff, of an obstacle before him, knows the obstacle, but only through something else. This is mediate knowledge. On the other hand, how is one aware of the thought which at any moment exists in his mind? He apprehends it, not through anything else, but in itself. This is immediate knowledge. Consciousness is employed by Sir Wm. Hamilton, and will be used throughout this article, as synonimous with immediate knowledge. When therefore sensation is represented as an act of immediate knowledge or consciousness, the meaning is, that the object known in sensation is apprehended in itself, and not through the medium of aught else.

This leads to the enquiry, what is the object of which we are conscious in sensation? Sensation is an act of knowledge; it is an act of immediate knowledge: what is the thing immediately known?

In answer to this we remark that the living organism of the body is capable of having a great variety of affections excited in it, either by external or by intraorganic causes. In the well-known theory of Dr. Reid, such affections are recognised as the antecedents of our sensations. The sensation of sweetness, for example, is consequent upon one particular modification of the animated organism; the sensation of redness upon another; the sensation of the odour of a rose, upon a third; and so forth. The sensorial affections which are thus regarded by Reid as the antecedents of our sensations, constitute, according to Hamilton, the objects known in sensation. The living organism, in consequence of the application of some stimulus, is affected in a certain way; the mind immediately knows, or becomes

conscious of the organic affection; and it is in this immediate knowledge or consciousness that sensation consists. Sensation may accordingly be defined to be an act of consciousness whereby we apprehend in our body, certain special affections of which, as an animated organism, it is contingently susceptible.

In saying that the object of which we are conscious in sensation is an affection of the animated corporeal organism, let it be understood that Hamilton does not altogether negative the commonly received opinion, that the object of sensation is in the mind. A word of explanation is requisite here. The body, as animated, ought not in propriety to be considered external to the mind; for it exists in a mysterious connection with the indivisible thinking principle, in consequence of which, the affections of the living organism are apprehended as subjective affections. The terms *objective* and *subjective* denote, the former what is without the mind, and the latter what is in the mind. Now undoubtedly, the body, as a material organism, with the general relations of extension under which it in that character necessarily exists, is without the mind, and can only be apprehended objectively; but as a living organism, it is in union with the mind, and its affections are felt as subjective. The general relations of extension under which our bodies exist as material substances, belong to our bodies alone. They cannot in any sense be predicated of the mind. I, the Ego, do not exist under any relations of extension. But the special affections excited in my body as an animated organism, I claim as mine. I am conscious of them as affections of Self. It is only with this seriously qualifying explanation that Sir W. Hamilton would subscribe to the doctrine of Reid, and of philosophers generally, that the object of sensation is in the mind. He would not allow that it is in the mind purely. Strictly, it is a sensorial affection, which we are constrained, however, to view as of the Ego, in consequence of the union subsisting between the Ego and the living organism.

In the opinion of Reid, the dependence of our sensations upon affections of the bodily organism is altogether arbitrary. A piece of sugar is taken into the mouth; the organ of taste is affected in some unknown way; thereupon the sensation of sweetness arises. So says Dr. Reid, and he tells us that no necessary connection exists between the condition determined in the organ, and the sensation to which it is antecedent. It is a connection which has been established arbitrarily, by the will of the Creator. Had the author of our being so pleased, the sensation of sweetness might have been made to arise, not in connection with the particular condition of the body upon which it is actually consequent, nor in connection with

any state of the organism whatever, but as the consequent of some change in the planet Jupiter, or in the volcanoes of the Moon. But on the view taken by Sir W. Hamilton of the object of sensation, such an opinion is manifestly inadmissible. If sensation be, as he maintains, the immediate apprehension by intelligence of certain affections in our living bodies, the dependance of our sensations upon our organic states cannot be arbitrary. To speak of an act of consciousness without an object, would be a contradiction in terms.

Let us now turn to perception, the other form of sensitive apprehension. According to Sir W. Hamilton, perception is, like sensation, an act of immediate knowledge or consciousness; but whilst the latter has for its object, as we have seen, affections of the Ego, the former has for its object relations of the Non Ego. Is it asked: what are these relations, and how are they presented to the mind so as to be perceived? The answer is: they are relations of extension, and they are apprehended in and along with our organic affections. Here, for the sake of simplicity, as well as because the distinction requires to be made on other accounts, we shall consider separately the relations of our organism to itself, and the relations of the organism to what is extraorganic. In the first place, with regard to the relations of our organism to itself: suppose that affections locally out of or external to one another are excited in the organism by some stimulus. The mind immediately apprehends the fact of their existence; and this is what we call sensation. But in immediately apprehending affections mutually out of one another, it obtains a consciousness of the relation of mutual outness which they bear to one another; in other words, it becomes conscious of the organism as existing under relations of extension. This is perception, apprehending our body as a finite, extended—that is, as a material object.* In the next place, with regard to the relations in space of the material organism to what is extraorganic, in order to show how these become objects of perception, we must refer to a class of sensorial affections which possess a character altogether peculiar; we mean modes of resistance. In

*Sir William Hamilton defines Body to be *that which occupies space and is contained in space:* and (as the text explains) an objective reality answering to the definition is, according to him, ascertained to exist, in the consciousness which we have of affections of the corporeal organism mutually external to one another.

Now it is worthy of remark that the consciousness here described—and which is the only consciousness that is supposed to reveal the extension of matter—does *not* reveal matter or body as *continuously extended*. We offer no criticism now on Sir W. Hamilton's general doctrine. For the sake of argument, let that general doctrine be admitted. Let it be admitted, in particular, that, when the mind perceives, it cognizes a plurality of organic affections in their relation of mutual outness to one another. Does it follow that the organism in which two such affections A and B are simultaneously apprehended is a *continuum*, a substance stretching with unbroken extension from the locus of the one affection to that of the

fact, resistance as a subjective mode will, upon reflection, be seen, (Sir W. Hamilton holds) to be a relative, having for its correlative (the consciousness of which is therefore necessarily involved in our consciousness of resistance as an organic mode) a degree of outward force or pressure opposed to our locomotive energy. A person exerting a muscular effort, and feeling that the limb which he essays to move is impeded, cannot be conscious of resistance in this phasis, as an effort of self, an organic mode, without at the same time being conscious of it in its other phasis, as a force which is not self-opposing the attempted movement of his organism. It may thus be understood how relations in space of the corporeal organism to what is extraorganic, as well as relations in space of the organism to itself, fall within the reach of the perceptive faculty. Modes of resistance are immediately apprehended in the organism, as actual phenomena; this is sensation. In and along with the immediate apprehension of the fact of their existence, comes a consciousness of the mutual relation of outness in which they stand to one another; this is perception, revealing the organism as extended. But still further, in the same indivisible act of consciousness, we apprehend our organism standing in the relation to something extraorganic, of being resisted by it; this is perception recognising the existence of extraorganic objects. We do not indeed immediately know that what resists our locomotive energy is body or matter: we only learn in course of time, mediately, through induction, to connect pressure with bodies. But even prior to induction, immediately, in and along with sensations of resistance, and the accompanying perception of relations of extension in our organism, we have a knowledge of a resisting extraorganic something—whether identical with matter, or in any way connected therewith, deponent (to wit consciousness) saith not.

We remarked when speaking of sensation, that, in virtue of the union betwixt the mind and the animated organism, the special affec-

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other? By no means. Extension is not supposed to be apprehended in the consciousness of the affections A and B as actual phenomena; but only in the consciousness of their mutual outness. If, however, neither the affection A *per se*, nor the affection B *per se*, reveals the organism as extended, then all that is fairly implied in the mutual outness of A and B, is, that the organism is plural, compound, having the locus of one element here, and that of another there—which is a very different thing from saying that it is a continuously extended substance, or composed of elements which possess continuous extension. Even though the organism of our bodies were known to exist as a congeries of elements external to one another, it might still be the case that matter did not possess extension in the proper sense of the term; in other words, matter might not be a substance in which different points could be taken, such that the substance would stretch as an unbroken *continuum* from one of them to the rest.

tions of the latter which are apprehended in sensation, possess a subjective character. They are felt as affections of self. But when we consider the general relations of extension under which the organism is perceived to exist—relations under which, as body, it necessarily exists—it is plain that as respects these, it has no claim to be viewed as subjective. They do not belong to it as united with the thinking principle, and cannot in any sense be predicated of self. Hence the organism which in sensation is reckoned of the Ego, is in perception accounted Non-Ego. This will probably seem strange doctrine to those to whom it is presented for the first time. That the organism in one aspect, as animated, and the object of sensation, should be of the Ego, while in another, as material and the object of perception, it is ignominiously reduced to the rank of Non-Ego—that it should be at once within and without the mind—may, as Sir W. Hamilton confesses, "appear not a paradox merely but a contradiction." But upon any theory, the connection between soul and body is a deep mystery—"the mystery of mysteries;" and should a particular doctrine be in other respects agreeable to the imitations of consciousness, Sir William Hamilton contends that it is not rendered unworthy of acceptance, merely by being paradoxical or even seemingly contradictory [real contradiction being always supposed to be avoided] where it touches upon a matter so obscure.

Sir William does not admit that distant objects—that is, such as are not in proximate relation to the organism—are perceived. We perceive our body (as a material organism), and also extraorganic objects (not known by consciousness to be material) directly pressing against the organism; but we perceive nothing else. And indeed a moment's reflection is sufficient to shew that no system in which perception is viewed as an immediate cognition, can, without palpable error, affirm the perception of distant objects; for such objects are not in presentation to the mind, which never sallies out beyond the organism: and the mind cannot immediately apprehend what is not in presentation to it. Here Dr. Reid is grievously in fault. His philosophy knows nothing of any such limitation of the range of the perceptive faculty as that described. He claims for perception a capacity of reaching to distant objects; and classes himself, even ostentatiously, with "the vulgar" who think that they perceive ships and houses, and men, and women, and other external realities which lie confessedly beyond the sphere of proximate relation to their organism. But this is, of course, perfectly absurd, on the supposition that perception is, what Reid every where affirms it to be, an immediate cognition. A book lies upon the table; our eyes

are directed towards it. Do we perceive it? In the proper sense of the term, assuredly not—that is, if perception be an immediate cognition. The book is not in presentation to the mind; and therefore any knowledge of it to which we attain is of necessity got mediately, as the result of the immediate cognition of some other object or objects lying within the reach of consciousness. Sir W. Hamilton, by denying that distant objects are perceived, escapes the charge of suicidal inconsistency to which his predecessor is exposed. According to his doctrine, the sun is not perceived in the firmament; its presence there is only known mediately and inferentially. David did not perceive Goliah when he was in the act of slinging the stone at his forehead; he merely *guessed*, as our American neighbours would say, founding on some particular consciousness of which he was the subject, that the giant was before him.

It will be obvious from the statement made, that sensation is the condition *sine qua non* of perception. For what is perception? It is the immediate knowledge of relations under which the organism exists, to itself, or to something extraorganic. But these relations are apprehended only in and along with organic affections. Let no organic affections be cognized — in other words, let there be no sensation—and the organism is no longer known at all; *a fortiori* its relations remain unknown. Perception therefore implies sensation as its indispensible condition. Yet it must not be supposed that, as Reid affirms, the one precedes the other in time. A sensation (Reid tells us) is first experienced; and and thereupon a conception of the external object which was concerned in originating it, together with an irresistible belief of the existence of the object, are instinctively suggested to, or inspired in, the mind. The conception and belief, forming the constituent elements of the perception, are suggested to, or inspired in the mind, on occasion of the sensation; so that the perception is subsequent, by however brief a period, to the sensation. In opposition to this, it is a perfectly essential part of the doctrine of Sir W. Hamilton, that though sensation must, indeed, as a *conditio sine qua non* of perception, be antecedent to it in the order of nature, the two are inseparable in time. The relations of extension which we apprehend in our body, when we perceive, are apprehended not after, but in and along with organic affections. It hardly requires to be added, that Hamilton's principles are diametrically opposed to those statements also of Dr. Reid, which represent the connection between sensation and perception (like that imagined by Reid to subsist betwixt our organic states and our sensations,) as arbitrary, and which affirm that

had it so pleased God, external objects might have been perceived by us, independent of sensation altogether. The dependence of the knowledge of a relation upon the knowledge of the things correlated is so far from being arbitrary, that even Divine power could not work an impossibility of giving us the former save on condition of the latter.

It cannot have escaped the notice of our readers, that perception must, on the doctrine expounded, have for its condition, not only sensation, but a plurality of sensations, because the perception of our organism (which enters into all perceptive consciousness, even into that of the extra-organic world,) is the consciousness which we have of the mutual outness of organic affections locally external to one another, and therefore plural. These affections do not indeed constitute sensation, but sensation consists in the recognition of them; so that perception can take place only where sensation is recognising a plurality of objects. Sir W. Hamilton not only holds this, but maintains that sensation itself supposes plurality in the object or objects of its apprehension. Let us quote his own words: "The second," (that is, the second condition of sensitive perception, in either of its forms; attention having been named as the first,) "is "*plurality, alteration, difference*, on the part of the perceived object "or objects, and a recognition thereof on the part of the perceiving "subject." However technical a sound these words may have in uninitiated ears, (Sir William is partial to esoteric phraseology,) the thing meant may, without much difficulty, be understood. Were the organism of our body without affections capable of being discriminated as plural, it would in fact be devoid of affections altogether; for what are affections except alterations or differences? If, therefore, sensation be the recognition of affections in the organism, it follows that where there is no alteration or plurality, there can be no sensation: as Hobbes has pointedly expressed it, "sentire semper "idem, et non sentire, ad idem recidunt." But indeed it is not in sensitive perception alone, that alteration is held to be an indispensable condition, but in every other exercise of consciousness likewise; and this, it may be remarked, is a grand fundamental principle on which Sir W. Hamilton relies, in seeking to refute those theorists in the highest region of thought, who claim for man a knowledge of the Unconditioned. The Unconditioned, including the Infinite and the Absolute, does not exist under characters of plurality or difference, and therefore, (Sir William argues) cannot be apprehended by human consciousness. Without, however, attempting to soar to such sublime speculations at present, but keeping to the *terra firma* of our

proper theme, it is sufficient to observe that the philosopher whose views we are expounding, assumes it as an axiom, that there can be no sensation and of course no perception, except on condition of plurality—plurality in this besides other respects, that the organic affections apprehended in sensation be out of, or locally external to, one another.

We are now in a position to understand the manner in which scepticism regarding an external world is dealt with by Sir William Hamilton.

Strange as it may appear to "the vulgar," (we employ Dr. Reid's familiar expression in no disrespectful sense), that any person out of a lunatic asylum should call in question the reality of external objects, and hesitate to allow the existence of the friend whom he beholds, of the food which he tastes, or of the wall against which he knocks his head, Sir William Hamilton maintains, that on any other doctrine than one of immediate perception, such scepticism not only is natural, but becomes a logical necessity. It is a first principle in philosophy that nothing should be believed, except it be known, either immediately in consciousness, or mediately by inference from data which consciousness affords. The Cartesian spirit, which doubts whatever is not established—which relentlessly bars out of the mind the most universally received maxims, so long as they seek admittance in the guise of dogmas—whose stern decision regarding every propositon affirming what is not either immediately or mediately known, is, let it be rejected: this is the true philosophic temper, not at all deserving the censure that has so often been ridiculously passed upon it, but on the contrary worthy of the highest commendation. Let, then, a student endowed with this disposition, address himself to the subject of sensitive perception, starting with the idealistic view, that we possess an immediate knowledge only of what is in our minds. How shall he proceed? Suppose that, sailing down the St. Lawrence, he is admiring the strange and beauteous spectacle of the Thousand Isles. The only thing of which he is presumed to be immediately cognizant is a mental affection, a peculiar sensation connected (the vulgar think) with the presence of certain islands. But does the vulgar opinion—he, as a philosopher, is necessitated to ask himself—rest upon a solid foundation? Are there really any islands in the case? How does he know that? Should it be suggested that the sensations excited in him must have a cause, the question will still occur, must the cause be an external one? Must it be material? May not his sensations arise from his own mental energy, unconsciously exerted? May those subjective

representations which (even after the manner of the vulgar) he is prone to ascribe to the presence of objective realities, not be merely phantasmagoria produced by the unconscious activity of the Ego, or otherwise conjured up before his mental eye? May they not be due to the direct operation of the Divine Being? Might not God excite within the individual all the sensations which he experiences, even though material objects were not? Can purely mental phenomena —phenomena which might take place though there were no such thing as matter—warrant the conclusion that matter exists? It may perhaps be urged that our observer is irresistibly impelled to believe that he is perceiving external objects; but what of that? The felt necessity of affirming the non-ego, is a circumstance both intelligible and important, as we shall presently see, on the doctrine of those who hold that the non-ego is immediately cognized; but the Cosmothetic idealist can make no use of it to serve his purpose. For *what* impels him to believe in outward objects? His very nature. After all, then, the much-vaunted necessity of believing in material realities, indicates nothing except the manner in which we are constituted, and in which we feel ourselves obliged to think. From considerations such as these, Sir W. Hamilton, in common with the most distinguished and consistent idealists themselves, maintains that if an immediate knowledge of the non-ego be denied, scepticism as to its existence becomes logically unavoidable. No better exemplification could be afforded of the difficulty of saving an external world on idealistic principles, than is furnished by Dr. Thomas Brown, whom Sir William not only criticizes mercilessly for his opinions on sensitive perception, but whom, we may add, he wonderfully delights to kick on all occasions, and who certainly is exposed, on many inviting points, to the toe of an opponent. Dr. Brown expressly avows that the irresistible belief to which we have referred, is the only thing which stands betwixt himself and Pyrrhonism. Assuming on the one hand that matter is not immediately known, he grants on the other that its existence cannot be legitimately inferred from aught that we do immediately know, but that "the sceptical argument, as a mere play of reasoning, admits of no reply." Yet forsooth, we are irresistibly compelled to believe in matter! We are irresistibly compelled to believe what we have no knowledge of, either mediate or immediate! A miserable thing would Philosophy be, were this truly the issue of her speculations. Alas! if, after she has inscribed on the portals of her temple the great idea, that only what is known is to be believed, she is found to utter as her very first oracle in the ears of her votaries, that an external world is not known, yet must

be believed, to exist! Admit that a blind faith, a faith without knowledge, is either satisfactory, or all that we can attain to, and Philosophy may break her staff. There is no longer any work for her to do.

If Sir W. Hamilton's views be adopted, scepticism in regard to an external world ceases, as a matter of course. The non-ego, according to him, is immediately known to exist. No proof of the fact is given; none is needed; we are conscious of it; and our consciousness involves its absolute certainty. Consider in what circumstances alone doubt can, by any possibility, be legitimate. Should an object not revealed in consciousness be affirmed to exist, there may be good ground for calling its existence in question; some defect may be capable of being pointed out in the evidence through which a knowledge of it is supposed to be attained; and in such a case, scepticism is not only warrantable, but imperative. In regard, however, to the existence of an object revealed in consciousness, scepticism is utterly inadmissible. The data of consciousness—those primary beliefs which do not depend upon reasoning, but are the starting points from which reasoning sets out—cannot be assailed. Not only when considered simply in themselves, as apprehended facts, but also when considered as testimonies to the truth of facts, beyond their own phenomenal reality,* "they *must*," Sir W. Hamilton writes, "by us be accepted as true. To suppose their falsehood, is to suppose that we are created capable of intelligence, in order to be made the victims of delusion; that God is a deceiver, and the root of our nature a lie." Now, in Sir William Hamilton's opinion, the existence of the non ego is one of the primary data of consciousness, and therefore beyond cavil—"a chield that winna ding, and downa be disputed."—Scepticism might be possible, on the principles of Mallebranche, who seeks to prove by Scripture that a material world exists; or on those of Des Cartes, who reaches the same result through a consideration of the veracity of the Divine Being. A sceptic is at liberty, in either case, to bring to trial the demonstration offered, and to withhold his assent from the conclusion till he has satisfied himself that the proof is good. But on the principles of Sir William Hamilton, the door is shut against scepticism, for he affirms the existence of the non-ego on an authority above argument. And, though our consciousness of the non-ego does not, according to him, extend to distant objects, but is confined to the bodily organism, and to extra-organic

*The Hamiltonian doctrine of consciousness, here presented, seems liable to grave objections. For a review of it, by the writer of the present article, see Canadian Journal, N. S., vol. 1., page 379.

objects in proximate relation to the organism—though the observer, for instance, whom we supposed to be sailing among the Thousand Isles, is not held to be immediately cognizant of the islands by which he is surrounded, but only to know them through inference, mediately—there is nothing at all dangerous to our faith in a material world, in this limitation of the range of consciousness. For why do the various idealistic systems inevitably lead to scepticism? Because they furnish no basis whatever for our belief in the non-ego. Assuming that we immediately know only what is in the mind, they weary themselves in vain to infer from this the existence of anything without the mind. But Hamilton in affirming that we are conscious of material objects (though not of those which are distant,) destroys scepticism: for however narrow the sphere within which we communicate with an external world, the external world is, on his doctrine positively known to exist; and what we do immediately know of it, forms a foundation on which conclusions can safely be erected, regarding the existence of objective realities out of the reach of our immediate apprehension. "The doctrine of Natural Realism," Sir William writes, "requires no such untenable assumption for its basis," [as that distant realities are immediately perceived]. "It is sufficient to establish the simple fact, that we are competent, as consciousness assures us, immediately to apprehend, through sense the non-ego in certain limited relations; and it is of no consequence whatever either to our certainty of the reality of a material world, or to our ultimate knowledge of its properties, whether by this primary apprehension we lay hold, in the first instance, on a larger or a lesser portion of its contents."

But should it be denied that the existence of the non-ego is revealed in consciousness, what then? In fact, the whole body of Idealists maintain that consciousness gives no such testimony as Hamilton ascribes to it. How shall we decide this question? Philosophers, since the time of Kant, have commonly consented to regard universality and necessity as the sure criteria of first truths; and applying these, among other kindred tests, Sir William contends that mankind are universally and necessarily determined to believe that they immediately apprehend the non-ego. No man living—not even a philosopher—can help being fully persuaded, when he perceives, that he is apprehending immediately something finite and extended which is not self, but exists without self. Either, therefore, universality and necessity must be rejected from being criteria of first truths, or the existence of the non-ego must be allowed to be a datum of consciousness. Observe the difference between this use of the criterion

of necessity, and the reference which writers like Brown make to the irresistible belief that all men have of an external world. What Brown speaks of is a persuasion of the existence of an object which is not known, and possibly may be non-existent. On the other hand, the necessity which those who hold the non-ego to be revealed in consciousness, allege in support of their views, is just consciousness irresistibly asserting itself. Should it be said that, on this view, the application of the criterion of necessity to settle the question in dispute, involves a *petitio principii*—inasmuch as the conclusion sought to be established is proved by an appeal to a test, the affirmation of which is not substantially different from the affirmation of the conclusion; we answer that this objection would undoubtedly be valid, were the immediacy of our apprehension of an external world supposed to be *proved* (in the proper sense of the term) by the criterion mentioned. But this is not meant. All that is meant is, that the consciousness of an external world irresistibly asserts itself. A datum of consciousness cannot (strictly speaking) be proved by argument to be so; it must be immediately known as such; and if any one deny that a truth, which really forms one of the data of consciousness, is entitled to be regarded in that light, we must content ourselves with requesting him to purge his reflective eye with "euphrasy and rue," and to think again. If he do so, well. He will then recognise, without argument, what even now amidst his hallucination, he is knowing, and irresistibly feeling that he knows.—If not, his scepticism cannot be helped; reasoning will never drive it out of him; he must be permitted to enjoy it.

Neither Cosmothetic Idealists, nor those who, like Sir W. Hamilton, plead for an immediate apprehension of the external world, suppose that we know matter as absolutely existing; both parties agree that only its properties are known. From the earliest time, a two-fold distinction among the properties of matter had been recognized, corresponding more or less nearly (as stated by different writers) with Locke's distribution of the qualities of bodies into primary and secondary. Sir W. Hamilton adopts a new division; making three distinct classes of qualities, the primary, the secondary, and the secundo-primary; the last being so called, because they possess a double phasis, partaking in one aspect of the nature of the primaries, and in another of that of the secondaries. The grounds on which Sir William proceeds in this entirely original arrangement may be in a measure anticipated from what has been said; and a brief notice of his classification, will virtually involve a summary

of the leading points in his system, and must bring our exposition to a close.

It will be remembered that sensitive perception (taking the expression in its widest sense) apprehends three things—*first*, (in sensation) the affections of our animated organism—*secondly*, (in the perception of our organism as material) the relations of mutual outness which these bear to one another—and *thirdly*, (in the perception of extra-organic objects, not revealed to consciousness as material) resistance offered to the movement of our organism in space. We have here the basis of Sir W. Hamilton's division of the qualities of bodies. Sensation reveals to us the secondaries. The perception of the organism as material, discovers to us the primaries. And the perception of extraorganic resistance makes us acquainted with the secundo-primaries. To begin with the primaries. In being conscious of the relations of our organism to itself in space, we apprehend it as an object not indivisible and unextended like the ego, but such that affections exist in it, mutually external to one another: an object which is also finite, and which may hence be defined as "occupying space and contained in space." This is the definition of matter or body; and whatever properties can be evolved out of this definition, are primary qualities of matter. Thus, figure is a primary quality, because whatever occupies space and is contained in space, must possess figure. It is apparent that the primaries are only in an improper sense termed qualities (or suchnesses); for a body is not, by possessing them, constituted such a body. They do not discriminate one body from another, but belong to all bodies alike. Turn next to the secondaries. In being conscious of organic affections, we apprehend them as differing in kind or quality strictly so called. For example, one affection of the animated organism, apprehended by consciousness, gives the sensation of redness; another, the sensation of acidity —two sensations of a different kind or quality altogether. Now organic affections may be stimulated by causes either within or without the organism. To causes of the former description our attention is seldom powerfully called; but it is necessary on many accounts that the latter sort should be discriminated among themselves, and should receive distinctive names. Accordingly, when we have been led by experience to attribute a particular affection to the stimulating influence of some external body, we ascribe to that body a quality commonly denoted by the same name with the sensation produced in us. Such qualities, collected into a class, form the secondary quali-

ties of bodies. Thus we say that vinegar possesses the secondary quality of acidity, and a rose that of redness, because we suppose that the stimuli which originated the organic affections, in apprehending which we felt the sensations of acidity and of redness, proceeded from the vinegar and the rose respectively. We are entirely ignorant what the secondary qualities in bodies are; we only know the affections of which they are deemed to be the stimulating causes.—As the secondaries are revealed through sensation, and the primaries through the perception of our material organism, so the secundo-primaries are discovered (we said) by the resistance offered to the movement of our organism in space. We are not conscious of this resistance as proceeding from bodies; but after we have been led by induction to believe that it is exerted by bodies, we then reckon resistance to be a quality of bodies. But is it a primary or a secondary quality? It partakes in some sort of the nature of both. As a mode of resistance felt in us, it is allied to the secondaries. As a degree of resistance opposing our locomotive energy, it resembles the primaries, being like them objectively apprehended. It cannot therefore be placed under either of the two previous divisions; but must be constituted into a class by itself, viz: the class of secundo-primaries. Every particular species of resistance or pressure which a body is capable of exerting, against the movement of our organism, or against any other body, is a secundo-primary quality of the body in question.

G. P. Y.

SCIENTIFIC AND LITERARY NOTES.

GEOLOGY AND MINERALOGY.

EARTHQUAKES IN CALIFORNIA.

In a paper by Dr. Trask, of San Francisco, published in the May number of Silliman's Journal, it is stated that the number of earthquakes experienced in California in 1856, amounted to sixteen. The shocks, with one exception, appear to have been comparatively slight; and Dr. Trask (writing from San Francisco) observes moreover, that along the coast of Mexico and Central America, to the south of California, there seems to have been a much greater exemption from these phenomena than has been usual in former years. This appears to have been the fact also, throughout the Pacific, Oceanic, and most of the continental islands along the coast of China; while, on the contrary, to the north and northwest, beyond the fifty-fifth parallel, both volcanic and earthquake phenomena appear to have been of more than average intensity. Dr. Trask cites more especially, the neighbourhood of the Aleutian Archipelago, the north-east coast of Japan, the British and Russian possessions of North America on the Pacific, and the islands of the Sea

of Ochotsk. A submarine eruption in the Straits of Ourinack (lat. 54° 36' N., longitude 135' W.) is reported by Captain Newell, of the "Alice Frazer." A column of water was projected upwards to a height of several hundred feet, and immediately following this, immense masses of lava were thrown into the air whilst the sea for miles around, and for many days after, was covered with floating fragments of pumice. The principal earthquake experienced in San Francisco itself, during the year 1856, occurred on the 15th February, at about half-past five in the morning. Several buildings were injured; and the shock appears to have extended over an area of about one hundred and forty-three miles in length, by sixty-six in breadth.

ROCK METAMORPHISM.

Professor T. Sterry Hunt, of the Geological Survey of Canada, has lately made known a very interesting illustration of metamorphic phenomena arising from the action of alkaline silicates on carbonate of magnesia or of iron, or earthy carbonates generally. His experiments shew that when a mixture of silica and carbonate of magnesia is boiled with carbonate of soda, the silicate of soda, at first formed, is decomposed by the magnesian carbonate; and secondly, that the regenerated carbonate of soda is enabled to take up a new portion of silica: the result being a continued silification of the magnesia through the agency of the alkaline carbonate. Mr. Hunt finds that, if pulverized quartz be boiled for several hours with corbonate of soda and carbonate of magnesia, a large amount of magnesian silicate is formed; and that, if we suppose a solution of alkaline silicate (which will never be wanting among sediments in which feldspar exists) to be diffused through a mixture of siliceous matter and earthy carbonate, we shall have, with a temperature of 112° Fahr. or perhaps with less, all the conditions necessary for the conversion of the sedimentary mass into pyroxenite, diallage, serpentine, talc, rhodonite, &c., all of which constitute beds in our metamorphic strata. If, also, aluminous matter be added to the above, the elements of chlorite, garnet and epidote will be present.

WATERS OF THE ST. LAWRENCE AND OTTAWA.

Professor Hunt has also communicated to the Philosophical Magazine for April, 1857, analyses of the waters of the St. Lawrence and Ottawa rivers, accompanied by some interesting observations, the concluding portion of which we give below. The subject will be found more fully discussed in the Report of the Geological Survey for 1854, now on the eve of publication.

1. *Water of the River St. Lawrence* (10,000 *parts.*)

A. Obtained.		*B. Calculated.*	
Carbonate of Lime	0.8033 grm.	Carbonate of Lime	0.8033
Carbonate of Magnesia	0.2537	Carbonate of Magnesia	0.2530
Chlorine	0.0242	Silica	0.3700
Sulphuric Acid	0.0687	Chloride of Potassium	0.0220
Silica	0.3700	Chloride of Sodium	0.0226
Chloride of Sodium	0.1280	Sulphate of Soda	0.1229
Chloride of Potassium	0.0220	Carbonate of Soda	0.0061
Residue, dried at 300°f	1.6780	Fe O and Mn O, Al O and P O	traces.
Residue, ignited	1.5380		

2. *Water of the Ottawa River* (10,000 *parts.*)

A. Obtained.		*B. Calculated.*	
Carbonate of Lime	0.2480	Carbonate of Lime	0.2480
Carbonate of Magnesia	0.0696	Carbonate of Magnesia	0.0696
Chlorine	0.0076	Silica	0.2060
Sulphuric Acid	0.0161	Chloride of Potassium	0.0160
Silica	0.2060	Sulphate of Potassium	0.0122
Chloride of Sodium	0.0607	Sulphate of Soda	0.0188
Chloride of Potassium	0.0293	Carbonate of Soda	0.0410
Residue, dried at 306°f.	0.6975	Al_2O_3, PO_5 } Fe O, Mn O }	traces.
Residue, ignited	0.5340		

"The comparison of the two river-waters whose analysis we have just given, shews the following differences:—The water of the Ottawa, containing little more than one-third as much solid matter as the St. Lawrence, is impregnated with a much larger proportion of organic matter derived from vegetable decomposition, and a larger amount of alkalies uncombined with chlorine or sulphuric acid. Of the alkalies in the state of chlorides, the potassium salt in the Ottawa constitutes 32 per cent., and in the St. Lawrence only 15 per cent.; while in the former the silica equals 34, and in the latter 23 per cent. of the ignited residue. The Ottawa drains a region of crystaline rocks, and the alkalies liberated by the decomposition of the feldspar of these rocks give their character to its waters; the extensive vegetable decomposition evidenced by the organic matters in solution, must also contribute a portion of potash; while the basins of the great lakes through which the St. Lawrence flows are excavated in palæozoic strata which abound in limestone, rich in salt and gypsum, and have given to the water of this river that predominance of soda, sulphuric acid and chlorine, which distinguishes it from the Ottawa. The presence of large amounts of silica in river-waters is a fact but recently established. Until the analysis by Deville of the rivers of France (1848), the silica in water had generally been wholly or in great part overlooked; and, as he suggests, had, from the mode of analysis been confounded with gypsum. The importance in an agricultural point of view of this large amount of dissolved silica, where river-waters are employed for the irrigation of land, is very great; and geologically, the fact is not less significant, as it marks a decomposition of the siliceous rocks by the action of waters holding in solution carbonic acid, and the organic acids arising from the decay of vegetable matter, which, dissolving the lime, alkalies, and magnesia, from the native silicates, liberate the silicic acid in a soluble form.* Silica is never wanting in natural waters, whether neutral or alkaline, although proportionably less abundant in neutral waters which contain large amounts of earthy ingredients. The alumina, whose presence is not less constant, although in much smaller quantity, appears equally to belong to the soluble constituents of the waters. The amount of dissolved silica annually carried to the sea by the rivers must be very great; yet sea-water, according to Forchhammer, does not contain any considerable quantity in solution; it doubtless goes to form the

* Although this may be true enough to a certain extent, yet, undoubtedly, a large portion of the silica present in the waters of rivers, more especially of such as flow through uncleared districts, is derived from the constant decomposition of the wood of fallen trees, of ferns and other vegetable matters. In the ashes of most ferns, the silica is over 70 per cent., and in those of equiseti, over 50; whilst it averages about 10 or 12 per cent. in the ashes of the bark, wood, and leaves (taken together) of our common pines. E. J. C.

shields of Infusoria, and may play an important part in the consolidation of the ocean sediments and the silification of organic remains."*

AZOIC ROCKS OF CANADA.

Professor Whitney in an article in the May number of Silliman's Journal, takes exception to Sir William Logan's subdivisions of our Azoic rocks. He contends that the so-called Huronian Formation belongs in part to the Potsdam sandstone, and in part to the underlying Laurentian group; and, further, that the latter should simply be called "Azoic," to the exclusion of the term "Laurentian"—this term having been already bestowed by Deser on the local, post-tertiary beds of Beauport, and other places, in the valley of the St. Lawrence and elsewhere. Without attempting, in the present place, to discuss the claims of the Huronian rocks to be considered a distinct formation, we may reasonably call in question the justness of that view, which, by collecting all of our unfossiliferous strata into a single group, would represent them as the products of a single epoch or period. Surely, if the Palæozoic age be looked upon as typical of at least four periods in the history of the Earth, a subdivision of some kind may be equally conceded to the formations of the great Azoic age: although from the absence of fossils, the subdivision of these formations may be a work of more difficult attainment. That such will some day be effected however, and to a greater extent than many geologists may at present be willing to allow, we are fully confident. With regard to the term Laurentian as applied to some of these Canadian rocks, we would observe, that, even if the same term were previously applied to the patches of post-tertiary strata alluded to above, its peculiar fitness for the gneissoid rocks of the Laurentian Range and connected country, would fully warrant its retention. On the other hand, we quite agree with Professor Whitney respecting the use of the term "Cambrian." If this term cannot be applied in accordance with the views of Sedgwick to the whole of the lower Silurians (a conclusion becoming more and more apparent every day,) let it be abandoned altogether. Its application to the Huronian formation, or to the Potsdam sandstone as proposed by Sir Charles Lyell, answers no object whatever, and is but little likely, moreover, to be generally adopted.

SUPPOSED EMERALDS FROM ALGIERS.

The pale green crystals from the Upper Valley of the Harrach in Algiers, announced as emeralds by M. Ville, have proved to be tourmalines, analogous to the somewhat rare variety met with at St. Gothard, and in Elba. They were first discovered in 1855, in a crystalline limestone associated with gypsum and diorite, about ten miles east of Blidah. (Bulletin de la Société Géologique de France: tome XIII, page 416.) Most tourmalines when treated with salt-of-phosphorus before the blow-pipe, effervesce and dissolve readily; but this pale green variety, curiously enough, behaves just like the emerald: exhibiting a scarcely perceptible effervescence, and dissolving very slowly.

CYSTIDEANS.

Mr. Billings, palæontologist to the Geological Survey of Canada, has discovered in the Chazy limestone near Montreal, a new Cystidean, more or less allied to *Cryptocrinus* by its three basal or pelvic plates, but *differing from that genus by*

* Some, although probably but a small portion, may be taken up by marine vegetation, as seven per cent. of silica appears to have been detected in the ashes of *fucus vesiculosus*. The ashes of most sea-weeds, however, contain no more than one or one-and-a-half per cent. of silica. E J. C.

the possession, amongst other peculiarities, of more than two ranges of plates above the pelvic range. Mr. Billings proposes, we believe, for this new genus, the name of *Malocystites*.

The following list of the principal genera of Cystideæ at present known, with their leading characteristics, etc., may not perhaps be unacceptable to some of our readers.

Cystideæ :—principal genera:

1. *Echinosphærites*, Wallenberg (*Spheronites*):—Cup of numerous plates with irregularly distributed pores. The principal species comprise: *E. Balticus*, *E. Aurantium*, *E. Pomum*,* *E. Punctatus*, and *E. Granulatus*.

2. *Caryocystites* (Von Buch):—Cup of five ranges or series of plates. Pelvic plates 2 + 2. Included by some palæontologists in *Echinosphærites*.

3. *Echino-encrinites*, Meyer (*Sycocystites*, V. Buch; *Gonocrinites*, *Eichwald*,) cup of 4 ranges of plates. Pelvic range: 3 + 1. Other ranges: 5, 5, 5 Pores bordering rhomboidal areas. Only two openings (?): perhaps one divided to serve both for anal and ovarian orifice.

4. *Glyptocystites* (Billings:)—Cup of 4 ranges. Pelvic range: 3 + 1. Other ranges: 5, 5. 5. Five (= 4 + 1,) attached arms. Three openings: the ovarian opening without valves (?), and distant from the mouth. Numerous pore-areas, or "pectinated rhombs." We have placed this genus here, because if not identical with *Echino-encrinites*, it is evidently closely allied to it. The numerous pore-areas constitute its great distinguishing feature. Where these pore-areas occur in other genera, more than three, or three pairs, are never present.

5. *Apiocystites* (E. Forbes.) Cup of 4 ranges. Pelvic range of 4 plates. Four attached arms in shallow grooves. One American species (*A. elegans*): Hall, Pal, New York, vol. II, page 241,) from the Niagara group. Perhaps identical with the *A. Pentremioricas* of the English survey.

6. *Prunocystites* (E Forbes.) 7. *Pseudocrinites* (E. Forbes.)

8. *Hemicosmites* (Von Buch):—Cup of 4 ranges. Pelvic plates 4. Plates of the other ranges: 6, 9, 8, (at least in the known species.) The three openings in the top range.

9. *Pleurocystites* (Billings:)—Large plates on only one side of the cup. On the other side a large opening, probably covered by an integument strengthened by numerous small plates. Pelvic range of six plates (= 2 + 2 + 2.) Second half range of three large plates. Third half-range of four plates. Top range (entire) of ten small plates carrying the two arms. Several species from the Trenton limestone of Ottawa.

10. *Callocystites* (Hall:)—Cup of 4 ranges. Pelvic range of 4 plates (=2 + 1 + 1.) Second range of 8 plates. Five attached arms. Stem of very thin joints, (at least in the known species:—V. Pal, New York, vol. 2, page 238). One species *C. Jewettii*, (Hall) from Niagara group.

11. *Malocystites* :—Mr. Billings' new genus alluded to above.

12. *Cryptocrinites*, or *Cryptocrinus* (Von Buch):—Cup of three ranges. Three

* E. Pomum is viewed by some authors as the type-form of a distinct genus (*Sphæronites* an old name revived,) characterised by the presence of two pores, in place of several, on each plate.—E. J. C.

pelvic plates. Five plates in second, and six in top range. *C.* lævis is the more common species.

13. *Calliocrinites* (*Calliocrinus*, d'Orb)? Cup of two ranges. Pelvic range of 5 plates. Apparently a very doubtful genus.

Appendix:—Hemicystites, Hall, (including *Agelacrinites:* Pal, N. Y., vol. 2, page 245, and also page 355.) *Tetragonis*, Eichwald (including *Ischadites*, Murchison; and *Receptaculites*, Salter. (V. McCoy's Cambridge Museum Fossils, page 62.)

E. J. C.

CHEMISTRY.

NOTE ON THE OXALATE OF MANGANESE.

I have to correct a slight error in my note on the oxalate of manganese, published in a former number of this journal*. I have there supposed the formula of Graham's oxalate to be Mn O, C^2O^3+5 aq., whereas, adopting the bibasic character of the acid, it should be 2 Mn O+C^4O^6+5 aq.

Souchay and Lenssen have lately (Ann. Ch. u. Ph. April) examined the same salt, and confirm Graham's formula; in the single analysis mentioned in their paper, they found 37,55 p. c. of Mn O, the formula requiring 37,83. According to the formula 2 Mn O+C^4O^6+6 aq, the quantity of Mn O should be 36, 09, while my four determinations range from 36,39 to 36,79. The pink hydrate is very prone to lose water in a warm atmosphere, and if not analyzed quickly the amount of Mn O would of course come out too high.

Moreover, the quantity of water lost by the pink salt, at a temperature of 212° was in my experiments 8.75, the formula requiring 9.09, whereas if Graham's formula be adopted the loss should be only 4.78. The extrication of the water takes place easily and rapidly, and cannot therefore be due to a loss of water from the white hydrated salt, which, according to Liebig, loses nothing at 212°, and only after continuous heating, according to Souchay and Lenssen.

I am therefore inclined to retain the formula 2 Mn O+C^4O^6+6 aq.

H. C.

BORON.

By the action of aluminum on fused boracic acid, at a high temperature, Wöhler and Deville have obtained boron in the amorphous (already known), the graphitoid, and the crystallized state. The graphitoid boron is obtained by the action of an acid on the boride of aluminum, and appears in the form of spangles, often hexagonal, slightly reddish, and with the form and brilliancy of natural graphite and graphitoid silicon; it is perfectly opaque. The crystallized is obtained in small red or yellow crystals, the form of which cannot be determined, as they seem to be composed of a number of small crystals. These possess a brilliancy and refractive power only comparable to the diamond, and rival it in hardness. When heated it oxidizes only on the surface, not altered by nitre at a red heat, readily acted on by chlorine, and slowly by carbonate of soda at a red heat. It forms alloys with platinum and palladium.

When a filter on which amorphous boron has been dried is inflamed, the boron burns with great ease; the graphitoid variety resists combustion in this way.

* Can. Jour. N. S. vol. ii. pp. 30–32.

MANGANESE.

Brunner prepares this metal by the action of sodium on the fluoride. Its specific gravity is 7.138–7.206, unchanged in the air, harder than steel, oxidizes on the surface when heated, like iron, is non-magnetic, dissolves readily in diluted sulphuric acid, and in nitric and hydrochloric acids. From its extreme hardness it may probably find useful applications in the arts.

CHROMIUM.

Fremy obtains this metal in crystals of great brilliancy by passing the vapour of sodium over the chloride. The crystals are very hard, and resist the action of the strongest acids.

SILVER IN SEA WATER.

It has long been known that sea water contains an appreciable quantity of silver, probably in the form of chloride, dissolved in the chloride of sodium. As such a solution is readily decomposed by metallic copper, Field was induced to examine whether the yellow metal employed in the sheathing of vessels contained more silver after long exposure to sea water than it did when first applied. One specimen from sheathing which had been used for seven years gave as much silver as would amount to upwards of one pound per ton. The original yellow metal could not be obtained for examination, but it undoubtedly could not have contained anything like this quantity. Sheathing, which had been exposed for three years was compared with some of the unused metal; the latter contained about one ounce of silver per ton, the former more than seven ounces.

Various other experiments were made, and in every case a similar difference observed, but in cases where the sheathing had only been exposed a short time, the differences were very slight.

MAGNESIUM.

Deville and Caron have prepared this metal in considerable quantities and examined its properties. They find that it resembles zinc in being volatile, and almost at the same temperature. It fuses at about the same temperature as zinc; at a higher point it inflames, and burns like zinc, producing a brilliant flame and white flakes. Specific gravity, 1.75.

PREPARATION OF METALS.

Deville recommends the use of lime crucibles in the preparation of chromium and manganese, as thereby the presence of silicium is avoided, which is almost always formed when earthen and porcelain crucibles are employed. Charcoal vessels are equally objectionable. Cobalt and Nickel, when prepared in this way, possess very different properties from those usually ascribed to them, cobalt being one of the most ductile and tenacious of metals. Manganese and chromium thus prepared are excessively hard; the latter, when pure, is less fusible than platinum, it dissolves readily in hydrochloric acid, giving a blue solution of Peligot's protochloride.

OXIDE OF SILICIUM.

Wöhler found that by heating silicium to a slight red heat in a current of dry hydrochloric acid gas, hydrogen is given off, and a new chloride of silicium formed. It is a very mobile fuming liquid, more volatile than the ordinary chloride. Water decomposes it into hydrochloric acid and the new oxide. The latter is white, slightly soluble in water, easily in alkalies, even in ammonia, evolving

hydrogen with effervescence, and being converted into silicic acid. When heated in the air it ignites and burns with a very white light.

FORMATION OF NITROUS ACID.

Tuttle has found that nitrous acid is formed when copper is oxidized in presence of ammonia; the blue solution obtained by exposing strips of copper and ammonia to the air, contains nitrous acid. None is formed by exposing an ammoniacal solution of black oxide of copper, but a trace is produced by employing the colourless solution of the red oxide.

ÆTHYLAMINE.

According to Tuttle this is best prepared by heating a mixture of urea with five parts of sulphovinate of lime and excess of caustic lime. The vapours are passed into muriatic acid, the solution evaporated and treated with a mixture of alcohol and æther, to separate the sal ammoniac. The solution furnishes a deliquescent salt, from which the æthylamine can be obtained by the action of potassa.

ARTIFICIAL FORMATION OF GLYCERINE.

Wurtz has obtained glycerine in the following way: Berthelot's iodized propylene C^6H^5I is treated with excess of bromine, and a tribromide obtained $C^6H^5B^3$. This is mixed with acetate of silver, and excess of glacial acetic acid, and kept for several days at a temperature of 248°–257° F.; the liquid filtered off, and the bromide of silver washed with æther, the liquid distilled until the temperature rises to 284° F., the residue treated with lime and æther. The æthereal solution leaves a yellowish oil, which is triacetine, and can be resolved by saponification into acetic acid and glycerine. That the substance was really glycerine was proved by the action of iodide of phosphorus, which gave iodized propylene.

LEUCINE AND ALANINE.

Limpricht has found that by distillation leucine is resolved into carbonic acid and amylamine. Alanine yields æthylamine, and glycocine would, in all probability, give methylamine. H. C.

MISCELLANEOUS.

We are strongly tempted to find a place for the following graceful and humorous metrical tributes paid to one of the most distinguished scientific men of this continent, under our periodical heading of *Ethnology and Archæology*. Ethnological it will be seen the muse has grown, under the inspiration of her theme; and though recognising the event she celebrates as one which looks forward to an antiquity yet to be attained: there is an Archæological treatment of the subject ample enough for all purposes, at least of the comic muse!

On the 28th of May last, the distinguished American savant, Louis Agassiz, attained his fiftieth birth day; and on that pleasant anniversary an assembly of poets, men of science, and loving friends, of Boston and its neighbourhood, met together and celebrated a birth-day dinner, such as those who shared in the enjoyment of it will long keep in fresh remembrance. None who have met with the genial and highly gifted Agassiz, and so learned to appreciate how thoroughly the delightful elements of the companion and friend blend in him, with those of the acute and fearless investigator of science, will fail to appreciate the hearty sincerity and cordial warmth which must have united together the friends gath-

ered round the festive board on the late Anniversary of the Agassiz birth-day, "when Hope and Memory kissed," in welcoming him into his fiftieth year. No wonder that the poets found a ready inspiration alike for grave and graceful fancies; and for humorous, yet kindly irony, and playful badinage, such as sports with his favourite ethnic opinions, and humorously hints at the heresies of his scientific views in relation to his Adamic ancestry.

Various impromptu contributions proved the richness of the poetic fancy and humour which the happy occasion excited; while others, from the pens of some of America's most gifted poets, will survive as lasting memorials of the happy festive meeting. The following is the lively contribution of JAMES RUSSELL LOWELL:—

A health to him who reached to-day
  Life's height of water-shedding,
Where Hope and Memory kiss and say
  Let's keep our golden wedding;
To him whose glow the heart could reach
  Of glaciers that he studied,
Who learned whatever fish could teach,
    Except to be cold-blooded!

To him, who, if our earth were lost,
  And Nature wanted counsel,
Could make it over at less cost
  From ridge-pole down to groun' sill;
Could call the Dodo back to youth,
  Could call Ornithorynchus,
Nay! were *we* gone, from just a tooth
  Could good as new re-think us!

To him who every egg has scanned,
  From roc to flea included,
Save those which savants find so grand
  In nests where mares have brooded!
To him, who gives us each full leave
  (His pedigree amended,)
To choose a private Adam and Eve
  From whom to be descended!

But stay—for chance-come thoughts are best—
  I meant the health to proffer
Of him, our friend there and our guest,
  And yet not that I offer:—
No, rather drink this toast with me,
  Worth any common dozen:
Here's Adam and Eve Agassiz,
  To whom we owe our cousin!

Such is a good specimen of the gayer fancies which the happy anniversary has called forth. The following piece is graver, more earnest, and as we think, worthy of the occasion, no less than of the pen of America's gifted poet Longfellow:—

It was fifty years ago
  In the pleasant month of May,
In the beautiful Pays de Vaud,
  A child in its cradle lay.

And Nature, the old nurse took
  The child upon her knee,
Saying: "Here is a story-book
  Thy Father has written for thee.

"Come, wander with me," she said,
"Into regions yet untrod;
And read what is still unread
In the manuscripts of God."

And he wandered away and away,
With Nature, the dear old nurse,
Who sang to him night and day
The rhymes of the universe.

And whenever the way seemed long
Or his heart began to fail,
She would sing a more wonderful song,
Or tell a more marvellous tale.

So she keeps him still a child,
And will not let him go,
Though at times his heart beats wild
For the beautiful Pays de Vaud;

Though at times he hears in his dreams
The Ranz des Vaches of old,
And the rush of mountain streams
From glaciers clear and cold;

And the mother at home says "Hark!
For his voice I listen and yearn;
It is growing late and dark,
And my boy does not return!"

CANADIAN INSTITUTE.

ELEVENTH ORDINARY MEETING.—*7th March*, 1857.

Colonel BARON DE ROTTENBURG, Vice-President, in the Chair.

The following Donations received since last Meeting were announced; and the thanks of the Institute voted to the Donors:

1. From B. Gibb, Esq., of Montreal, per A. H. Armour, Esq.,:
"Two small mummy Crocodiles, from the mummy Pits of Upper Egypt."
"Some Egyptian Papyrus from Ancient Thebes."
"A small piece of mummy cloth."
2. From the Regents of New York State Library."
Documents relating to the Colonial History of the State of New York, Holland Documents, 1603, 1656. Vol. I.
4. From Messrs. Gould and Lincoln, per A. H. Armour, Esq.,:
Annual of Scientific Discovery, 1857. 1 vol.
5. From Hon. J. M. Brodhead, Washington, per A. H. Armour, Esq.,:
"Official Army Register, United States, for the year 1857." Pamphlet.
"Navy Register of the United States, for the year 1857." Pamphlet.

The following Gentlemen were elected Members:

JOHN MCNAUGHTON, Esq., Lancaster, C. W.
JOHN MORRIS, Esq., Toronto, C. W.
DR. SAMUEL STRATFORD, New Zealand, Corresponding Member.

The following papers were then read;

1. By the Rev. Prof. YOUNG, M.A.:

"On Sir David Brewster's supposed law of visible direction in monocular vision, and the corresponding law of visible direction in binocular vision."

2. By Professor WILSON, LL.D:

"Remarks on a specimen of Indian Corn having the male and female flower developed on the same stalk. The specimen was presented to the Institute.

3. By Col. BARON DE ROTTENBURG:

"Report of the Committee appointed to consider a proposition from Lieutenant Ashe, R.N., for the establishment of an Astronomical Observatory at Quebec.

The Report was adopted, and the following draft of a memorial was approved of, and ordered to be transmitted to His Excellency the Governor General, and to the Legislative Council, and the Legislative Assembly, the Council being requested to take the requisite steps for securing the fitting presentation thereof.

The Memorial of the Canadian Institute Incorporated by Royal Charter,—

HUMBLY SHEWETH,—That Your Memorialists have been informed that application has been made to Your Excellency by Lieutenant Ashe, Royal Navy, for an extension of the Astronomical Observatory at Quebec, whereby the same may be rendered more efficient and useful.

Your Memorialists most respectfully beg of Your Excellency to take this application into consideration, and in support of the same they desire humbly to represent to Your Excellency, that Astronomy, while deservedly ranking as the first of sciences, both on account of the certainty of its processes, the brilliancy of its results, and the wide field it offers for investigation, is at the same time that above all others which is most closely connected in its practical bearings with the interests of civilized life and the progress of commercial intercourse; that so fully has this truth been recognized that at the present day there does not exist a kingdom in Europe which has not established one or more National Observatories, while in the United States so strong an interest has been awakened on this point that such institutions are being founded in all parts of the country, of which the recently opened Observatory at Albany is a splendid and notable example.

Your Memorialists believe that even if the practical benefits that would result from the establishment of such an institution were not directly and immediately felt, Canada has now taken such rank among communities that it would not consist with her dignity to lag behind in the march of scientific research; but the requirements of her rapidly increasing commerce render this establishment almost a necessity.

Your Memorialists need only refer to the important duties which would devolve on the Observatory in connection with Navigation, such as the determination of true time, the regulation of Chronometers, the correction of Ship-compasses; and here also they might be permitted to recall the great services rendered by a similar institution at Washington, under the conduct of Lieutenant Maury, by his famous Charts and system of Navigation which are producing effects the value of which can hardly be over-rated.

Your Memorialists would also represent that Quebec is peculiarly and fortunately qualified for the site of an Observatory, both from its steady climate, the clearness of its atmosphere and its local advantages of position; and also from its being at once an inland town and a seaport.

Your Memorialists would not presume to dictate to Your Excellency the manner in which the object of this petition should be carried out, but they may be permitted to state their opinion that for a sum of Five Thousand Pounds and an annual endowment of One Thousand Two Hundred Pounds, a first-class Observatory could be efficiently and permanently constructed, equipped and maintained.

Your Memorialists, while urging with earnestness on your consideration this prayer, have all confidence in the wisdom and liberality of Your Excellency, and feel assured that should a National Canadian Astronomical Observatory be founded, it will be on a scale commensurate with the importance of the object and the character of the country.

And Your Memorialists as in duty bound will ever pray.

EDWARD J. CHAPMAN, *1st Vice-President.* DEROTTENBURG, *2nd Vice-President.* JOHN LANGTON, *3rd Vice-President.*

J. GEORGE HODGINS, *Secretary.*

TWELFTH ORDINARY MEETING.—*14th March*, 1857.

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

The following Donation for the Library was presented, and the thanks of the Institute voted to the Donor;

From T. Henning, Esq., :

"Villa and Cottage Architecture," by Calvert Vaux.

The following papers were then read:

1. By JAMES H. MORRIS, M.A., :

"Notes of Travel in China."

2. By Col. BARON DE ROTTENBURG :

"Report of the Committee on Prof. Kingston's paper on the use of the Electric Telegraph in giving notice of storms.

The report of the Committee was adopted, and remitted to the Council to be carried into effect.

3. By Col. BARON DE ROTTENBURG :

"Extract of a letter from Mr. Chalmers of Barrie, F. R. Astronomical Society detailing some observations which he had made on the 26th February, on a supposed volcano in the moon.

THIRTEENTH ORDINARY MEETING.—*21st March*, 1857.

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

The following Gentleman was elected a Junior Member:

JAMES BEATTY, Esq.

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

1. From the Patent Office, Washington:
"Report of the Commissioners of Patents for 1854: Mechanics. Vol. II.

2. From G. W. Allan, Esq.,:
"Gould's Trochilidæ."

3. From John Gould, Esq.:
"Fifty specimens of Birds."

A letter was read announcing the donation to the Institute by Jesse Ketchum, Esq, of two acres of land on Yonge Street, for the erection of an Astronomical Observatory, on condition that the Institute shall take effectual steps for establishing the same within two years from this date.

The letter was referred to the Committee on the Quebec Observatory.

The following papers were then read:

1. By J. H. Morris, M.A.,:
"Notes of Travel in China." Part II.

2. By Professor Wilson, LL.D.,:
"On certain homogeneous characteristics ascribed to the aboriginal tribes of this continent."

3. By John McNaughton, Esq.,:
"Some remarks on the relations of Canada to the adjacent territories."

FOURTEENTH ORDINARY MEETING.—28*th March*, 1857.

John Langton, M.A., Vice-President in the Chair.

The following Gentlemen were elected Members:

George A. Pyper, Esq., Toronto.

William McCabe, Esq., Whitby, C.W.

The following Donation to the Library was announced, and the thanks of the Institute voted to the Donor:

From the Author:
"Surnames," by B. Homer Dixon, Esq., Boston. Privately printed.

The followiny papers were then read:

1. By the Rev. A. Constable Geekie:
"On Canadian English."

2. By A. Brunel, Esq., C.E.:

"A proposition, in relation to the Desjardin-Bridge Railway accident, to refer the subject of the strength of timber used in railway bridges, to gentlemen connected with the Institute, whose tastes or pursuits are connected with such an inquiry." An interesting discussion arose from this communication, and while it was not deemed expedient to make any special reference of the subject, a wish was expressed that the matter should engage the attention of some members of the Institute, whose practical knowledge qualified them for such an inquiry, and that the results be communicated to the Institute, and published in the Journal.

MEAN METEOROLOGICAL RESULTS AT TORONTO FOR THE YEAR 1856. *Read before the Canadian Institute 21st February.* 1857.

BY PROFESSOR KINGSTON, M. A., DIRECTOR OF THE PROVINCIAL MAGNETIC OBSERVATORY, TORONTO.

The year 1856, was a year of extremes. It was the coldest, the most windy, and the least rainy year of any known in the history of the Observatory, and, omitting two exceptions, one of each kind, it affords instances also of the highest and the lowest temperatures that have been ever recorded.

Ushered in by a day cold, keen, and of unusual brilliancy, the year commenced with the coldest and most windy January on record. The month was rainless, and showed no trace of the ordinary January thaw. February and March were more windy respectively, than any previous February and March; and with the exception of February and March, 1843, and February, 1855, they were colder than the corresponding months of all past years. These two months also, like January, were without rain, and it was not till the 2nd of April that the first rain of the year began to fall, after an interval, quite unprecedented, of 109 days.

The Spring was backward; the ice did not wholly disappear from the Bay till the 19th of April, and snow, though in a very slight quantity, fell as late as the 30th of May.

July was the warmest July but one yet known. In October, a fog, remarkable for density, duration and extent, prevailed from the 10th to the 22nd inclusive, and was said to have extended from Chicago as far as Quebec. In November the snow exceeded that of any previous November. December was marked by the coldest day and lowest temperature that ever occurred in the month of December, and by the most windy day recorded in any month whatever, in this or past years.

The mean temperature of 1856 was 42°.16, which is 1°.99 below the average of 17 years, and the lowest annual mean on record; the nearest approach to it having been 42 .35 in 1843.

As usual, July was the warmest month in the year; its mean temperature was 69°.9. July, besides being absolutely, was also relatively the warmest month in the year, estimated, that is, by the excess of its mean temperature above the standard temperature for the month, whether the standard chosen be that belonging to the parallel passing through Toronto or to Toronto itself. When considered further, with reference to past years, the mean temperature of July, 1856, was never exceeded by any monthly mean excepting that of July, 1854, which was 72°.5.

The coldest month absolutely was February, with a mean temperature of 15°.69; the coldest month relatively to the standard of Toronto, was January, with a mean temperature 7°.81 below the average. The warmest day was July 17, when the mean temperature was 81°.77, and the coldest day was Feb. 13 with a mean temperature—6 .88.

The maximum temperature of the year, 96°.6, occurred on July 17, and, with the exception of that of 24th August, 1854, when it reached 98°.1, was higher than any temperature before known at the Observatory. The minimum of the year—18°.7, on Feb. 12, was an example of cold never exceeded but in February of the preceding year.

The range of temperature for the year, derived from these two extremes, was 115 .3, one never exceeded but by that of 1855, which amounted to 118 .2.

The deviations in *defect* from the normals and exceeding 20° were numerous; but no example occurred of a deviation to that extent in *excess*.

BAROMETER.—The highest reading of the barometer was 30.480 inches, at 10.30 A. M. of Dec. 18th, and the lowest 28.459 inches, at 11.40 A. M. of Dec. 14, thus giving a range (the range also of the whole year) of 2.021 inches in less than 95 hours. The minimum, 28,459, was identical with that of 1855, which occurred on the 9th of Dec., and which also was followed by a considerable rise.

The mean humidity of the year, .75 of saturation, was rather less than usual, and the distribution of humidity among the different months more than ordinarily equable. Complete saturation occurred only four times—Jan. 9, Oct. 18, and the 11th and 14th of December. The greatest dryness was .30, which occurred at 4 P. M., of Aug. 11th.

It will be seen from the table, that the extent of sky clouded was on the average .75 of the whole sky, and rather less than in the two preceding years. Of the different months, November was the most cloudy, and July most free from clouds.

The resultant direction of the wind was N 71° W, and the resultant velocity 3.03 miles, or in other words, the actual displacement of air was that which would have been produced by a wind blowing throughout the year from N 71° W, with a constant velocity of 3.03 miles per hour. The mean velocity of the wind, without regard to direction, was 8.31 miles per hour, a velocity exceeding the average of nine years by 2.19 miles.

The whole depth of rain that fell during the year, 21.565 inches, was less by upwards of ten inches than that of 1855, and more than nine inches below the average of the last 16 years. The depth of snow was 65.5 inches, which exceeds the average by 3.6 inches, but falls short by more than 13 inches of the snow of the preceding year. The rain occupied 359.7 hours, and the snow 310.8 hours in its fall, giving 670.5 hours, or nearly 28 days, as the total duration of the fall of rain and snow.

Frost occurred in every month but in June, July and August. The latest frost in Spring was on 31st May, and the earlist frost in Autumn on Sept 21. The last snow in Spring was on the 30th of May, and the first snow in Autumn on 30th Oct. The Bay of Toronto was frozen over on Dec. 8.

Twenty-five thunder storms only occurred during the year. The most remarkable example was that of the 4th of June, which was accompanied for a short time by a violent fall of hail with stones in many cases more than half an inch in diameter. The storm lasted, with only occasional intermission, from 10 A. M. to 10 P. M., with the wind mostly from the East.

Of the 212 nights when the state of the sky was favorable for observing auroras, there were 35 nights only when auroras were seen, and these all belonged to the lowest class, unless that of Oct. 4 be excepted, when the phenomenon was accompanied by considerable magnetic disturbance.

The usual August season for the appearance of falling stars, passed by without any remarkable display, either as regards number or apparent magnitude. In November the sky was not favourable for the exhibition of these meteors.

The following table exhibits the general Meteorological Register, for the year 1856, deduced from the observations taken at the Provincial Observatory, Toronto :

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year 1856.	Year 1855.	Year 1854.	Year 1853.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
Mean Temperature	16.02	15.69	23.06	42.27	50.52	62.11	69.90	63.59	57.15	45.34	37.39	22.38	42.16	43.98	45.21	44.78
Difference from average (17 years)	—7.81	—6.96	—6.88	+0.88	—0.93	+0.70	+2.92	—2.47	—0.89	+0.15	+0.59	— 3.14	— 1.99	—0.29	+0.87	+0.44
Thermic Anomaly (Lat. 43° 40′ N)	—16.78	—19.01	—17.04	—7.93	—7.58	—2.49	+1.20	—4.91	—4.35	—8.46	—5.81	—13.12	— 8.84	—7.02	—5.79	—6.22
Highest Temperature	34.4	37.8	41.4	72.2	82.2	89.2	96.6	82.7	78.4	71.4	56.4	42.2	96.6	92.8	99.2	94.9
Lowest temperature	—12.1	—18.7	—14.0	14.2	31.2	42.0	49.5	41.5	35.0	23.0	18.8	—9.1	— 18.7	—25.4	—10.8	—9.7
Monthly Range	46.5	56.5	55.4	58.0	51.0	47.2	47.1	41.2	43.4	48.4	37.6	51.3	48.63	50.63	50.90	48.47
Mean Maximum Temperature	22.65	24.22	30.47	50.47	59.56	71.59	80.36	73.74	66.69	54.04	43.02	28.74	.....	.....	.....	.....
Mean Minimum Temperature	6.02	3.57	12.87	33.39	40.63	52.39	59.04	52.95	45.66	35.22	28.74	15.55	.....	.....	.....	.....
Mean daily Range	16.63	20.65	17.60	17.08	18.93	19.20	21·32	20.79	21.03	18.82	14.27	13.19	18.29	18.19	19.77	16.89
Greatest daily Range	34.6	28.7	32.4	29 4	44.2	28.8	28.7	31.5	29.5	28.5	32.4	25.5	44.2	39.4	44.5	40.9
Mean Height of Barometer	29.6696	29.4883	29.5592	29.5790	29.5822	29.5484	29.5912	29.5208	29.6001	29.7069	29.6421	29.7113	29.5999	29.6249	29.6077	29.6299
Difference from average (12 years.)	+.0398	—.1242	—0722	—.0281	—.0013	—.0334	—.0061	—.1153	—.0540	+.0671	+0233	+.0650	—0.0200	+0·0050	—0.0122	+0 0100
Highest Barometer	30.280	30.086	30.082	30.099	29.969	29.798	29.844	29.797	30.013	30.200	30.048	30.480	30.480	30.552	30.245	30.315
Lowest Barometer	29.186	28.778	28.828	29.081	29.125	29.207	29.241	29.174	29.149	29.217	28.902	28.459	28.459	28.459	28.685	28.653
Monthly Range	1.094	1.308	1·254	1.018	0.844	0.591	0.603	0.623	0.864	0 983	1.146	2.021	1.029	1.032	1.074	0.986
Mean Humidity	.78	.76	.74	.75	.71	.79	.69	.73	.75	.75	.78	.82	.75	.77	.79	.79
Mean Elasticity of Aqueous Vapour	0.080	0.080	0.099	0.203	0.259	0.432	0.489	0.419	0.351	0.231	0.179	0.110	0.244	0.263	0.279	0.271
Mean of Cloudiness	.66	.55	.52	.60	.59	.47	.30	.48	.49	.47	.81	.76	.57	.60	.59	.57
Resultant Direction of the Wind	75° W	N 81° W	N 71° W	N 29° E	N 4° E	S 21° W	N 79° W	N 50° W	S 79° W	N 76° W	S 85° W	S 87° W	N 71° W	N 62° W	N 43° W	N 38° W
" Velocity (miles per hour.)	5.24	7.70	7.68	1.64	3.99	0.90	1.57	2.87	1.98	2.15	2.95	4.62	3.03	2.51	1.37	1 17
Mean " " "	10.69	10.71	11.36	6.05	9.81	5.30	5.84	7.03	6.53	6.07	8.75	11.56	8.31	8.18	6.02	5.08
Difference from average (9 years)	+3.44	+3.34	+3.89	— 0.66	+3.90	+0.89	+1.31	+2.18	1.24	+0.65	+2.23	+3.33	+2.19	+2.33	+0 53	—0.33
Total amount of Rain (inches)	0.000	0.000	Inapp.	2.780	4.580	3.200	1.120	1.680	4.105	0.875	1.375	1.790	21.505	31.650	27.765	23.550
Difference from average (16 years.)	—1.595	—1.020	— 1.512	+0.196	+1.511	+0.149	— 2.447	—0.974	0.331	—1.925	—1.548	+0.251	— 9.329	+0.286	—3.576	—8.076
Number of days Rain	0	0	0	13	14	13	8	12	13	10	10	6	99	103	114	109
Total amount of snow (inches)	13.6	9.7	16.2	0.1	Inapp.	.....	.....	.....	.....	0.1	9·5	16.3	65.5	99.0	49.5	53.2
Difference from average (14 years)	+0.2	—8.0	+5.9	—1.8	—0.1	.....	.....	.....	.....	.....	+6.5	+1.9	+3.6	+37.4	—8.9	—6.1
Number of days snow	14	8	12	3	1	.....	.....	.....	.....	—1.0	9	20	69	64	52	52
Number of fair days	17	21	19	14	16	17	23	19	17	19	11	5	198	198	199	204
Number of Auroras observed	1	5	7	4	0	1	4	5	3	3	1	1	35	46	52	57
Possible to see Aurora (No. of Nights)	12	20	20	18	16	18	26	22	20	19	10	11	212	204	203	233
Number of Thunderstorms observed	0	0	0	2	2	9	4	3	4	1	0	0	25	38	58	34

MONTHLY METEOROLOGICAL REGISTER, AT THE PROVINCIAL MAGNETICAL OBSERVATORY, TORONTO, CANADA WEST—APRIL, 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.			Resultant Direction.	Velocity of Wind.					Rain in Inches.	Snow in Inches.
	6 A.M.	2 P.M.	10 P.M.	MEAN	6 A.M	2 P.M	10PM	MN'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 A.M	2 P.M	10PM	Result's.	MN'N		
1	29.238	29.443	29.717	29.4907	39.3	23.2	15.8	26.68	— 9.55	.190	.097	.082	.118	.80	.76	.87	.77	Calm.	NW bN	N N W	N 26 W	0.0	26.0	29.2	22.36	23.03	Inap	0.3
2	.822	.927	30.006	.9333	10.0	27.4	22.7	20.35	— 16.28	.061	.075	.082	.073	.83	.49	.64	.65	N N W	W N W	N W	N 32 W	16.2	13.4	5.5	9.11	9.25	...	...
3	.968	.794	29.636	.7840	19.4	36.3	27.4	23.23	— 8.78	.082	.128	.131	.117	.75	.62	.86	.75	N	E S E	Calm.	S 51 E	2.5	14.5	0.0	3.12	5.61	...	...
4	.538	.564	.523	.5477	35.9	51.9	39.5	43.40	+ 6 07	.176	.236	.212	.217	.83	.62	.88	.78	W b S	S	N N E	S 48 W	1.6	7.0	7.0	1.89	5.72	0.020	...
5	.347	.240	—	—	40.7	44.3	—	—	—	.240	.259	—	—	.95	.90	—	—	E	S b W	N N W	S 77 W	3.7	7.0	18.5	3.65	9.44	0.390	2.0
6	.116	.157	.216	.1793	31.0	31.4	19.4	26.90	—11.13	.164	.108	.088	.121	.95	.62	.81	.81	W b N	S W b W	W	S 72 W	11.2	22.4	8.0	12.77	13.74	...	2.7
7	.411	.668	.764	.6322	19.3	31.7	30.6	27.65	—10.77	.076	.113	.149	.113	.69	.63	.88	.73	W b S	S W b W	S S W	S 48 W	20.1	14.5	6.0	9.84	13.87	...	0.3
8	.606	.524	.674	.6033	31.5	40.2	36.4	35.60	— 3.12	.147	.197	.186	.178	.82	.80	.87	.86	E	S S E	W	S 21 W	10.6	3.5	2.1	0.94	6.39	Inap	1.9
9	.716	.720	.706	.7352	32.4	40.0	31.4	34.82	— 4.22	.157	.168	.153	.159	.86	.69	.87	.79	N W b W	S b E	N E	S 85 E	2.0	7.5	1.5	0.84	3.88	...	...
10	.719	.647	—	—	30.7	41.8	—	—	—	.146	.159	—	—	.81	.61	—	—	N b E	S b E	N	N 36 E	6.0	10.0	7.5	3.04	7.27	...	...
11	.421	.431	.483	.4633	32.4	41.5	34.2	36.00	— 3.73	.144	.189	.172	.168	.79	.73	.88	.79	N b W	S S W	N W	N 43 W	11.6	7.0	10.0	5.26	7.87	...	...
12	.529	.530	—	—	32.1	41.5	—	—	—	.146	.221	—	—	.80	.85	—	—	N N W	S	W N W	S 48 W	1.9	11.7	3.0	3.87	5.27	...	...
13	.634	.630	.526	.5942	28.1	42.3	37.1	36.43	— 4.00	.133	.172	.125	.156	.88	.64	.57	.73	N	E	N b E	N 65 E	1 0	8.4	1.2	4.20	5.55	...	...
14	.388	.233	.132	.2330	35.1	44.5	37.8	38.55	— 2.18	.157	.213	.187	.169	.78	.73	.84	.82	N E b N	S S W	W b S	S 67 W	9.2	7.4	21.5	6.02	11.93	Inap	...
15	28.959	28.938	.077	28.9963	35.0	36.1	32.1	34.47	— 6.58	.166	.159	.166	.161	.82	.75	.92	.82	S W b S	W S W	S W b W	S 62 W	11.5	23.0	19.0	14.80	15.48	...	0.5
16	29.155	29.232	.391	29.2720	30.3	37.5	32.8	33.55	— 7.93	.151	.143	.173	.158	.89	.64	.93	.83	W S W	S W b S	S W b W	S 54 W	7.5	14.8	4.0	8.75	10.11	...	0.2
17	.524	.600	.643	.5928	27.4	39.3	31.5	33.17	— 8.58	.131	.133	.118	.122	.86	.56	.64	.65	W N W	S S W	N	S 55 W	8.8	16.4	6.0	6.03	10.53	...	...
18	.590	.512	.485	.5223	27.9	37.3	30.0	35.83	— 6.23	.118	.115	.221	.152	.77	.52	.91	.72	N	E N E	E b N	N 73 E	6.8	7.0	8.0	7.36	8.20	Inap	...
19	.469	.432	—	—	36.1	35.7	—	—	—	.203	.201	—	—	.96	.96	—	—	S	S S E	N W	N 53 W	2.6	14.0	8.5	2.36	7.51	0.565	1.8
20	.519	.493	.448	.4892	28.3	40.9	36.2	35.17	— 7.62	.138	.169	.132	.147	.89	.66	.63	.73	W N W	N N W	N W	N 32 W	15.8	24.0	19.2	20.36	20.52	...	1.5
21	.332	.321	.424	.3620	34.2	46.2	35.0	38.45	— 4.65	.186	.221	.187	.194	.95	.72	.92	.84	N N W	N b W	N b W	N 9 W	17.4	8.2	1.0	6.67	8.11	0.095	0.2
22	.449	.441	.483	.4617	37.4	50.0	38.2	42.58	— 0.78	.159	.177	.150	.163	.72	.49	.65	.61	N b W	N b W	N N W	N 21 W	11.1	13.5	9.5	12.64	12.83	...	...
23	.513	.518	.574	.5372	33.7	46.5	36.4	39.15	— 4.55	.140	.165	.192	.165	.72	.53	.90	.70	N N W	N W b N	N N W	N 30 W	12.3	13.5	15.4	12.38	12.64	...	...
24	.591	.557	.636	.5878	34.3	48.0	37.3	40.10	— 3.90	.158	.184	.150	.171	.78	.56	.68	.69	N W	W N W	N W	N 76 W	8 0	8.2	3.3	3.63	6.57	...	...
25	.618	.586	.650	.6145	31.7	49.0	35 7	39.55	— 4.85	.144	.193	.131	.159	.80	.57	.62	.66	N W	W N W	N W	N 52 W	6.0	14.6	6.4	9.30	9.85	...	...
26	.627	.516	—	—	32.4	44.2	—	—	—	.131	.180	—	—	.72	.63	—	—	W b S	S b E	E b N	S 86 E	1.8	4.8	18.0	5.07	7.83	0.670	1.5
27	.120	.102	.398	.2208	37.9	42.9	37.1	39.27	— 5.75	.214	.184	.191	.196	.95	.67	.87	.83	S W b W	S W b W	N W b W	S 86 W	8.4	21.4	24.8	15.84	19.09	0 015	...
28	.579	.617	.770	.6663	34.3	46.6	31.4	37.93	— 7 47	.174	.199	.134	.166	.89	.63	.76	.73	W	N W b W	Calm.	N 62 W	4.0	19.2	0.0	11.77	12.14	...	...
29	.826	.824	.848	.8403	31.4	46.8	37.5	39.50	— 6.23	.153	.195	.127	.172	.87	.61	.57	.69	W b S	S b E	N	N 85 W	1.0	5.4	10.5	0.87	6.49	...	...
30	.938	.953	.813	.8840	34.2	44.9	38.6	40.55	— 5.50	.145	.175	.164	.158	.74	.59	.70	.64	N b E	E b S	E N E	N 80 E	5.2	10.4	10.5	10.28	10.60	...	...
M	29 5108	29.5122	29.5647	29.5300	30.90	40.86	33.27	35.36	— 5.63	.147	.164	.152	.156	.82	.63	.79	.74	.....	.....	.....	.....	7.53	12.62	9.50	.....	10.24	1.755	12.9

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR APRIL, 1857.

Highest Barometer 30.006 at 10 p. m. on 2nd } Monthly range=
Lowest Barometer . . . . . 28.898 at 9.20 a. m. on 15th } 1·108 inches.

Self-registering Thermometer.

Maximum temperature . . . . 52°0 on p. m. of 25th } Monthly range=
Minimum temperature . . . . 15.9 on a. m. of 2nd } 46°1

Mean maximum temperature . . 43°36 }
Mean minimum temperature . . 27°24 } Mean daily range = 16°12

Greatest daily range . . . . . 32°5 from a. m. of 1st to a. m. of 2nd.
Least daily range . . . . . 9.0 from p. m. of 15th to a. m. of 16th.

Warmest day . . 4th ... Mean Temperature . . . 43°40 }
Coldest day . . . . 2nd ... Mean Temperature . . . 20.35 } Difference=23°05.

Maximum. { Solar, ... 69°0 on p. m. of 29th } Monthly range=
Radiation. { Terrestrial . . . . . —4.0 on a. m. of 2nd } 73°0

Aurora observed on 1 night, viz.: 22nd at 10 p.m; possible to see Aurora on 17 nights; impossible to see Aurora on 13 nights.

Snowing on 11 days; depth, 12.9 inches; duration of fall, 41.9 hours.

Raining on 10 days; depth, 1.755 inches; duration of fall, 39.6 hours.

Mean of cloudiness=0.54; most cloudy hour observed, 2 p. m., mean=0.67: least cloudy hour observed, 10 p. m.; mean=0.42.

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

North.	South.	East.	West.
3080.40	1591.83	1087 08	3676.85

Resultant direction of the wind, N 60° W; Resultant Velocity, 4.15 miles per hour.

Mean velocity of the wind 10.24 miles per hour.
Maximum velocity . . . 33.6 miles per hour, from 9 to 10 p. m. of 27th.

Most windy day . . . . . 1st—Mean velocity, 23.03 miles per hour.
Least windy day . . . . . 9th—Mean velocity, 3.88 do

Most windy hour noon to 1 p. m.—Mean velocity, 13·30 do } Difference
Least windy hour 4 to 5 a. m.—Mean velocity, 7.30 do } 6.00 miles.

Solar Halos on 3rd from 2 to 3 p. m. (perfect) 4th 7 to 8 a. m. 10th Halo & Parhelia 6.30 to 7.30 a. m. and on 23rd, 10 a. m. to noon.
Lunar Halos on 7th from 8 to 10 a. m. (large and perfect) 8th, 11 p. m. 9th at midnight (perfect).
1st—Very stormy day, with occasional Rain and Snow.
13th—Foggy at 8 a. m. on 14th 6 and 8 a. m.
14th—Distant Thunder at 3.50 p. m.
29th—Thin Ice on the pools at 5.30 a. m.
29th and 30th—Hoar frost at 6 a. m.

Temperature—This month was the coldest April that has occurred during the last 18 years being 5°7 below the average. It shews also the lowest maximum temperature, and with one exception, the lowest minimum temperature during the same period.

Rain and Snow—The quantity of rain was small, being 0.783 inches below the average; but it was more than compensated by the great depth of snow that fell which was 10.29 inches above the average or about five times the usual depth. The total moisture was thus 0·246 inches above the mean.

Wind—This was the most windy April on the records of the observatory, the velocity of the wind being 3.17 miles above the average of ten years.

The Resultant Direction and Velocity from 1848 to 1857 inclusive for the month of April were N. 19° W., 1.93 miles per hour.

COMPARATIVE TABLE FOR APRIL.

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	42.4	+ 1.3	65.9	23.3	40.6	14	3.420	2	...	—	—	—
1841	39.2	— 1.9	62.9	22.1	40.8	3	1.370	3	...	—	—	0.51 lbs
1842	43.1	+ 2.0	89.5	21.6	67.9	8	3.740	2	...	—	—	0.57 "
1843	40.9	— 0.2	70.0	15.1	54.9	7	3.185	3	0.1	—	—	0.46 "
1844	47.5	+ 6.4	74.5	17.2	57.3	10	1.515	1	Inapp	—	—	0.24 "
1845	42.1	+ 1.0	66 0	14.8	51.2	11	3.290	4	1.5	—	—	1.00 "
1846	44.0	+ 2.9	79.4	24.4	55.0	10	1.300	2	1.3	—	—	0.55 "
1847	39.2	— 1.9	65.6	8.4	57.2	8	2.870	2	4.0	—	—	0.59 "
1848	41.3	+ 0.2	65.4	26.5	38.9	5	1.455	1	0.5	N 77 W	1.46	4.89 mls
1849	39.0	— 2.1	70.9	23.2	47.7	10	2.655	2	1.7	N 43 W	3.14	7.50 "
1850	37.9	— 3.2	63.2	18.2	45.0	7	4.720	2	1.1	N 39 W	1.12	7.64 "
1851	41.3	+ 0 2	59.2	25.8	33.4	11	2.295	3	1.2	N 14 E	2.52	3.07 "
1852	38.2	— 2.9	53.8	19.8	34.0	6	1.990	4	9.4	N 23 E	2.44	1.68 "
1853	41.9	+ 0.8	65.7	27.0	38.7	10	2.625	1	1.0	N 12 W	1.90	5.20 "
1854	41.0	— 0.1	63.1	22.3	42.8	12	2.685	4	2.7	N 53 E	2.44	3.82 "
1855	42.4	+ 1.3	63.8	12.2	51.6	8	2.080	3	1.6	N 36 W	3.99	7.57 "
1856	42.3	+ 1.2	69.8	15.1	54.7	13	2.780	3	0.1	N 29 E	1.64	5.05 "
1857	35.4	— 5.7	51.9	10.0	41.9	10	1.755	11	12.9	N 60 W	4.15	10.24 "
Mean	41.06	...	66.81	19.36	47.42	9.1	2.538	3.9	2 61	—	—	7.07

MONTHLY METEOROLOGICAL REGISTER AT THE PROVINCIAL MAGNETICAL OBSERVATORY, TORONTO, CANADA WEST,—MAY, 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.			Resul't. 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	10PM	MR'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 PM.	10 P.M.	Result'.	ME'N		
					°	°	°	°	°																			
1	29.679	29.546	29.492	29.5662	41.8	44.7	42.9	43.42	— 3.00	.185	.252	.239	.231	.71	.86	.88	.83	E N E	E b s	S S E	S 78 E	8.3	3.6	5.2	5.11	5.50	0.345	...
2	.413	.492	.586	.4887	43.6	42.0	38.9	41.23	— 5.48	265	224	203	226	94	85	87	88	E N E	N W	W N W	N 38 W	1.8	18.5	7.6	8.13	8.96	0.420	...
3	.694	.683	—	—	37.8	47.3	—	—	—	208	241	—	—	92	75	—	—	Calm.	S b E	E N E	S 54 E	0.0	12.0	3.0	2.49	5.39	...	...
4	.653	.518	.306	.4663	38.2	41.5	43.6	41.62	— 5.80	180	221	265	228	79	85	94	87	E N E	N E b E	N E	N 53 E	12.2	10.2	21.5	12.96	13.27	1.375	...
5	.225	.270	.351	.2850	40.9	49.2	41.5	43.75	— 3.98	244	298	246	265	97	86	95	94	Calm	E S E	Calm.	N 46 W	0.0	2.5	0.0	0.11	4.61	0.245	...
6	.415	.516	.600	.5202	38.2	42.7	41.3	40.82	— 7.22	202	228	190	210	88	84	73	83	W N W	S W b S	Calm.	N 75 W	11.2	3.2	0.0	4.53	5.16	Inap	...
7	.656	.656	.741	.6877	36.8	50.5	41.1	43.52	— 4.90	189	293	186	227	87	81	73	81	W b N	S E	W S W	S 9 E	2.2	7.5	0.4	1.30	3.44	0.020	...
8	.819	.823	.694	.7748	38.6	53.8	46.2	46.48	— 2.30	160	287	220	216	69	71	71	69	N b W	E b S	E N E	N 85 E	3.6	5.2	4.8	4.85	5.42	...	...
9	.600	.470	.343	.4462	42.2	62.4	61.3	55.73	+ 6.57	222	299	489	329	83	54	92	75	N E	S W	W b N	S 46 W	0.4	12 0	13.0	8.06	9.97	0.315	...
10	.282	.494	—	—	51.9	42.3	—	—	—	234	161	—	—	61	60	—	—	W	W b N	N W b N	N 58 W	24.0	29.8	18.5	20.65	22.39	...	Inap
11	.834	.816	.813	.8205	27.9	36.0	32.4	31.95	—17.95	119	140	153	134	77	67	83	74	N N W	S S E	N N W	S 28 E	7.6	6.9	1.5	1.22	4.73	...	...
12	.862	.839	.835	.8485	32.4	46.3	36.4	39.72	—10.45	138	183	158	161	75	59	74	67	N N W	S S E	N N W	S 28 E	7.6	6.9	1.5	1.22	4.73	...	...
13	.861	.773	.646	.7493	36.8	50.9	44.3	45.40	— 5.17	154	154	230	175	71	42	80	60	N W b N	S S W	N	N 70 E	1.2	5.8	6.9	1.34	6.36	...	...
14	.460	.321	.328	.3530	45.4	46.9	46.2	46.25	— 4.63	212	213	243	220	71	67	79	71	N E	E b N	E b N	N 68 E	17.0	21.0	10.9	16.98	17.25	0.250	...
15	.232	.268	.383	.3035	42.5	48.0	46.3	45.57	— 5.72	260	278	237	254	97	84	76	84	E N E	N b E	W b S	N 53 W	14.2	14.3	9.5	1.62	9.61	0.305	...
16	.427	.504	.632	.5282	43.3	48.5	36.1	43.22	— 8.37	210	292	174	216	76	87	82	77	W b S	N W b N	W b N	N 78 W	6.0	17.9	14.8	13.85	15.09	0.140	...
17	.680	.758	—	—	36.8	47.6	—	—	—	164	236	—	—	75	74	—	—	S W b W	N W b N	W N W	N 62 W	11.8	11.2	3.5	6.07	7.06	...	...
18	.855	.796	.734	.7758	40.7	50.1	47.8	47.35	— 4.93	199	226	252	235	79	63	77	73	Calm.	E b S	N	N 53 E	0-0	10-0	4-2	6.48	8.39	...	...
19	.709	.688	.672	.6900	49.2	56.1	49.4	52.37	— 0.25	252	251	132	227	73	57	38	58	N E b N	E	N	N 32 E	16.4	9.2	10.0	9.51	11.85	...	...
20	.667	.586	.630	.6233	45.4	58.8	44.7	48.65	— 4.37	235	195	226	212	79	39	77	65	N b W	E b N	N W	N 12 E	15.8	9.5	0.5	5.35	8.89	...	...
21	.581	.535	.524	.5467	48.9	69.8	57.4	59.68	+ 6.37	174	279	376	271	51	39	82	55	N W b N	N W	N W b N	N 38 W	9.0	16.0	11.0	10.46	11.11	...	...
22	.543	.488	.441	.4872	51.7	61.4	54.1	56.28	+ 2.58	311	347	314	328	82	64	77	74	W S W	S b W	S b W	S 22 W	3.2	8.2	2.5	3.80	6.01	...	...
23	.455	.482	.515	.4912	55.2	68.2	55.2	60.48	+ 6.52	226	312	302	293	52	46	71	57	N W b N	S b W	S S W	S 49 W	11.2	7.7	0.3	2.24	4.71	...	...
24	.550	.476	—	—	53.9	64.2	—	—	—	277	351	—	—	70	60	—	—	S S W	E b S	S W b S	S 22 E	1.8	10.5	5 5	2.52	3.46	...	...
25	.490	.436	.468	.4640	54.5	72.5	62.1	63.85	+ 9.17	299	364	377	360	72	46	69	63	S W b S	S W b S	Calm.	S 32 W	1.6	17.0	0.0	5.06	6.16	...	...
26	.486	.460	.430	.4545	56.7	65.3	55.2	59.83	+ 4.85	368	399	369	371	84	66	86	75	N E b N	E b N	S E b E	S 77 E	2.2	3.5	1.0	4.21	5.34	Inap	...
27	.388	.344	.372	.3647	54.1	58.4	49.8	55.15	— 0.13	323	384	273	331	78	81	77	77	S b W	S S W	S S W	S 10 W	6.3	9.2	6.0	6.30	6.84	0.220	...
28	.284	.259	.315	.2812	50.5	59.3	49.6	52.15	— 3.50	287	365	306	312	80	75	88	82	E b S	S	W S W	S 20 W	5.5	14.8	1.5	6.73	7.95	0.295	...
29	.297	.356	.437	.3672	50.5	54.1	49.8	51.42	— 4.53	297	239	286	275	82	58	81	74	S W b S	W b S	Calm.	S 78 W	10.0	16.0	0.0	7.64	8.10	...	...
30	.505	.543	.536	.5330	49.8	60.6	52.1	54.78	— 1.47	278	285	276	292	79	55	72	70	W b N	S E b E	Calm.	S 60 E	0.4	5.0	0.0	1.50	2.78	.135	...
31	.499	.449	—	—	50.9	59.2	—	—	—	320	334	—	—	87	67	—	—	N E b E	E b N	E N E	N 74 E	6.2	8.5	6.5	7.28	7.38	.080	...
M	29.5525	29.5278	29.5317	29.5353	44.45	53.77	47.14	48.87	— 2.61	230	270	259	254	.78	.66	.78	.74					7.26	10.89	5.70	...	8.13	4.145	Inap

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR MAY.

Highest Barometer..... 29.896 at 8 a.m., on 12th } Monthly range=
Lowest Barometer ..... 29.199 at midn'ht, on 4th } 0.697

Self-regist'ing Thermom.
- Maximum Temperature.....74.°8 on p. m., of 25th } Monthly range=
- Minimum Temperature.....26.°0 on a. m. of 11th } 48.°8
- Mean maximum Temperature ..... 57°17 } Mean daily range=
- Mean minimum Temperature ..... 40°24 } 16.94
- Greatest daily range .....26°8 from a. m. to p. m. of 21st.
- Least daily range..... 7.4 from a. m. to p. m. of 4th.

Warmest day..... 25th ... Mean temperature..... 63°85 } Difference = 31°90.
Coldest day..... 11th ... Mean temperature..... 31.95 }

Maximum. } Solar..... 90°5 on 25th, p. m. } Monthly range=
Radiation. } Terrestrial..... 18°0 on 11th, a. m. } 72°5

Aurora observed on 3 nights, viz., 7th, 8th and 13th.
Possible to see Aurora on 17 nights; impossible on 14 nights.

Snowing on 1 day.—depth Insp. inches; duration of fall 0.5 hours.
Raining on 15 days,—depth 4.145 inches; duration of fall 94.8 hours.

Mean of cloudiness = 0.61.
Most cloudy hour observed, 4 p. m., mean = 0.80; least cloudy hour observed, 10 p. m., mean, =0.50.

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

North.	South.	East.	West.
2224.37	1448.93	1835.40	2172.53

Resultant direction N. 23° W.; Resultant Velocity 1.14 miles per hour.
Mean velocity..... 8.13 miles per hour.
Maximum velocity ..... 29.8 miles from noon to 1 p. m. on the 10th.
Most windy day..... 10th ...Mean velocity 22.39 miles per hour.
Least windy day ..... 30th...Mean velocity 2.78 ditto.
Most windy hour ... noon to 1 p. m.....Mean velocity 11.83 ditto. } Difference
Least windy hour ... midnight to 1 a. m..Mean velocity 4.76 ditto. } 7.07 miles.

Solar Halos on the 13th noon to 4 p. m., 22nd 10.30 a. m. to 1.30 p. m., 26th at 8 a. m., and 30th Halo and Parhelia during the evening.

Lunar Halo on the 2nd at 10 p. m.—imperfect.

Hoar Frost on the mornings of the 7th, 8th and 17th.

Ice on the pools on the mornings of the 11th, 12th, 13th and 18th.

Thunder on the 10th, at 2 a. m. (distant). Thunderstorm on the 16th, from 1 to 1.30 p. m.

Sheet Lightning on 25th at 9 p. m., and 26th at midnight.

Very perfect Rainbow with supplementary band on the 7th at 5.15 p. m.

Fog on the 2nd and 5th.

The resultant direction of the wind, from 1848 to 1857, for the month of May was N. 13° W., and the resultant velocity 1.35 miles.

COMPARATIVE TABLE FOR MAY.

Year.	Temperature.					Rain.		Snow.		Wind.		
										Resultant.		Mean Force or Velocity.
	M'n.	Diff. from Aver.	Max. ob'd.	Min. ob'd.	Range.	No. of days.	Inch's.	No. of days.	Inch's	Direction.	V'y.	
	°	°	°	°	°							
1840	53.8	+2.5	74.5	30.8	43.7	9	4.150	...	...	...	...	.....
1841	50.5	—0.8	76.2	26.6	49.6	11	2.350	1	...	...	...	0.35 lbs.
1842	49.1	—2.2	74.3	30.0	44.3	7	1.275	...	...	...	...	0.53
1843	49.1	—2.2	79.6	28.9	50.7	5	1.570	...	0.0	...	...	0.52
1844	53.6	+2.3	77.7	29.0	48.7	14	5.670	...	0.0	...	...	0.30
1845	49.6	—1.7	76.6	29.4	47.2	8	2.300	...	0.0	...	...	0.55
1846	55.5	+4.2	78.1	34.3	43.8	9	4.375	...	0.0	...	...	0.46
1847	54.4	+3.1	72.5	27.8	44.7	12	2.040	...	0.0	...	...	0.29
1848	54.1	+2.8	78.5	31.9	46.6	13	2.520	...	0.0	N 40° W	1.31	4.93 miles
1849	48.0	—3.3	72.5	32.7	39.8	16	5.115	...	0.0	N 51° E	1.97	5.33
1850	47.6	—3.7	76.3	31.1	45.2	7	0.545	1	Inapp	N 64° W	2.05	6.32
1851	51.3	0.0	73.2	28.7	44.5	12	2.950	1	0.5	N 32° W	1.59	6.34
1852	51.4	+0.1	73.3	34.5	38.8	7	1.125	1	Inapp	S 82° W	0.99	4.00
1853	50.9	—0.4	78.4	38.4	40.0	17	4.420	1	Inapp	N 20° W	0.98	5.14
1854	52.2	+0.9	69.0	27.6	41.4	11	4.630	...	0.0	S 66° E	0.26	5.38
1855	53.1	+1.8	74.8	33.9	40.9	6	2.565	2	0.9	N 1° W	2.76	5.93
1856	50.5	—0.8	80.1	35.5	44.6	14	4.580	1	Inapp	N 4° E	3.99	9.81
1857	48.9	—2.4	72.5	27.9	44.6	15	4.145	1	Inapp	N 23° W	1.14	8.13
M	51.31	...	75.45	31.05	44.39	10.7	3.129	0.5	0.08			6.13 miles

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

(NINE MILES WEST OF MONTREAL.)

BY CHARLES SMALLWOOD, M. D., L.L.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.		
	9 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	29.365	29.443	29.641	37.9	26.5	12.6	.199	.129	.088	.83	.80	.87	SW b W	N E b N	N b E	6.60	14.42	19.77	...	...	2.14	C. Str. 10.	Snow.	C. C. Str. 6.
2	.745	.862	.087	3.1	25.2	16.1	.044	.102	.076	.80	.65	.68	W	W N W	N b E	15.77	8.33	19.40	...	...	...	Clear.	Clear.	Clear.
3	.158	.056	29.896	14.4	33.0	25.6	.073	.189	.118	.68	.76	.78	S	S S W	S E b E	1.75	1.81	2.35	...	...	...	Do.	Str. 4.	Cum. 4 L. H.
4	.738	.703	.864	24.9	51.0	39.2	.102	.255	.234	.65	.66	.88	S S E	S W E	S S W	0.15	1.70	2.81	...	...	...	Cum. Str. 6.	C. C. Str. 4.	C. Str. 4 L. H
5	.730	.535	.471	29.8	51.1	51.6	.138	.315	.337	.74	.81	.87	E N E	S E by S	S S E	2.43	5.77	9.21	...	...	...	Do. 10.	Nimb. 10.	Rain.
6	.211	.224	.215	50.0	48.1	31.6	.336	.302	.171	.88	.86	.85	S S E	S S E	N W	24.82	12.20	12.53	...	0.116	...	C. C. Str. 10.	Rain.	Snow.
7	.494	.696	.922	21.2	32.1	25.4	.118	.160	.112	.88	.80	.70	S W	S W	S W	14.37	16.23	11.10	...	0.705	1.20	C. St. 4.	C. Str. 4.	C. Str. 2.
8	.986	.765	.864	31.3	37.1	40.6	.153	.199	.237	.78	.83	.86	S E by S	S E b S	S	5.31	6.73	6.62	...	...	1.50	Do. 10.	Do. 10.	Do 10.
9	.860	.848	.518	36.4	42.2	35.6	.192	.243	.203	.83	.85	.90	S	W S W	W	9.48	2.31	1.85	...	Inp.	...	Rain.	Do. 10.	Do. 8.
10	.883	.814	.765	32.0	39.1	36.0	.188	.220	.218	.90	.89	.94	N N E	N E	N E	1.33	6.63	17.43	...	0.533	...	C. C. Str. 4.	Do. 6.	Rain.
11	.538	.534	.710	35.0	44.6	37.2	.203	.211	.218	.91	.85	.91	N N W	S S W	S	19.86	0.66	2.18	...	0.103	...	Cum. Str. 10.	Do. 6.	C. Str. 10.
12	.680	.657	.732	35.8	53.0	39.4	.210	.299	.235	.91	.73	.89	W S W	S	S b E	4.20	2.12	1.76	...	0.436	...	Do. 4.	Cum. Str. 2.	Do. 4.
13	.785	.804	.791	32.1	53.5	41.6	.191	.293	.232	.94	.70	.85	S	E by N	S E b E	0.12	0.40	1.67	...	...	...	Clear.	Rain.	Do. 6.
14	.642	.358	28.983	32.7	36.2	37.0	.191	.229	.238	.93	.98	1.00	N E by E	N E b E	N E	1.90	20.86	29.31	...	3.196	...	Cum. Str. 10.	Cir. Str. 10.	Rain.
15	28.946	29.043	29.164	33.9	42.9	33.6	.204	.223	.187	.95	.79	.90	S W b S	W S W	S W	9.07	13.66	9.11	...	0.850	0.40	Do. 10.	Do. 2	Clr. Aur. Bor.
16	29.265	.350	.598	34.1	43.1	32 5	.178	.233	.182	.83	.79	.90	W S W	W S W	S W	9.72	10.61	9.77	...	...	...	Do. 4	Do. 8.	Do.
17	.650	.601	.565	31.4	42.6	40.8	.171	.225	.235	.83	.79	.85	N N E	N E by E	N N W	2.77	10.40	7.73	...	...	...	C. C. Str. 10.	Do. 10.	C. Str. 8.
18	.628	.710	.764	39.1	42.9	38.0	.214	.252	.227	.86	.85	.92	W S W	N E b E	N E b N	7.41	8.83	1.57	...	...	...	Do. 9.	Do. 9.	C. C. Str. 4.
19	.851	.721	.689	40.4	55.0	43.6	.227	.342	.261	.88	.76	.89	E N E	S E	S E b S	8.47	3.41	7.27	...	...	...	Clear.	Do. 10.	C. Str. 10.
20	.723	.593	.598	37.1	45.8	44.6	.199	.262	.283	.84	.81	.89	E by S	N E b E	N E b N	6.20	13.80	3.72	...	...	...	C. C. Str. 4.	Cir. Str. 4.	Do. 10.
21	.578	.583	.644	38.2	46.9	38.0	.207	.284	.194	.84	.82	.86	N E b E	N E b E	E N E	24.12	14.76	17.86	...	...	...	Cum. Str. 4.	C. C. Str. 4.	Clear.
22	.610	.513	.566	36.4	54.3	41.5	.193	.304	.201	.83	.76	.78	N E b. E	N E b E	N E b E	10.15	9.92	5.66	...	...	...	Clear.	C. Str. 10.	C. Str. 4.
23	.575	.564	.609	35.0	54.2	38.9	.186	.326	.179	.83	.76	.74	N N E	N E b E	S S E	4.01	0.63	1.92	...	Inp.	...	Cum. Str. 6.	C. C. Str. 4.	Do. 4.
24	.560	.533	.604	42.1	53.9	42.2	.242	.264	.198	.85	.61	.65	E S E	W by S	W S W	6.22	8.00	16.92	...	...	...	Str. 2.	Cum. Str. 8.	Do. 2.
25	.573	.614	.680	36.0	29.0	34.1	.192	.198	.162	.83	.76	.76	W b N	N W	W b N	4.01	10.30	3.43	...	...	...	C. Str. 4.	Cum. 4.	Do. 2.
26	.683	.670	.700	32.3	37.4	37.0	.167	.274	.198	.83	.70	.77	W b N	W by N	S E	1.55	4.93	1.10	...	...	...	Clear.	Do. 4.	Clear.
27	.310	.356	.415	32.4	34.4	32.5	.160	.178	.191	.80	.83	.95	S E	S E b S	E b N	1.92	4.57	0.05	...	0.710	1.70	Cum. Str. 10.	Rain.	Clear.
28	.467	.395	.799	34.7	38.2	32.5	.195	.207	.178	.91	.84	.86	W by N	W	W	12.26	19.55	18.12	...	...	...	Do. 9.	Cir. Str. 8.	Snow.
29	.901	.906	30.038	28.2	46.5	32.7	.135	.227	.174	.78	.75	.83	W N W	N W	W N W	9.40	12.35	6.75	...	...	...	Clear.	Do. 4.	Cir. Str. 10.
30	30.149	38.146	30.180	30.0	57.0	38.2	.160	.273	.177	.86	.76	.77	N E by E	W S W	S E	0.02	0.12	6.80	...	...	...	Do.	Clear.	Clear.
																								Do.

MONTHLY METEOROLOGICAL REGISTER, ST. MARTIN, ISLE JESUS, CANADA EAST—MAY, 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.		
	8 A.M.	2 P.M.	10 P.M.	6 A. M.	2 P. M.	10 P. M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.				6 A.M.	2 P.M.	10 P.M.
1	30.018	29.837	29.817	40.4	58.2	51.1	.227	.290	.238	.85	.59	.61	S E b S	S by E	S E	0.00	16.02	9.25	...	...	...	Cir. Cum-Str. 4	Cir. Str. 8.	Nimb. 10.
2	29.804	.538	.542	40.7	48.8	47.2	.235	.336	.344	.84	.93	.98	S by E	S by E	S	9.22	4.50	2.90	...	.543	...	Rain.	Rain.	Cir. Str. 10.
3	.784	.787	.854	40.1	48.0	39.8	.245	.266	.235	.95	.78	.91	W	W by N	S W	6.82	4.60	5.30	...	...	...	Cm. Str. 9.	Cir. Str. 6.	Clear Aur. Bor.
4	.866	.785	.751	36.0	54.6	46.9	.220	.349	.291	.94	.81	.85	S b E	N E by E	N E b E	1.55	2.40	1.21	...	...	...	Do. 6.	Do. 8.	Rain.
5	.800	.459	.548	40.9	39.3	36.1	.255	.245	.217	.94	.96	.98	N E b E	N E by E	N E b E	21.11	31.85	21.57	...	1.386	...	Rain.	Rain.	Cir. Str. 10.
6	.595	.650	.692	34.5	42.2	40.5	.214	.243	.24.	.99	.85	.92	N E by E	N W	S S W	5.93	0.20	0.01	...	0.086	...	C. to 10.	Cir. Str. 6.	Do. 9.
7	.717	.741	.847	41.1	48.3	41.2	.253	.324	.253	.91	.92	.91	S W b S	S W	W S W	0.55	3.65	2.80	...	0.041	...	Sligh Rain.	Do. 7.	Do. 2.
8	.899	.907	.983	38.5	60.4	50.4	.226	.350	.253	.90	.66	.75	S W b W	N W	S by W	1.30	8.71	4.65	...	...	...	Clear.	Clear.	Clear.
9	.779	.612	.496	47.4	80.0	62.0	.252	.481	.397	.76	.47	.71	S by E	S W	S by E	0.76	4.76	7.05	...	...	...	Cir. Cm. St. 4.	Cir. Str. 4.	Str. 2.
10	.324	.330	.593	55.0	58.5	39.0	.399	.346	.214	.89	.70	.84	S S W	S W	N W b W	6.15	9.15	10.70	...	0.009	...	Cm. Str. 8.	Do. 9.	Rain.
11	.840	.800	.914	30.1	44.0	35.0	.145	.223	.170	.78	.73	.76	N	N E b N	N E	24.41	4.00	2.25	...	...	...	Clear.	Clear.	Clear.
12	.994	.933	.910	29.7	54.1	40.6	.152	.326	.194	.82	.76	.78	N W b N	W by S	W by S	2.12	1.65	4.40	...	...	...	Do.	Do.	Str. 2.
13	.856	.801	.811	38.6	59.5	46.6	.199	.267	.210	.76	.52	.64	S W	N W b N	N	4.00	3.97	7.81	...	...	...	Do.	Cir. Str. 6.	Clear Aur. Bor.
14	.780	.612	.570	44.1	66.0	47.6	.223	.394	.273	.73	.61	.80	N E by E	N E by E	S S E	0.41	0.52	1.30	...	...	...	Do.	Clear.	C. Str. 8.
15	.506	.465	.510	42.0	54.6	46.7	.152	.199	.283	.53	.46	.86	N E by E	N E by E	S	11.52	6.60	0.92	...	...	...	C. to 10.	Cir. Str. 10.	Do. 10.
16	.563	.583	.670	40.1	63 6	47.0	.194	.326	.271	.73	.56	.80	N E b N	E S E	S by E	0.90	3.93	0.46	...	...	...	Cir. Cm. St. 8.	Clear.	Do. 10.
17	.696	.795	.895	42.2	42.4	41.6	.252	.243	.248	.85	.85	.86	S by E	W by N	S W	3.08	9.30	1.20	...	0.663	...	Rain.	Rain.	Clear.
18	.947	.831	.910	40.5	66.8	50.9	.210	.416	.283	.79	.65	.75	W by N	S S W	W	11.46	2.85	0.46	...	...	...	Clear.	C. Str. 4.	Cir. Cum. Str. 4.
19	.923	.861	.842	40.3	58.0	45.0	.153	.248	.202	.57	.49	.64	E N E	E N E	E N E	8.61	12.67	11.85	...	...	...	Clear Frost.	Str. 2.	Str. 2.
20	.776	.715	.678	43.3	56.9	47.0	.216	.255	.252	.73	.55	.75	E N E	E	W b S	15.81	6.92	1.42	...	...	...	Do.	C. Str. 9.	Cir. Cum. Str. 9.
21	.599	.574	.578	46.1	62.4	56.8	.262	.375	.305	.80	.67	.66	S W	W N W	W N W	2.80	2.77	6.76	...	...	...	C. C to 6.	Do. 4.	Clear.
22	.588	.584	.598	50.0	76 5	63.5	.328	.473	.366	.86	.50	.63	S	S S E	S W b W	0.00	1.15	2.21	...	...	...	Clear.	C. C. Str. 4.	Cum. Str. 9.
23	.560	.527	.596	52.8	80.9	62.4	.304	.473	.397	.76	.46	.71	S S W	S S W	S W b S	0.45	4.47	2 86	...	...	...	Do.	Clear.	Clear.
24	.689	.621	.606	59.4	88.1	64.0	.233	.532	.425	.72	.43	.71	W S W	S W b S	S	0.91	1.21	2.36	...	...	...	Do.	Do.	Do.
25	.572	.438	.525	64.0	87.0	70.5	.476	.607	.436	.78	.48	.67	S W b S	W b S	S W b W	1.92	6.46	8.90	...	...	...	C. to 4.	Hazy.	Hazy.
26	.793	.840	.797	47.3	65.5	55.4	.271	.473	.312	.80	.74	.81	N E b	N by E	N N E	11.65	21.25	2.20	...	Inapp	...	Clear.	Clear.	Cir. Str. 10.
27	.641	.530	.50	62.0	79.6	67.0	.431	.568	.408	.76	.58	.61	N E	S E	S E	7.05	2.96	12.97	...	0.100	...	C. to 6.	Cir. Str. 4.	Do. 4 R. with T.
28	.555	.424	.485	61.5	77.5	55.1	.879	.588	.394	.93	.64	.88	S E	E S E	S W	5.05	1.11	4.06	...	1.434	...	Rain.	Do 6.	Do. 8 R. with T.
29	.418	.344	.428	57.0	67.6	56.0	.432	.531	.383	.90	.81	.84	S W b W	S S W	S W b W	0.22	8.18	11.06	...	...	...	C. to 4.	C. Str. 2.	Str. 2.
30	.528	.567	.662	50.3	59.1	50.1	.326	.426	.321	.87	.84	.87	W S W	W S W	S S W	12.10	10.92	2.57	...	...	...	Do.	C. C. Str. 8.	Clear.
31	.675	.633	.663	50.0	72.0	54.2	.304	.498	.378	.80	.64	.87	S S W	S W	S S E	0.12	0.02	2.01	...	...	...	C. C. Str. 4.	Do. 4.	C. C. Str. 4 L. H.

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

Barometer	Highest, the 30th day	30.180
	Lowest, the 15th	28.946
	Monthly Mean	29.691
	Monthly Range	1.134
Thermometer	Highest, the 13th day	55°.7
	Lowest, the 2nd day	2° 9
	Monthly Mean	37°19
	Monthly Range	52°8
Greatest intensity of the Sun's Rays		98°.6
Lowest point of Terrestial Radiation		1°.4
Mean of Humidity		.821
Amount of Evaporation		1.75

Rain fell on 10 days amounting to 6.549 inches; it was raining 61 hours 46 minutes.

Snow fell on 5 days, amounting to 6.94 inches; it was snowing 26 hours 20 minutes.

The most prevalent wind was the N E by E.

The least prevalent wind E by S.

The most windy day the 21st; mean miles per hour 18.91.

Least windy day the 13th; mean miles per hour 0.73.

The Aurora Borealis visible on 1 night.

Lunar Halo visible on 2 nights.

Swallows first seen on the 19th days.

Frogs first heard on the 22nd day.

The electrical state of the Atmosphere has indicated moderate intensity.

Ozone was in rather large quantity.

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

Barometer	Highest the 1st day	30.018
	Lowest the 10th day	29 324
	Monthly Mean	29.682
	Monthly Range	0.694
Thermometer	Highest the 24th day	88°5
	Lowest the 12th day	26°.5
	Monthly Mean	51°90
	Monthly Range	61°6
Greatest Intensity of the Sun's Rays		122°4
Lowest Point of Terrestrial Radiation		24°.7
Mean of Humidity		.753
Amount of Evaporation		3.010

Rain fell on 9 days, amounting to 4.232 inches; it was raining 68 hours and 42 minutes and was accompaned by thunder on 2 days.

Most prevalent wind, N. E. by E. Least prevalent wind, N.

Most windy day, the 5th day; mean miles per hour, 24.84.

Least windy day, the 31st day; mean miles per hour, 0.71.

Aurora Borealis visible on 2 nights.

Lunar Halo on 1 night.

Shad first caught on the 21th day.

The electrical state of the atmosphere has indicated moderate intensity.

Ozone was in small quantity.

TO THE READER.

"So numerous a body as the Canadian Institute now is, ought to include a much greater number of working members; and the Council are led to believe that their apparent supineness arises, in part at least, from the mistaken idea that communications can only be made in the form of elaborate essays. They would strongly urge the encouragement of brief communications, in greater number, as at once more calculated to give general interest to the ordinary meetings, and to elicit such results of personal knowledge and observation as are best calculated to add to the true value of the published proceedings.

"Short notices of natural phenomena, features of local geology, objects of natural history, and the like subjects, derived from personal observation, must be readily producible by many members who have hitherto borne no active part in the Society's proceedings, but whose contributions would most effectually promote the objects which it is designed to accomplish."

Extract from the Annual Report of 1855.

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The next Number of this Journal will be issued in September.