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THE MOHAWK LANGUAGE.

BY ORONHYATEKHA,
OF THE MOHAWK NATION.

When I was requested to prepare a paper concerning the language of my people, to be read before your learned body, I readily assented, not because I was not fully sensible of the difficulty of the task, or that I was not painfully aware of my own inability to do a subject of so much importance anything like full justice, but in the hope that I may be able to contribute something which may prove of some assistance to those who may hereafter institute inquiries in the same direction.

It will not be expected, in a short paper like this, that more can be done than merely give a brief introduction to the subject in hand, trusting that future opportunities may be afforded to further prosecute our work. While it is the design to direct your attention mainly to the language, it may not be amiss to give, at the outset, a general outline of the history of the Mohawks.

They are the head tribe of the *Confederacy of the Six Nations*, and, like the other Indian tribes of this continent, their origin is involved in mystery.

The only source which has not been exhausted, from which we can derive any information, at present within our reach, is the Indian traditions. They are, however, so mythical in their character, as touching the origin of the Indian, that but little, if any, reliance can be placed in them. I may say, however, that they all teach that the red man was created upon this continent; and, were I to weigh the evidence given by these traditions, and that derived from the various theories of scientific writers upon the subject, I should be inclined, after making all allowances for the legendary character of Indian history, to decide in favour of the evidence of tradition, for I am disposed to attach but little weight to theories formed upon supposed similarity in manners and customs, or accidental resemblance, in words, of the language. I do think, however, that there is every reason to hope that we shall find, if not a solution of our difficulty, at least great assistance, from the Science of Language.

I know that the traditions of the Mohawks assume a rational and reliable character, with the formation of the Confederacy of the Five Nations by the Mohawk Chief De-ka-na-wi-dah, yet the Tuscaroras are completely lost sight of in all the earlier traditions of the Five Nations, and are represented to have first met the Mohawks when they joined the Confederacy at a comparatively recent date. An examination, however, of the two languages, leaves no room to doubt that at some remote period these two nations were one.

Here, therefore, we have a case where we are enabled by a knowledge of, and an examination into, the languages, to pronounce judgment with absolute certainty upon a point which goes farther back than tradition. I should be placing a low estimate to say that the Confederacy is 500 years old. Philology, therefore, immediately solves a question for us which is from 600 to 1,000 years old. Leaving, however, the question of our origin for discussion till we are in a position to bring the Science of Language to bear upon it, we will proceed to give a hasty view of the Confederacy of which we have already made mention.

I have said that it was first conceived by De-ka-na-wi-dah, at a time when the nations which subsequently formed the League were living in separate and independent communities, continually engaged in hostilities with each other. The Chief, no sooner thoroughly satisfied that a Confederation of the neighbouring tribes would result in mutual benefit and prosperity, made proposals to the Oneida for an alliance, to which the latter fortunately acceded without hesitation.

They next proceeded to the Onondaga, who at that time was the most powerful of the neighbouring Chiefs. Having received the proposition of the Mohawk and Oneida to form an alliance in which all would be equal, he rejected them, as he was then more powerful and had more influence than they, and by entering the alliance he would be brought down to an equality with them. Determined, however, to carry out the Confederation scheme, the Mohawk and Oneida tendered the Onondaga the office of " Fire-keeper " in the new Council they would form. This, giving him the sole authority of opening or closing the Councils of the Five Nations, and a *veto* power upon all transactions of the Confederate Chiefs, induced the Onondaga to yield. The Cayugas and Senacas were subsequently added, and thus completed the scheme of Confederation of the Five Nations—a lasting evidence of their wisdom, and that they were entitled to the name of statesmen much more than many "pale-faces" of the present day. From the consummation of this scheme, the "new nationality" steadily though slowly increased in prosperity and power till about the time of the settlement of the English at Jamestown, when they had reached the zenith of their power and glory. Their hunting grounds extended from the great lakes upon the north to the Cumberland River and Cherokee country upon the south and east of the Mississippi.

They subdued nation after nation, till their name was known and their arms dreaded by nearly all Indian tribes east of the Rocky Mountains.

With what has occurred to us since we came in contact with the pale-faces, most of you are familiar, and I need say but a few words. At the time that New Amsterdam changed masters, was formed that alliance with the English which has been kept inviolate by the Mohawks unto this day. The Indians were engaged in all the wars that took place upon this continent for the possession of Canada, between the English and French, and to them England, most undoubtedly, owes her possessions in America. Their fidelity and the strength of their friendship will better appear when it is taken into consideration that they had not only no personal interest to serve, but also tempting offers were frequently made to them by the foes of England, to remain at least neutral. But their invariable reply was, " When my brother is glad we rejoice, when he weeps, we also weep."

At the close of the revolutionary war, the Mohawks, having throughout fought for their brother the King, though the American Government generously offered them the undisturbed possession of their territory, left their "hunting grounds and the graves of their forefathers," and sought a new home in the wilds of Canada in order to preserve their alliance with their Great Brother the King.

A portion settled upon the shores of the Bay of Quinté, where there are now about 700, while the remainder passed up to their present reservation at the Grand River, numbering at the present day about 2,500. So, again, in the war of 1812, these people gave good evidence at "Beaver Dam," "Lundy's Lane," and "Queenston Heights," that the spirit of their forefathers had not yet entirely died out. As illustrating the "ruling passion," strong even in the din and smoke of battle, the father of the writer, who took a leading part in all the engagements on the Niagara frontier, being present at the burning and sacking of Buffalo, selected from a rich, varied, and costly assortment, as his share of the plunder, *a keg of rum!*

With this bare outline we shall now proceed with our subject proper.

Although all the traditions represent the Six Nations as originally separate and distinct tribes, there can be no doubt of their common origin when we come to examine the dialects.

The migration of a family away from the rest, and living in isolation, would, in time, give us the dialectic differences now existing among the languages spoken by the Six Nations. If this be true, we would naturally suppose that the greatest similarity would be found to exist between the languages spoken by tribes located contiguous to each other; and, on the contrary, the greatest dissimilarity between the languages of tribes that are most remote from each other. On reference to the geographical position of the tribes, we find that, according to this, the Mohawk and Oneida ought to be most alike. An examination will prove this fact, while the Tuscarora differs more from the Mohawk than any of the others; for the Chiefs of the Mohawks, Oneidas, Onondagas, Cayugas, and Senacas, speak each in his own language in the Council House, and is readily understood by all; but the speech of a Tuscarora Chief usually has to be interpreted into one or other of the five dialects before it can be understood by the Council.

Our first inquiries must be directed, as a matter of course, to the alphabet of the leading language, viz., the Mohawk, and our attention will at once be arrested by a curious peculiarity in the entire absence of the labials which in English are so prominent.

I ought, perhaps, here to explain that the name Mohawk was given to us by foreigners, and that the signification or derivation is entirely unknown to us. Some writers, I believe, have conjectured it to mean *man eaters*, but if it is implied by this that the Mohawks were cannibals, I have no hesitation in pronouncing it to be a libel.

The name by which we are known among Indians is, perhaps, not quite so euphonious, but much more complimentary. It is *Ka-nyen-ke-ha-ka*, which means "flint-people," or "people derived from the flint," given no doubt by those who had experienced something of the flinty character and the scalping propensities of the Mohawk when upon the war-path.

The following comprises all the letters of the alphabet, viz. :—

VOWELS.

A	as	*a*	in	far.	Vowels followed by h have a short, quick, explosive sound, *e.g.* Eh as *e* in met.
E	"	*a*	"	fate.	Ih " *i* " pin.
I	"	*e*	"	meet.	
O	"	*o*	"	old.	E followed by n has the sound of *u* in under.
U	"	*u*	"	tune.	

CONSONANTS.

d h j k n q r s t w x z.

It will thus be seen that b c f g l m p v z are wanting, leaving seventeen letters in the alphabet.

Writers who have gone before me have, as a general thing, retained c and g, but I conceive uselessly, as I think where former writers would employ these letters, j and k could be used quite as correctly.

It will be my object not so much to exhibit the language in some particular form, or according to certain preconceived grammatical notions, as to examine and analyze the language, and afterwards deduce rules founded upon such analysis. With most of the works upon the subject that I have been able to examine, I have found this difficulty, that instead of truly exhibiting the language as it exists, it has been distorted and made to assume new forms to suit the purposes of the author.

In order to indicate the connection between the language of the Mohawks with the other dialects of the Six Nations, I have prepared a comparative table of the numerals, and of a few common words, from which it will be seen that the Mohawk and Oneida are the most alike, while the Tuscarora is most unlike the rest.

	MOHAWK.	ONEIDA.	ONONDAGA.	CAYUGA.	TUSCARORA.
1	En-ska	En-ska	Ska-dah	Skat	En-jih
2	De-ke-nih	De-ke-nih	De-ke-nih	Dek-nih	Ne-ktih
3	Ah-senh	Ah-senh	Ah-senh	Ah-senh	Ah-senh
4	Ka-ye-rih	Ka-ye-lih	Ka-ye-ih	Ke-ih	En-dah
5	Wisk	Wisk	Wiks	Wi-sh	Whisk
6	Ya-yak	Ya-yak	Ah-yak	Nye-ih	O-yak
7	Ja-dah	Ja-dah	Ja-dah	Ja-dak	Ga-nah
8	Sa-de-konh	De-ke-ronh	De-kenh	De-krunh	Na-krunh
9	Tyo-donh	Wa-deh	Wa-donh	Dyo-ton	Ni-renh
10	O-ye-rih	O-ye-lih	Wa-senh	Wa-senh	Wa-senh
11	En-ska-ya-wen-reh	Combined same as in Mohawk, only using *l* wherever *r* occurs in the Mohawk.	Ska-dah-ka-he	Skat-ska-reh	En-jih-ska-reh
12	De-ke-nih-ya-wen-reh		De-ke-nih-he	Dek-nih-ska-reh	Ne-ktih-ska-reh
20	De-wa-senh		D-əwa-senh	De-wa-senh	Ne-wa-senh
21	De-wa-senh-en-ska-ya-wen-reh		De-wa-senh-ska-dah-ka-he	De-wa-senh-skat-ska-reh	Ne-wa-senh-en-jih-ska-reh
22	De-wa-senh-de-ke-nih-ya-wen-reh		Ah-senh-ni-wa-senh	Ah-senh-ni-wa-senh	Ah-senh-de-wa-senh
30	Ah-senh-ni-wa-senh		Ka-ye-ih-ni-wa-senh, &c.	Ke-ih, &c. &c.	En-dah-de-wa-senh, &c.
40	Ka-ye-rih-ni-wa-senh				
50	Wisk-ni-wa-senh				
60	Ya-yak-ni-wa-senh				
70	Ja-dah-ni-wa-senh				
80	Sa-de-konh-ni-wa-senh				
90	Tyo-donh-ni-wa-senh				
100	En-ska-de-wen-nya-weh		Ska-dah-de-wen-nya-eh-weh	Skat-de-wen-nya-woh	Ka-ya-swih
150	$\underbrace{\text{En-ska}}_{\text{One}}\text{-}\underbrace{\text{de-wen-nya-weh}}_{\text{hundred}}\text{-}\underbrace{\text{nok}}_{\text{and}}\text{-}\underbrace{\text{wisk-ni-wa-senh}}_{\text{fifty.}}$		Similar to Mohawk		
200	De-ke-nih-de-wen-nya-weh		De-ke-nih-de-wen-nya-eh-weh		
Man	Ron-kwe	Lon-kwe	Ha-ji-nah	Ha-ji-nah	Ra-ni-ha
Woman	Yon-kwe	Yon-kwe	E-henh	Kont-swi-sah	Ka-nen-wenh
Boy	Rax-ha	Lax-ha	Hak-sa-ah	Hak-sa-ah	Ra-ka-senh
Girl	Kax-ha	Ex-ha	Ek-sa-ah	Ex-ha-ah	Ya-ken-wa-ston
Husband (my)	De-ya-ke-ni-de-ronh	De-ya-ke-ni-de-lonh	De-ya-ke-ni-ke-onh	Ho-oh (husband)	Ro-ho
Wife (my)	De-ya-ke-ni-de-ronh	De-ya-ke-ni-de-lonh	De-ya-ke-ni-de-onh	De-ya-ke-ni-ya-seh (wife)	Ke-ho
Father (my)	Ra-ke-ni-ha	La-ke-nih	Khe-ni-ha	Ha-nih (father)	Ri-enh
Mother (my)	Is-ten-ah	Ah-ke-nol-ha	Ah-ke-no-ha	Kno-ha (mother)	Kwi-renh

DELAWARE.*

1	En-kwi-ta
2	Ni-sha
3	Nghah
4	Ni-wah
5	Nau-lon
6	En-kwi-tash
7	Ni-shash
8	Nghash
9	Nole
10	Wi-mbut
11	En-kwi-ta-nih
12	Ni-sha-nih
13	Nghah-nih
14	Ni-wa-nih
15	Nau-lon-na-nich
16	En-kwi-tash-ta-nich
17	Ni-shash-ta-nich
18	Nghash-ta-nich
19	Nole-ta-nich
20	Ta-kwi-na cheh
21	Ta-kwi na-cheh-wak-en-kwi-ta, &c.
30	Ngheh-nach-kenh
40	Ni-wah-nach-kenh
50	Nau-lon-nach-kenh
60	En-kwi-tash-ta-nach-kenh
100	En-kwi-ta-poh-kenh
175	$\underbrace{\text{En-kwi-ta}}_{\text{One}}\text{-}\underbrace{\text{poh-kenh}}_{\text{hundred}}\text{-}\underbrace{\text{wak}}_{\text{and}}\text{-}\underbrace{\text{ni-shash-ta-nach-kenh}}_{\text{seventy}}\text{-}\underbrace{\text{wak}}_{\text{and}}\text{-}\underbrace{\text{nau-lon}}_{\text{five.}}$

Man	Lin-non	Father	Noch
Woman	Oh-kwi	Mother	En-gik
Boy	Ska-hen-tson	Son	We-quo-shein
Girl	Oh-kwi-*sis* (little woman)	Daughter	En-da-nish
Husband	Ni-tah-wun-musk	Day	Ki-ish-koh
Wife	Ni tah-wun-musk	Night	Pi-skak

From the above table we can readily see that the numerals are combined according to the decimal system of notation, and that in the language of the Six Nations they counted as far as ten, and then began to combine, as *ten and one*, *ten and two*, &c., while in the Delaware language, they counted only as far as five. For, the form *Enquitash* = 6 is evidently allied to *Enquita* = 1, and so of *Neeshash* = 7, and *Neesha* = 2, &c.

Although there does not appear to be much connection between the Mohawk *O-ye-rih* = 10, and *De-wah-senh* = 20, yet when we come to look at the forms for *ten* in the other languages with which it is allied, we readily recognize in *De-wah-senh* the words *De-ke-nih* + *Wasenh*—two-tens.

*The writer is indebted for the *Delaware* to an educated young Indian of that tribe (Mr. Albert Anthony). Every possible care was taken to guard against errors, and it is believed that the examples given are as nearly correct as possible.

The addition of the ending *Ya-wen-reh* to *one, two, &c.,* to express *eleven, twelve,* &c., is peculiar to the Mohawk and Oneida. The form for the other languages, as in Cayuga,—*Wa-senh-skat-ska-reh,* simply means *ten* and *one piled on* in the sense of added. I am at a loss to trace the Mohawk and Oneida form *Ya-wen-reh.* It may be derived from *O-ye-rih* = 10, but more likely from *De-ya-weu-renh* = *over,* in the sense of overflowing—more than enough. You will have noticed the peculiarity in the Oneida in the substitution of *l* where *r* is used in the remaining dialects. In fact, this seems to be its principal difference from the Mohawk. The initial *R* and *Y* or *K* seem to have some connection with the gender, as, for instance, *On-kwe* for mankind, in contradistinction from *Kar-yoh* = beast, is changed into man by simply prefixing R, and into woman by simply prefixing Y. So we have *Ex-ha* = child, *Rax-ha* = a boy, and *Kax-ha* = a girl.

Before subjecting a verb through it various forms, it may help us to understand some of the changes which it undergoes, by first looking at the pronouns and nouns :—

		MOHAWK.		(Plural.)	
I	I-ih.	We (two)	Un-ke-non-ha.	We	Un-kynha.
My	Ah-kwa-wenh.	Ours	Un-kya-wenh.	Ours	Un-kwa-wenh.
Me	I-ih.	Us	———	Us	———
Thou	I-seh.	You (two)	Se-non-ha.	You	Jon-ha.
Thy	Sa-wenh.	Yours	Ja-wenh.	Yours	Se-wa-wenh.
He	Ra-on-ha.	They (two)	Ro-non-ha.	They	Ro-non-ha.
His	Ra-o-wenh.	Theirs	Ra-o-na-wenh.	Theirs	Ra-o-na-wenh.

		Dual and Plural.	
She or it	A-on-ha.	They	O-non-ha.
Hers or its	A-o-wenh.	Theirs	A-o-na-wenh.

There is another form for *she* and *hers* applied to those for whom we entertain love, respect, or esteem, viz., she = Ah-ka-on-ha ; hers = Ah-ko-wenh, in which we have introduced the *k* we have already mentioned as having some connection with the feminine gender. There is but one form for the nominative and accusative cases. But the chief peculiarity is the existence of a dual element : as, however, we shall see this more clearly when we come to consider the verbs, it may, perhaps, be better to proceed to an examination of the verb before we say anything of this peculiarity of the language.

We shall find great difficulty in our process of analyzing and tracing the words, from the great tendency to agglutination which exists in all of the dialects of the Six Nations. We shall frequently meet with compound words in which the characters of the original elements are so entirely changed, or so little left of them, that it will require the utmost caution to keep clear of error. It may be better, when such cases occur, not to attempt an analysis, rather than incur the risk of misleading in the matter.

As an example of this tendency to run words together, as well as showing how the possessive of nouns is formed, we have :—

My apple = *Ah-kwa-hih,* which is evidently a compound of the pronoun My = *Ah-kwa-wenh* and Apple = *Ka-hih,* but instead of using the full form *Ah-kwa-wenh* + *Ka-hih,* we have the last syllable of the pronoun and the first of the noun elided, and we get *Ah-kwa-hih.*

So in the second and third persons we have Thy apple = *Sa-hih,* from *Sa-wenh* + *Ka-hih.*

Thy apple	= *Sa-hih*	from	*Sa-wenh* + *Ka-hih.*
His apple	= *Ra-o-hih*	"	*Ra-o-wenh* + *Ka-hih.*
Her apple	= *Ah-ko-hih*	"	*Ah-ko-wenh* + *Ka-hih.*
Her or its apple	= *A-o-hih*	"	*A-o-wenh* + *Ka-hih.*

	Dual.	Plural.
Our apple	Un-kya-hih.	Unkwa-hih.
Your apple	Ja-hih.	Se-wa-hih.
Male—Their apple	Ra-o-na-hih.	Male—Ra-o-na-hih.
Neuter or female—Their apple	A-o-na-hih.	Female or N.—A-o-na-hih.

The rule which may be deduced from the above, with reference to the formation of the possessive case of nouns, I think will be found general. In many cases, however, we shall find that the final syllable of the pronominal part of a compound word, or rather of the possessive, is modified, doubtless for the sake of euphony, and according to certain general rules.

Take any number of words, as Bow = *Ah-en-nah,* Arrow = *Ka-yen-kwi-reh,* Tommahawk = *Ah-do-kenh,* Knife = *Ah-sa-reh,* Shoes = *Ah-dah,* and form their possessive cases, and we shall, I think, find that the same general rule applies to all, *e.g.* :—

My bow	Ah-kwa-en-nah.
Thy bow	Sa-en-nah.
His bow	Ra-o-en-nah.
Her bow	Ah-ko-en-nah.
Her or its bow	A-o-en-nah.

In this example we find that precisely the same rule applies as in the first instance given, and we need go no further than the singular, as the formation of the dual and plural is quite regular. Take the next word, Arrow :—

My arrow	Ah-kyen-kwi-reh.
Thy arrow	Sa-yen-kwi-reh.
His arrow	Ra-o-yen-kwi-reh.
Her arrow	Ah-ko-yen-kwi-reh.
Her or its arrow	A-o-yen-kwi-reh.

Dual.

Our arrow	Un-ke-ni-yen-kwi-reh.
Your arrow	Se-ni-yen-kwi-reh.
Male—Their arrow	Ra-o-di-yen-kwi-reh.
Neuter or female—Their arrow	A-o-di-yen-kwi-reh.

Plural.

Our arrow	Un-kwa-yen-kwi-reh.
Your arrow	Se-wa-yen-kwi-reh.
Male—Their arrow	Ra-o-di-yen-kwi-reh.
Female or neuter—Their arrow	A-o-di-yen-kwi-reh.

Here we have a slight change in the first person singular by the coalescing of the last syllable of the pronominal with the first of the substantive element, and instead of having Ah-*kwa-yen*-kwi-reh, as we should, we get *Ah-kyen-kwi-reh.* We also have a change in the dual, and in all probability this form of the dual is the primary, as far as the two given are concerned, and the more correct form. I think we shall find hereafter, in various forms of the verb, that the *ni* in the first and second persons, and *di* in the third person, is the proper dual element, which we may hereafter be able to trace to *De-ke-nih,* two.

The following are the possessive forms for the remaining three words :—

	Tommahawk.	Knife.	Shoe
My	Ah-kwa-do-kenh	Ah-kwa-sa-reh	Ah-kwah-dah
Thy	Sa-do-kenh	Sa-sa-reh	Sah-dah
His	Ra-o-do-kenh	Ra-o-sa-reh	Ra-oh-dah
Her	Ah-ko-do-kenh	Ah-ko-sa-reh	Ah-koh-dah
Her or its	A-o-do-kenh	A-o-sa-reh	A-oh-dah

The formation of the dual and plural follow throughout the same rules as the first example given.

It will be seen that in the third person plural there is a variation from the English, in there being a distinction made in Mohawk with regard to the gender of the possessor when such possessor is of the human species.

That arises from there being two forms—a masculine and feminine, for the pronoun *their*. Were we speaking of both genders, as a boy or girl, in the expression "their book," we would use the masculine form.

There is no distinction between the nominative and accusative forms.

Reference has already been made to a masculine, feminine, and neuter gender.

We shall find that the masculine and feminine are confined entirely to mankind, and that the initial R seems to be in some way connected, as already mentioned, with the masculine, while with the feminine, K and Y are used, *e.g.* :—

*R*on-kwe	Man.	*Y*on-kwe	Woman.
*R*ih-yen-ah	My son.	*K*he-yen-ah	My daughter.
*R*ax-ah	Boy.	*K*ax-ha	Girl.

We have already pointed out the existence of two forms of the feminine, confined, I believe, to the singular. There is one form applied to those whom we esteem, as to a mother, and there is a general form, which, perhaps, may be more properly regarded as a *common gender*, and it is the form used when speaking of the beasts of the field, and applied without distinction of gender. This form is used when speaking in general terms of the female sex.

The common gender is confined entirely to the brute creation. Where no masculine or feminine exists, as I stated in the formation of the possessive case, whenever we are speaking of both sexes, as man or woman, we use the masculine, dual, or plural form, as the case may be.

There are in nouns, contrary to what we should expect from what we have seen of the pronouns, only two numbers, the singular and the plural, there being no dual.

The formation of the plural is quite simple and uniform, being effected in two ways, according as the word represents an animate or inanimate being. For the former we add to the singular the termination *o-konh*, *e.g.* :—

Ya-ko-sa-tens = Horse	Ya-ko-sa-tens-*o-konh* = Horses.
On-kweh = Mankind	On-kweh-*o-konh*.

For the inanimates we add *o-kon-ah*, *e.g.* :—

Ah-sa-reh = Knife	Ah-sa-reh-*o-kon-ah* = Knives.
Ah-dah = Shoe	Ah-dah-*o-kon-ah* = Shoes.

There are a few exceptions where the animate form is applied to inanimates, and we may be able, after a more extended observation, to point out the rules that govern these exceptions.

With this brief introduction we leave our subject for some future occasion, and shall close by translating one or two words whose signification may interest you.

The name *Oh-nya-ka-ra,* "on or at the neck," is applied to the whole stream of water between Lakes Erie and Ontario, and is derived from *O-nya-ra,* "neck," or *contraction* between head and trunk.

The Mohawks applied this name to the *neck-like* contraction between the two lakes, and hence we have *Niagara.*

In one of the excursions of the Mohawks, they are reported to have found themselves in the Bay of Toronto. Casting their eyes round, they saw as it were, in every direction, trees standing in the water, hence they called the place *Ka-ron-to,* "trees standing in water," from which, doubtless, you get your To*ronto**; while Ontario is supposed to be from *Ken-ta-ri-yoh,* "placid sheet of water."

* For a reconciliation of the two meanings commonly assigned to "Toronto," viz, "Place of Concourse," i e populous region, and "Trees standing out of the water," see pp. 74, 75 of "Toronto of Old." "Toronto" as a local name was first applied to the populous region round the lake now known as Lake Simcoe At p 76 of the work just named will be found the interpretation of "Sen-aga" and "Mo-aga," according to Pownall, Governor of Massachusetts in 1763, an intelligent investigator in such matters.—[Ed. *Canadian Journal.*]

ON THE LEADING GEOLOGICAL AREAS OF CANADA.

BY E. J. CHAPMAN, Ph. D,
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In a recent number of the *Canadian Journal*, an outline was given of a proposed subdivision of the Province of Ontario into certain natural areas. In the present essay, an attempt is made to extend a subdivision of this kind to the entire Dominion, but in the form of an index only, defining the general position of each area, and summarizing in a few words its distinctive characters, without entering, at present, into physical and geological details. That a generalization of this sort, now first attempted, must present many imperfections, can well be understood; but, as the only condensed view, hitherto published, of the leading geological features of the entire country, it may not be altogether unacceptable.*

The Dominion of Canada includes, at present, three western and four eastern Provinces. The western Provinces comprise: Ontario, Manitoba, with the North-West Territory at present attached, and British Columbia. The eastern Provinces include: Quebec, New Brunswick, Nova Scotia, and Prince Edward Island. In the following geological summary, these Provinces will be taken in the above order.

PROVINCE OF ONTARIO.

This Province admits of a subdivision into six natural areas, comprising: (1) The Lower Ottawa District; (2) The Gananoque and Back Townships District; (3) The Lake Ontario District; (4) The Erie and Huron District; (5) The Manitoulin District; and (6), The District of the Upper Lakes.

(1.) *The Lower Ottawa District.*—Comprises a comparatively level area, bounded on the north by the Ottawa River; east by the

* It is proposed to issue this Index, when completed, in a separate form, with the addition of two or three pages of introduction, a list of the works consulted in its compilation, and outline maps of the various Provinces, showing the subdivisions adopted in the text.

Province boundary line between the Ottawa and the St. Lawrence; south by the latter river; and west by a line extending roughly from Brockville to the vicinity of Perth, and from the latter point to the mouth of the Madawaska. Essentially an agricultural region, occupied by Lower Silurian formations (ranging from the Potsdam to the Hudson River series), with overlying Glacial, Post-Glacial, and Recent deposits: the latter represented principally by extensive beds of peat. The average elevation of the district above the sea is from 200 to 300 feet.

(2.) *The Gananoque and Back Townships District.*—Extends along the St. Lawrence, between Brockville and Kingston, and from these points north-westerly to the north shore of Georgian Bay, thus including the back portions of Frontenac, Addington, Hastings, Peterborough, Victoria, and Simcoe. Essentially a mineral region, occupied by Laurentian strata, composed of gneissoid and micaceous rocks, with beds of crystalline limestone, &c. These, as a rule, are much tilted and broken up, producing a rugged and hilly country, with numerous exposures of bare rock. The district contains important deposits of magnetic and specular iron ore, auriferous mispickel, galena, fluor-apatite, marble, &c. Average elevation above the sea, about 800 feet; but many parts of its area exceed 1,000 feet in altitude.

(3.) *The Lake Ontario District.*—Ranges along the entire north and west shores of Lake Ontario, and extends northwards to the crystalline gneissoid area of the Gananoque and Back Townships District—a chain of small lakes marking more or less continuously the junction of the two areas. In the west, it is bounded by the great Niagara escarpment, which extends from the Niagara River to Georgian Bay. It is essentially an agricultural region, occupied by Lower Silurian strata—represented chiefly by the limestones of the Trenton, the bituminous shales of the Utica, and the shaly sandstones of the Hudson River formations—except in its more western limits where the red marls and sandstones of the Medina formation (of the Middle Silurian series) appear. These formations follow each other in ascending order from east to west, but their strata, apart from the slight dip necessary to effect this, are practically undisturbed. The whole district is more or less overlaid, however, by Glacial boulders, clays, and gravels; Post-Glacial sands, and other deposits holding shells of existing fresh-water mollusca; and Recent deposits of shell-marl, &c. The Drift or Glacial gravels form a series of roughly parallel terraces or ridges, running from the Niagara escarpment, or its vicinity, in a general west and east direction. The highest ridge is in places from 700 to 750 feet above Lake Ontario. The latter is 232 feet above the sea.

(4.) *The Erie and Huron District.*—Forms a comparatively elevated table-land, extending from the summit of the Niagara escarpment southwards to the Niagara River and Lake Erie, and westward to Lake Huron. In its central and north-eastern portions it presents an average elevation of from 1,000 to 1,200 feet (higher in places), but slopes gradually to Lake Erie, 565 feet, and to Lake Huron, 578 feet above the sea. Constitutes a very fertile agricultural region, underlaid by Middle and Upper Silurian, and succeeding Devonian formations: the more important comprising the Clifton, Niagara, Guelph, Onondaga, Corniferous, and Hamilton subdivisions. The district is apparently traversed by some flat anticlinals running in a general west and east, or north-east, direction, but its strata are otherwise practically undisturbed. Gypsum deposits occur largely in the Onondaga strata; and brine and petroleum are obtained, by boring, from the Devonian formations. Glacial, Post-Glacial, and Recent accumulations, overlie the district generally.

(5.) *The Manitoulin District.*—Comprises the Great Manitoulin and adjacent series of islands lying off the north shore of Lake Huron. Geologically, it forms a continuation of the Ontario and Erie Districts, being underlaid essentially by Silurian strata, striking nearly due east and west, and following each other in ascending order from north to south. The principal subdivisions comprise the Black River-and-Trenton, Utica, Hudson River, Medina-and-Clinton, Niagara, and Guelph formations. In the Great Manitoulin, the northern portion contains numerous lakes, and the north coast is indented by deep bays, originating, apparently, in anticlinal undulations. The Niagara escarpment, with its steep face towards the north, runs through the entire island; and, southwards, bare outcrops of flat limestone strata extend over many acres. In other places the rocks are mostly covered by Glacial and Post-Glacial deposits, yielding tracts of average fertility.

(6.) *The District of the Upper Lakes.*—This district comprises a vast area of a more or less mountainous character, extending, from the north shores of Lake Huron and Lake Superior, to the boundaries of the Province in the north and west. It is essentially a wooded district, underlaid by hard crystalline rocks, and lying at an average elevation of from 1,000 to 1,500 feet above the sea—Lake Huron being 578 feet, and Lake Superior 600 feet above the sea level. Gneissoid Laurentian strata occupy the greater portion of its area ; but these are overlaid along a large portion of the north shore of Lake Huron, and in other localities (as in the country adjacent to Thunder Bay, &c.) by belts of Huronian slates, semi-crystalline conglomerates, and other metamorphic strata; and intrusive masses of granite and trappean rock appear in many places. A higher series of strata, known provisionally as the "Upper Copper-bearing rocks of Lake Superior," overlie these Huronian and Laurentian formations around Thunder Bay and elsewhere in the Lake Superior region. They consist of an under series, mostly of dark slates, and a higher series of indurated marls and calcereous sandstones, the whole traversed or overlaid by enormous masses of trap, as seen at Thunder Cape, &c. Finally, Glacial boulders, clays, and gravels, and Post-Glacial sands, &c., in many places in the form of high terraces, are distributed over the region generally. The Laurentian rocks of the district appear to be destitute of economic minerals, but the Huronian and higher beds are penetrated by numerous metalliferous veins containing copper-pyrites, native silver, silver glance, galena, and other ores. Beds and veins of hæmatite and magnetic iron ore are also present in the Huronian strata of the region ; and native gold has been found in rocks of the same age in the Lake Shebandowan country. The copper pyrites and zinc blende of the higher strata around Thunder Bay are also more or less auriferous.

PROVINCE OF MANITOBA,

AND

REGION OF THE NORTH-WEST TERRITORY.

The geology of this vast area — extending from the western boundary-line of Ontario (not yet permanently established) to the Rocky Mountains—is only known at present in its broader or more general features, but it appears to indicate a natural subdivision of the region into four leading districts. These comprise :—(1) The Eastern or Laurentian District; (2) The Eastern Prairie or Lake Manitoba District; (3) The Central Prairie District; and (4) The Mountain District.

(1.) *The Eastern or Laurentian District.* — An elevated rocky region, more or less densely wooded: a continuation of the Lake

Superior country, described, under the District of the Upper Lakes, in the geology of Ontario. It includes all the country lying between the boundary-line of Ontario (not yet definitely settled), and the Winnipeg River and Lake, with probably a wider extension of area towards the north-west. It is occupied essentially by Laurentian strata of micaceous and syenitic gneiss, quartzite, &c., with overlying belts, in various places, of micaceous, chloritic, and hornblendic slates, and slaty conglomerates, of Huronian age. These Crystalline strata form the surface in many parts, but in others, and especially on the south-east shore of Lake Winnipeg, they are covered by thick deposits of Glacial and Post-Glacial clays and sands. The average altitude of the district is about 1,200 feet—the ground rising in places to 1,500 or 1,600 feet above the sea, but descending to 710 feet at Lake Winnipeg.

(2.) *The Eastern Prarie, or Lake Manitoba District.*—This subdivision comprises the country immediately west of Lake Winnipeg, Deer Lake, Lake Arthabasca, &c., and the entire area around Lake Manitoba, Lake Winnipegosis and connected series of lakes, with the valley of Red River and the lower courses of the Assiniboine, Swan River, and Saskatchewan. It forms essentially the "First Prairie Steppe" of the north-west, and occupies an elevation of about 750 or 800 feet above the sea, stretching to the base of the second prairie along the line of hilly country defined by the Pembina, Riding, Duck, and Porcupine Mountains and the Basquia Hills. It is underlaid in its more eastern portion (including Fort Garry, the lower course of Red River, the western shores of Lake Winnipeg, Cedar Lake, &c.) by Lower Silurian strata belonging essentially, if not wholly, to the Trenton formation, and consisting chiefly ot dolomitic limestones in horizontal or nearly horizontal beds. The more western and north-western portion (including Lake Manitoba, Dauphin Lake, the west shore of Lake Winnipegosis, Swan Lake, &c.) is underlaid by Devonian strata, consisting most probably of the higher portion of the series. Numerous brine springs, and, here and there, outflows of petroleum, appear to mark the Devonian area generally; but the surface of the district is almost entirely covered by Glacial and Post-Glacial deposits, mostly in the form of stratified marly clays.

(3.) *The Central Prairie District.*—This is essentially a prairie region, but interspersed with patches of woodland, and forming on the whole a rolling and often hilly country. It comprises the second

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and third prairie-steppes, rising in the east, above the line of elevation between Pembina Mountain and the Basquia Hills to an altitude of about 1,600 feet above the sea, and in its more western extension on the third prairie (west of the Grand Coteau, Eagle Hills and Thickwood Hills) to from 2,000 to over 4,000 feet. It encloses many sterile tracts, but over a large portion of its area the soil appears to be of good fertility. Ranging west of the Pembina, Riding, Porcupine, and Basquia Hills, it extends over the vast region traversed by the Qu'Appelle River, the Upper Assiniboine, north and south branches of the Saskatchewan, and the upper course of the Arthabasca, and rises gradually into the eastern slopes of the Rocky Mountains. The eastern section—and probably the greater portion of the entire district—is occupied by Cretaceous strata, consisting mostly of sandstones and shaly clays in generally horizontal beds, overlaid more or less by sands of Glacial or Post-Glacial age; whilst towards the west, but without any strongly-marked lines of demarcation, these Cretaceous strata are succeeded by Cainozoic deposits. The latter consist chiefly of sandy clays, with associated beds of lignite and ironstone. Lignite occurs also in the Cretaceous strata of the district. In many of its beds, as in the Qu'Appelle valley and southwards generally, it presents the usual woody or earthy character, but on the Upper Saskatchewan and elsewhere, much of it is of a comparatively dense compact quality, and closely resembles ordinary bituminous coal.

(4.) *The Mountain District.*—Includes the foot-hills and eastern ranges of the Rocky Mountains, and extends westward to the boundary-line of British Columbia. This eastern portion of the Rocky Mountain chain enters the North-west Territory in the form of several distinct ranges which curve towards the north-west, and appear gradually to intermingle. Southwards, the mountains present an average elevation of about 8,000 feet above the sea, with occasional points of higher altitude; but in their northern extension—as seen in the transverse valley of the Peace River, and elsewhere towards the Arctic Ocean—their altitude becomes greatly diminished. They are composed essentially of dolomites, limestones, and sandstones, apparently of Devonian, or of Devonian and Carboniferous age. Probably, older Palæozoic and more recent formations, will eventually be found amongst them. In some few places their uplifted strata still retain their original horizontality, but as a rule they occur in highly-tilted, broken, and contorted beds, with deeply escarped faces fronting abruptly on the east, and strong westerly dip towards the central part or axis of the chain. Gneissoid rocks and crystalline schists—which make up the main mass of the Rocky Mountains in New Mexico and Colorado, and which occur also immediately west of the chain in British Columbia—appear to be altogether wanting in these eastern ranges. Finally, it may be pointed out, as a characteristic feature of the district, that, along the base and gorges of the mountains, terraced accumulations of gravel and limestone-shingle are seen at varying elevations; and in many cases these shingle terraces or beaches extend along the river-valleys far into the prairie region to the east.

PROVINCE OF BRITISH COLUMBIA.

This Province—extending westward from the boundary-line of the North-West Territories in the Rocky Mountains, to the Pacific coast and outlying islands—admits of a convenient and more or less natural subdivision into four areas. These may be named as follows:—(1) The Eastern Mountain District; (2) The District of the Central Table-land; (3) The Coast and Western Mountain District; and (4) The Island District.

(1.) *The Eastern Mountain District.*—This includes the western ranges of the Rocky Mountains proper, and the adjacent ranges of the Selkirk, Gold, and Cariboo Mountains. Physically, it consists of a number of roughly-parallel chains, running in a general north-west direction, and presenting an average elevation of from 8,000 to 10,000 feet above the sea, with many isolated points of greater altitude. Among the latter, some of the more striking in the main chain include Mount Sabine, Mt. Forbes (13,460 ft.?), Mt. Balfour (14,431 ft.?), Mt. Murchison (16,000 ft.?), Mt. Hooker (15,700 ft.?), and Mt. Brown (15,990 ft.?) Several points in the Selkirk Mountains also exceed 12,000 feet; and glaciers occur in the higher valleys or gorges of both chains. Tilted and contorted strata of limestone and sandstone, apparently for the greater part of Devonian and Carboniferous age, occur on the western as on the eastern slopes of the Rocky Mountains proper, and terraced accumulations of gravel and limestone-shingle are seen at various elevations. The Selkirk, Gold, and Carriboo ranges, which are only separated from the western flanks of the central mountains by comparatively narrow valleys, appear, on the other hand, to consist largely of talcose and micaceous schists. It is through these ranges, therefore, rather than along the line of the "Rocky Mountains" as defined on maps, that the core of the great chain would seem to be continued to the north.

(2.) *The District of the Central Table-Land.*—This district comprises the great plateau which extends from the Selkirk and other mountain ranges, on the east, to the Cascade and Coast Mountains on the west. It lies at an average elevation of from 2,000 to 4,000 feet above the sea, and presents for the greater part a more or less mountainous character. Numerous lakes occur upon its surface and it is traversed by the Columbia, Fraser, and other rivers, flowing mostly in deeply-cut channels or cañons. In many places it is thickly wooded; but gravelly and comparatively sterile tracts prevail over considerable areas, and swamps are also numerous. So far as known at present, its lower rocks appear to consist of granitic, talcose, and micaceous formations (more or less tilted or contorted), succeeded by shales, conglomerates, and limestones of Middle and Upper Palæozoic age, or by more recent strata of alternating sandstones, shales and lignites, with bedded volcanic products (partly of trappean, and partly of scoriaceous lava-like aspect)—the whole overlaid, very generally, by accumulations of sand and gravel. The latter, as seen more especially in the valleys of the Fraser, Thompson, and other rivers, often form sharply-defined terraces or beaches at varying elevations on the flanks of the older rocks. These sands and gravels, especially in the streams which descend from the Cariboo and Gold ranges, and in the valley of the Lower Fraser, are more or less auriferous. The lignite-bearing strata and associated volcanic beds are probably in part Cretaceous, although chiefly of Cainozoic age.

(3.) *The Coast and Western Mountain District.*—This is essentially an alpine region, forming the western margin of the high Table-land, and extending from the latter to the coast-line of the Pacific Ocean. With the exception of some comparatively restricted areas upon the coast, as at the mouth of the Fraser and smaller rivers, it is occupied entirely by the northern ranges, and their spurs, of the Cascade Mountains, which present an average elevation, in this district, of from 5,000 to 7,000 feet above the sea, with perhaps here and there a peak of somewhat higher altitude.* Glaciers occur in many of the higher gorges; and deep fiords, between, in many places, high walls

* Mt. Baker, Mt. Hood, and Mt. Regnier or Rainier, although referred to in many works on Physical Geography as belonging to British Columbia, lie south of the Province boundary-line as now adopted—*i.e.*, the parallel of 49°.

of perpendicular rock, strike far inland from the sea. Very little is known respecting the geology of the district; but the mountain ranges appear to consist largely of granitic or crystalline formations, broken through by volcanic rocks of comparatively recent origin. Outlying patches of intervening Palæozoic strata, and more recent coal-bearing beds, probably occur amongst these, with overlying terraced deposits of sand and gravel, as seen in the Table-Land District on the west.

(4.) *The Island District.*—This subdivision comprises Vancouver Island, Queen Charlotte Islands, and the numerous smaller groups lying between these and along the coast generally. All are essentially of a mountainous character; and the larger islands contain isolated peaks, or are traversed by broken ranges—northern outliers of the "Sea Alps" of California, and thus, undoubtedly, composed in part of volcanic rocks—of comparatively high elevation. In Vancouver Island, amongst other elevated points, the Beaufort Range exceeds 5,000 feet in altitude; and Mt. Arrowsmith is 5,970 feet, Victoria Peak 7,484 feet, Mt. Albert Edward 6,963 feet, and Mt. Alexandra 6,395 feet above the sea. In the Charlotte Islands, the ranges are apparently of nearly equal height. In both of these island groups, however, comparatively level tracks, well adapted for agricultural settlement, occupy extensive areas. The geology of the district, so far as at present known from the Reports of Mr. Richardson of the Canadian Survey, Mr. Bauerman, Dr. Brown, and others, may be briefly summarized as follows: The smaller islands lying more immediately along the coast consist principally of crystalline hornblendic strata, associated with beds of semi-crystalline limestone, and holding in some localities—as on Texada Island, more especially—valuable beds of magnetic iron ore. Rocks of a similar kind occur upon the flanks of the mountain ranges in Vancouver and other islands to the east—these westerly and easterly exposures seeming to form the edges of a long trough, or series of troughs, filled with coal-bearing Cretaceous strata. The semi-crystalline limestones contain in places many imperfectly preserved fossils of Carboniferous or Upper Palæozoic types. The coal-bearing strata consist mostly of alternations of sandstones, conglomerates, and shales (the first greatly predominating), with layers of iron-stone nodules and seams of coal, the latter varying from a few inches to about five or six feet in thickness. These coal strata are characterized by the presence of many well-known Mesozoic types—Ammonites, Belemnites, &c.

Those of the Queen Charlotte Islands to the north, apparently indicate Lower Cretaceous deposits, or beds of passage between Jurassic and Lower Cretaceous formations, whilst the fossils of the coal strata of the Vancouver group are clearly Upper Cretaceous. The coal of the northern islands is more or less anthracitic in character, but that of Vancouver Island is of ordinary bituminous quality, identical in all essential respects with the coals of the Coal Measures proper. These Cretaceous strata are covered very generally by thick deposits of sand and clay, forming high cliffs in many places; and over a large portion of Vancouver Island, the latter deposits are again overlaid by a dark vegetable soil, holding, here and there, layers of marine shells, belonging apparently to existing species. Brine springs occur on one of the islands of the Vancouver group; and the sands of Leech River and other streams have yielded considerable amounts of gold.

NOTE.—As the composition of the iron ore of Texada Island has not hitherto been made known, the following analysis (by the writer) of a sample received from Mr. de Cosmos, M.P., on whose property on the island a large display of the ore occurs, may not be out of place. A description of the exposure will be found at page 99 of the Geological Report for 1873–4.

The ore, as regards the sample analysed, is of a coarse-granular texture, and is strongly magnetic, but shows polarity only in special places. Its specific gravity=4.71: the average weight per cubic foot is thus equal to 293½ lbs; and 6.81 cubic feet (of solid ore) will make a Canadian ton, and 7.63 cubic feet an English ton.

The analysis yielded:—

Protoxide of iron	28.33
Sesquioxide of iron	67.31
Oxide of manganese	tr. only
Titanic acid	0.11
Phosphoric acid	0.07
Sulphuric acid	0 09
Insoluble siliceous matter	3.97

Metallic Iron=69%

Another trial, in which all the iron was calculated from the Fe^2O^3 obtained, (without separation of FeO), gave Fe^2O^3 98.49=Metallic Iron 68.94%.

*** The concluding portion of this article, embracing the Eastern Provinces — Quebec, New Brunswick, Nova Scotia, and Prince Edward Island—will appear in the next issue of the Journal.

ON THE

EARLY GAZETTEER AND MAP LITERATURE OF WESTERN CANADA.

BY HENRY SCADDING, D.D.

All books consisting of descriptions and statistics of new countries become, as a matter of course, speedily obsolete, and are superseded by others which in their turn have to give place to fresh essays of the same class. Even in old countries, in these days, the changes constantly going on are so many, as to require the issue periodically of new accounts. Thus we have a Murray, a Black, a Bradshaw, a Baedeker, putting forth year after year, not merely new editions of their "guides," but those "guides" reconstructed throughout, curtailed here, expanded there, so as to be in accordance with the real situation of affairs. But volumes having reference to the growing colonies of Great Britain, become superannuated in a particularly short space of time, so very rapid is the progress made therein; and in such quick succession come the changes. After all, however, although a person who is seeking for the latest information in regard to a new country, desires, and must have, the latest book on the subject, yet, let only a sufficient number of years pass away, and the books which from time to time had become obsolete, again recover a value, and are gladly resorted to for purposes of comparison or for the verification of partially forgotten facts. To each generation the actual state of things must be that which chiefly absorbs the attention. But society amongst us has been all along in a state of flux; and each person, though still of necessity kept busy by the calls of the moment, cannot help looking back to particular stages of the past with a peculiar interest: to the era, for example, when he himself was first called to take part in the serious battle of life, and to his surroundings then; or it may be, his regards are turned to one remove further—to the time when a father, perhaps, or grandfather commenced a career in the new land and laid a foundation on which his heir has built. In such a case as this, many books which in a certain point of view are entirely out of date, at once regain a value as important helps to the mind in a desired resuscitation of a particular period of the past. Furthermore, in the lapse of time—in the lapse of even a few years—in some instances, a certain pleasant flavour of age is acquired by the language employed in local books; and a volume in itself perhaps of no especial intrinsic merit is, for this reason, sought after and enjoyed.

The first Gazetteer of Upper Canada, compiled soon after the organization of the Province in 1793, attracted my attention a few years since; and, as it is a work which has become scarce, and the contents of which seem likely to interest those who concern themselves about the early history of the country, I thought it would not be unfitting to reproduce it by instalments in the pages of our Canadian Journal, accompanying each part with such annotations as might throw light, where needed, on the origin of the names.

The perusal of this Gazetteer has led me to the consideration of other early topographical sketches of Canada, and other Gazetteers, antecedent or subsequent, having reference to Canada. And I have supposed that a short account of such productions, with brief specimens, would not be uninteresting or out of place.

The earliest Gazetteer that I have seen, embracing accounts of Western Canada, is one published in London, soon after the conquest of Canada in 1759, by G. Robinson, Paternoster Row. Its title is "The North American and the West Indian Gazetteer." It contains accounts of all the British Colonies of North America, none of which in 1759 had revolted. A copy of the second edition of this work, published in 1778, is in my possession. I have seen mentioned an "American Gazetteer, containing an account of all the parts of the New World. 3 vols., 12mo. Maps. 1762," but upon this work I have not been able to lay my hands. I think it was printed on this continent, and not in England.

The North American and West Indian Gazetteer has no notice of the locality on which Toronto is situated, and from which it took its name. But Toronto appears very plainly on the folding map prefixed to the book, and the same name is attached to a lake north of Lake Ontario, and also to the chain of lakes and water communication connected with the Trent and the Bay of Quinté. We do not find even Cataraqui in this Gazetteer—the germ of Kingston—but of Montreal we read as follows:—"It is a well-peopled place, of an oblong form, the streets very open, and the houses well built. The fortifications are pretty strong, being surrounded by a wall, flanked with eleven redoubts, which serve instead of batteries; the ditch is about eight feet deep, and of a proportionable breadth, but dry, encompassing the town, except that part which lies towards the river. It has five gates, one of them very small. It has also a fort or citadel, the batteries of which command the streets of the town from one end to the other; and over the River St. Peter is a bridge." Then follows an account of the monastic institutions, &c.

Our Lake Ontario is thus described:—"A large collection of fresh water, above 270 miles in length from E. to W., and 65 in breadth from N. to S. The fortress of Oswego stands on the southern shore of this lake. It has a small rising and falling of the water, like tides, 12 or 18 inches perpendicular. The snow is deeper on the south side of this lake than any other, and its water does not freeze in the severest winter out of sight of land." (This is all.)

In the article on Canada, the limits of the country are thus given: "The limits of this large country are fixed by an Act of Parliament in 1763 as follows:—The north point, even the head of the river St. John, on the Labrador Coast; its westernmost point, the south end of Lake Nipissing; its southernmost point, the 45th parallel of north latitude, crossing the river St. Lawrence and Lake Champlain; and its easternmost, at Cape Rosiers, in the Gulf of St. Lawrence; including about 800 miles long, and 200 broad; which boundaries, in 1774, were extended southward to the banks of the Ohio; westward to the banks of the Mississippi; and northward to the boundary of the Hudson's Bay Company." Further on still larger limits are assigned; Louisiana is included within them. "Canada, in its largest sense, is divided into Eastern and Western, the former of which is commonly known by the name of Canada, and the latter, which is of later discovery, Louisiana, in honour of the late Louis XIV. * * * The number of the inhabitants in 1763 was 42,000, but since they have increased very considerably. Its trade employs 34 ships and 400 seamen. The exports to Great Britain consisted of skins, furs, ginseng, snakeroot, capillaire, and wheat, all which amounted annually to 105,500, which was nearly the amount of the articles sent from England to them." The article IROQUOIS reads as follows :—"The most considerable and best known of all the Indians, as well as the strongest and most powerful. Their country lies between lat. 41 and 44, and extends 70 or 80 leagues from E. to W., from the source of the river of the Iroquois (ST. LAWRENCE) to that of Richelieu and Sorêl; from the lake of St. Sacrament to the Fall of Niagara; and upwards of 40 leagues from N. to S., viz., from the springhead of the River Agniers to the Ohio, which, together with Pennsylvania, forms the southern boundary. * * * They are divided into several cantons, the five principal of which are the Tsonontonons, Goyogoans, Onnontagues, Ounogoats, and Agniez. These five nations have each a large village, consisting of mean huts, about 30 leagues from one another, mostly seated along the southern coast of Lake Ontario." The Hurons are "savages inhabiting the country contiguous to the lake of the same name in Canada. Their true name is Y-en-dats. The country inhabited by these people at the beginning of the last century, [*e.g.*, 17th], had the Lake Erie to the south, the Lake Huron to the west, and Lake Ontario to the east. It is situated between Lat 42 and 45 N. Here they have a good many cantons or villages, and the whole nation still consists of between 40,000 and 50,000 souls." After speaking of the forests :—"Here are some stones that can be fused into metal, and contain veins of silver. This country is well situated for commerce, whence, by means of the lakes by which it is almost surrounded, it would be an easy matter to push on discoveries even to the extreme parts of North America." A long article is devoted to the Esquimaux, who, in 1759, were in the habit of coming down to lower latitudes than they are wont to do at the present time. They are spoken of with great horror :—"Their name is supposed," the Gazetteer says, "to be originally Esquimantsic, which, in the Albenaquin dialect, signifies eaters of raw flesh, they being almost the only people in those parts that eat it so, though they use also to boil, or dry it in the sun. * * * They hate the Europeans, and are always ready to do them some mischief, so that they will come to the water side, and cut their cables in the night, hoping to see them wrecked upon their coast against the next morning. * * * The Esquimaux are the only natural inhabitants ever seen on the coasts of Newfoundland, who pass thither from the mainland of Labrador, in order to hunt and for the sake of traffic with Europeans. One of their women was brought to England and presented at Court in 1773." [This is in the second edition, dated 1778.] Tadousac, in this Gazetteer, is said to be "a place of great traffic and resort for the wild natives, who bring hither large quantities of furs to exchange for woollen cloths, linen, iron and brass utensils, ribbons and other trinkets. The mouth of the river on which it stands is defended by a fort erected on a rock almost inaccessible."

In 1765, Major Robert Rogers published in London "a Concise Account of North America, containing a description of the several British Colonies on that Continent, &c." Major Rogers' account of the particular locality which we inhabit, is as follows:—"The country on the west and north of the lake (Ontario), down to the River Toronto (Humber), which is about 50 miles, is very good. At the west end (of this lake) a river runs in, from which are carrying-places both to Lake St. Clair and Lake Erie, or to rivers that flow into them. The country upon the lake between St. Lawrence (where the St. Lawrence leaves the lake) is inhabited or owned by the Mississagas, and, by the fair and lofty timber upon it, is a good soil. Here is likewise great plenty of grape vines. By one of the branches of the River Toronto (the Humber) is an easy communication with the rivers flowing into Lake Huron. Upwards of a hundred miles from Toronto, at the north-easterly corner of the lake, the River Cataraqui flows into it: there are likewise several smaller streams between these. From Cataraqui is a carrying-place to the Attawawas River, which joins St. Lawrence near Montreal. This country is also owned by the Mississagas, as far northward as Cataraqui: they likewise claim all the west side of Lake Ontario, and north of Lake Erie, but live a roving unsettled life, literally without any continuing city or abiding habitation, as hath been already remarked of them." Major Rogers further reports that "in the rivers round Lake Ontario are salmon in great plenty during the summer season; and at the entrance of the River St. Lawrence (*i.e.* at Kingston) are, during the winter season, an abundance of a kind of fish called white fish, which seem to be peculiar to this place, there being none such anywhere else in America, excepting some few at Long Point; nor can I learn that any such are to be seen in Europe. In summer they disappear, and are supposed to be during that season in the deep water, out of soundings. They are about the size of shad, and very agreeable to the palate. Here is great plenty of water fowl, and game of all kinds common to the climate. In a word, the country round this lake is pleasant, and apparently fertile, and capable of valuable improvements." The narrative then goes on to say that "the River St. Lawrence takes its leave of Lake Ontario at the north-east corner of it. Near the lake it is ten or twelve miles wide, having several islands on it, on one of which, the most northerly, at the head of the rifts, is a small fortress erected by the French and now kept up by us." The Major uses, we will observe, the good old English word "Rifts" for "Rapids"—or parts of a river where the bed is broken into steps or precipices: this is, in fact, the exact representative of the word *Cataract*, which properly denotes a broken, rocky bed of a river, rather than an abrupt fall of the whole stream.

This Major Rogers was the officer sent up by General Amherst from Montreal, in 1760, to take possession of the French posts in the west, evacuated after the conquest.

In 1799 appeared David William Smith's Topographical Description and Provincial Gazetteer of Upper Canada. Its full title runs as follows:—"A Short Topographical Description of His Majesty's Province of Upper Canada, in North America, to which is annexed a Provincial Gazetteer. London: published by W. Faden, Geographer to His Majesty and to His Royal Highness the Prince of Wales, Charing Cross, 1799. Printed by W. Bulmer and Co., Russell Court, Cleveland Row, St. James'."

It is said in the preface to have been drawn up by "David William Smith, Esq., the very able Surveyor-General of Upper Canada, on the plan of the late Captain Hutchins, for the River Ohio and the countries adjacent."

This work gives briefly the name and situation of all the original townships, towns, counties, and districts of Upper Canada, together with names and situations of all the lakes, bays, islands, and rivers. As being the first record of the kind, it has now acquired, as I have said, a certain historical interest. What I have attempted to do in the republication of this Gazetteer in the Canadian Journal is, to subjoin to the several names such information as may seem needful for elucidation: if a native name, to give, if possible, the interpretation: if a name transferred either from the British Islands or from from France, to point out the place or object bearing that name in the mother-countries of the Colony, or the statesman, nobleman, or prince sought to be complimented or commemorated by this application of his name.

The larger Almanacs or Calendars of former days contain a good deal of information about Canada.

In the Quebec Almanac and British American Royal Calendar for 1819, we have "A brief account of Canada written in 1811." It is there stated that "the largest quantity of wheat ever exported from Canada, was in 1802. It amounted to 1,010,033 bushels. There were besides exported that year, 28,301 barrels of flour and 22,051 cwt. of biscuit. Animal food has generally been furnished in abundance in Lower Canada. * * * The value of the exportations from the St. Lawrence in 1810 has been estimated by mercantile men at 1,200,000 pounds sterling, including disbursements of ships employed in the trade, the number of which was 661, men 6,578, tonnage 143,893, and also the value of 5,896 tons of new ships built in the Province. A considerable proportion of the produce of the United States, and all the furs obtained in the Indian countries, are included in the general amount. The price of labour in the towns," it is added "for four years past may be estimated at four shillings ($\frac{4}{5}$ of a dollar) per day throughout the year, one half of which sum has been paid for board and lodging. Bread has been at about $2\frac{1}{2}$d. per ℔., and beef 5d."

In 1813 there was published at Philadelphia, "A Geographical View of the Province of Upper Canada," by M. Smith. Mr. Smith appears to have been a citizen of the U. S. He dates his preface from Winchester, Connecticut, and he says, "I was induced to this business about three years ago, while in Canada, from a belief that a full and impartial account of the Province would be acceptable and useful to my fellow citizens, as of late years many have been in the habit of moving there. And I also knew that a correct geographical account of the Province of Upper Canada had never been published: whatever had been, was brief and defective. I may add that the mildness of the climate, fertility of the soil, benefit of trade, cheapness of the land, and morals of the inhabitants, so far exceeded my expectations and the apprehensions of the public in general, I deemed it my duty to make known the same. I will also observe, that I have wrote from experimental knowledge, and not merely from what has been suggested by others. Some may imagine, because I write thus, that I have a partiality for the English, but this I solemnly deny. I only describe things in their true characters, with the impartiality of an historian. I began this work before the war. I undertook it with an earnest desire to benefit some, I care not who. If any are benefited I shall be gratified. In short, I write this *pro bono publico*."

He may, perhaps, have thought that his glowing descriptions would whet the appetite of his fellow-citizens for Canada, its conquest by the United States being fully expected. His account of the London District is very inviting. "The district of London," he says, "is certainly much the best part of Canada. It is sufficiently level, very rich, and beautifully variegated with small hills and fertile valleys, through which flow a number of pearly streams of almost the best water in the world. In this district there is a large quantity of natural plains, though not in very large bodies, and not entirely clear of timber. This land has a handsome appearance, and affords fine roads and pasture in summer. Here the farmer has little to do, only to fence his land, and put in the plough, which, indeed, requires a strong team at first, but afterwards may be tilled with one horse. These plains are mostly in the highest part of the ground; are very rich, and well-adapted for wheat and clover. The surface of the earth in this district is almost entirely clear of stone. It is of a sandy quality (especially the plains) which renders it very easy for cultivation. This district is situated in the 41st degree, and 40 minutes of north lat., and is favoured with a temperate climate. The summers are sufficiently long to bring all the crops to perfection, if planted in season. Indeed, there is hardly ever any kind of produce injured by the frost. This is the best part of Canada for wheat, and I believe of any part of the world. From 20 to 35 bushels are commonly gathered from one acre of ground, perfectly sound and clear from smut. Corn thrives exceedingly well, as also all other kinds of grain. Apples, peaches, cherries, and all kinds of fruit common to the United States, flourish very well here. Woodland sells from two to five dollars an acre. The timber of this district consists of almost all kinds common to the U. S. The inhabitants of this district enjoy a greater degree of health than is common to observe in most places, but doubtless there are reasons for this." He enumerates their temperance and moderation, the excellence of the climate, and water and vegetables, and sixthly, he says, "The people of this Canadian paradise are more contented in their situation of life than is common to observe in most places, which also very much preserves the health of man, while a contrary disposition tends to destroy it."

Mr. Smith was in Canada at the beginning of the war. He thus speaks of the capture of Detroit by General Brock:—"The capture of Hull and his army, with the surrender of the fort of Detroit, and all the Michigan territory, were events which the people of Canada could scarcely believe, even after they were known to be true. Indeed, when I saw the officers and soldiers returning to Fort George, with the spoils of my countrymen, I could scarcely believe my own eyes. The most of the people in Canada think that Hull was bribed by the British to give up the fort." Mr. Smith's description of York, our present Toronto, reads as follows:—"This village is laid out after the form of Philadelphia, the streets crossing each other at right angles, though the ground on which it stands is not suitable for building. This, at present, is the seat of Government, and the residence of a number of English gentlemen. It contains some fine buildings, though they stand scattering, among which are a court-house, council-house, a large brick building, in which the King's store for the place is kept, and a meeting-house for Episcopalians, one printing and other offices. This city lies in north latitude 43 degrees and some minutes. The harbour in front of the city is commodious, safe, and beautiful, and is formed after a curious manner. About three miles below or east of the city, there extends out from the main shore, an arm or neck of land about 100 yards wide, nearly in the form of a rainbow, until it connects with the main shore again about a mile above or west of the city, between it and where the fort stands. About 300 yards from the shore, and as many from the fort, there is a channel through this circular island, merely sufficient for the passage of large vessels. This basin, which in the middle is two miles wide, is very deep and without rocks, or any thing of the kind. While the water of the main lake, which is 30 miles wide in this place, is tossed as the waves of the sea, this basin remains smooth. The fort in this place is not strong; but the British began to build a very strong one in the year 1811." Thus far Mr. M. Smith.

In 1815, Joseph Bouchette, Surveyor-General of Lower Canada, and Lieutenant-Colonel Canadian Militia, published his Topographical Description of Lower Canada, with remarks upon Upper Canada, and on the relative connection of both Provinces with the United States of America.

"What is said of the Province of Upper Canada," the author observes, "is the substance of notes and memoranda made in that country very recently, as well as a knowledge obtained of it during an anterior service of six years as an officer of the Provincial Navy, upon the lakes: these have been corroborated and enlarged from other sources of undeniable intelligence and veracity."

An excellent engraved plan of Toronto harbour is given, shewing the singular conformation of the Peninsula, of which more presently.

A plan of Kingston harbour is also given, with the different channels leading to it from the lake.

In 1822, Robert Gourlay published his statistical account of Upper Canada. In consulting this work for statistics and topographical information, the attention is inconveniently drawn aside to other matters—especially to the personal grievances of the author, which, doubtless, were many: and they are set forth at great length. The idea with which he started of collecting statistics from all quarters of the country in the form of replies to a circular, was, of course, quite a natural one; but it was a novelty in the young colony, and offended the susceptibilities of the local authorities, who charged Gourlay with disaffection to the Government. This soon transformed the diligent gatherer of statistics into a violent political agitator. Subsequent topographical writers have gleaned much from the three volumes of Gourlay. The information which they contain is in reality of the date 1818. The maps that accompany the work are excellent; and, as a vignette, on the engraved title-page of each volume is as good a little picture of the Falls of Niagara, seen from the heights on the Canadian side, as any that are in circulation now taken by photography.

In 1831, appeared Bouchette's larger work:—"The British Dominions in North America, or a Topographical and Statistical Description of the Provinces of Lower and Upper Canada, New Brunswick, Nova Scotia, the Islands of Newfoundland, Prince Edward, and Cape Breton." This work consists of two volumes, 4to., with 23 plates of views and plans.

Four chapters are devoted to Upper Canada. Goderich is thus spoken of: "The town is very judiciously planned, and peculiarly well situated, upon the elevated shores of the lake, and on the southern side of the harbour formed by Maitland River. This harbour is capable of affording safe shelter to vessels of 200 tons burden, and is well calculated to admit hereafter of the construction of quays, to facilitate the loading and unloading of produce and merchandise.

The River Maitland affords of itself many important advantages, arising out of the numerous sites it presents for the erection of mills of every description, and likewise for the excellence of the fish with which it abounds. The lake is equally well stored, and yields especially great quantities of sturgeon. The broad expanse of its beautifully transparent waters, whilst it adds to the interest of the locality, and favourably influences the atmospheric changes, affords an advantageous means of forwarding and receiving goods to and from the lower extremities of the Province through the straits, lakes, and canals, by which, in fact, an uninterrupted water communication is opened to the Atlantic Ocean."

The personal appearance of Colonel Bouchette, the author of the work now quoted from, is familiar to most persons from the portrait prefixed to it, which also appeared in the volume of 1815, and has been reproduced in a pamphlet, setting forth the claim of M. Bouchette's heirs to certain sums of money alleged to be due from the Government of Canada.

Bouchette was the first to lay down with accuracy the outlines of the peninsula which formed the harbour of Toronto. In a reduced plan in his 4to. work, we can see how the peninsula was gradually generated. We can see that there has been (1) a constant drift of materials from the east, and (2) a constant tendency in this drift to be turned northwards, and then back again eastwards by the action of southerly and westerly winds. At one period, the inward tendency was so successful as actually to form a connection with the shore, the only interruption in the continuity of the material being the outlet of the Don. Probably at this period the Scarboro' heights extended far out into the lake, and sheltered the sandy embankment which had been formed. After the establishment of this union with the shore, a steady drift from the east still went on, carrying material year after year westward, that material, however, now spreading itself more than before, but still showing a tendency continually to turn in towards the mainland, forming a succession of irregular hooks.

This remarkable wing-shaped breakwater was the *raison d' être* of Toronto. It attracted the eye of the first organizer of Upper Canada, and led him to lay the foundations of the capital of the new province where now it stands. The coolness with which the demolition of this all-important peninsula is beheld by the general public is something amazing. The work of destruction carried steadily forward, now during a series of years, by the relentless surges of Lake Ontario, appears to be regarded simply as a curious spectacle arranged for the entertainment of "the judges, magistrates, and gentry of the province;" for the delectation of the merchant princes, the great manufacturers, the railway directors, the civil engineers, the common council and aldermen of Toronto, who look on, like the chorus in a Greek play, and prattle to each other about some nefarious deed which is being perpetrated before their eyes, but never seem to be aware that common sense points to action of some kind on their part, with a view to the prevention, if possible, of the direful result which is threatened.

In 1832, appeared Dr. Dunlop's Statistical Sketches of Upper Canada. We have here no formal topographical arrangement, but much excellent matter of use for Gazetteer purposes, and abounding with humour. The climate, especially, is graphically described. Field sports, fishing, shooting, and hunting are dwelt upon. Each chapter has a motto, like Sir W. Scott's novels, some of them extemporized.

In 1832, Mr. Andrew Picken published in London (Effingham Wilson, Royal Exchange), a book, entitled "The Canadas," containing information for Emigrants and Capitalists. One division of this book consists of Geographical and Topographical Sketches (1) of Lower and (2) of Upper Canada. We have here virtually a brief Gazetteer of the latter Province, principally confined to an account of the soil, the advantages and disadvantages of position. Mr. Picken derived the materials of his volume chiefly from Mr. Galt, formerly "Chief Commissioner" of the Canada Company. In his dedication to that gentleman, Mr. P. uses the following language: "It is proper that a work of this kind should be inscribed to you, from the services you are known to have rendered to Canadian colonization. Of the extent and value of those services—services which will hereafter connect your name with the history of this interesting colony—it is to be hoped, for your own sake, that the public at home may yet become as fully aware, as the settlers are in those parts of the Province where the effects of them are more particularly felt." Mr. P. gives as the population of York (Toronto), in 1832, between four and five thousand; and of the whole Home District, including the neighbouring District of Newcastle, 36,264 (in 1828).

Effingham Wilson, the publisher of Picken's book in 1832, published in 1833, "Sketches of Canada," by W. L. McKenzie. In this work, which had a political object, there is no systematic topography, but the writer very truly says: "Without giving occasionally, minute sketches of the progress of the new settlements from a state of wilderness to cultivated farms, villages, dwellings, chapels, school-houses, orchards, barn-yards, and fruitful fields, the property of a happy and intelligent population, a correct knowledge of America is unattainable." Accordingly, we have numerous graphic notices, with statistics, of localities in Upper Canada scattered about, amidst articles on public affairs and public institutions, and characteristic anecdotes of public and private personages of the United States and British America.

In 1836, Dr. Thomas Rolph, of Ancaster, Gore District, Upper Canada, published a Statistical Account of Upper Canada, in connection with "Observations made during a visit in the West Indies, and a tour through the United States of America."

In his Preface, Dr. R. says (1836): "The inhabitants of Great Britain have been too apt to consider Canada as merely a region of ice and snow, of pine forests and lakes, of trappers and Indians, with a few forts and villages intermixed, and producing only moccasins, furs, and ship timber. But this is a very imperfect view of that interesting country, which is growing in population, and improving in cultivation more rapidly, perhaps, than any part of the United States, if we except the territory of Michigan, and which must become, at no very distant period, a wealthy, powerful, and populous Province." Dr. R.'s account of Belleville contains some archæological information, such as one would like to see recorded whenever it exists: "The site of the town of Belleville is situated between Kingston and Toronto, on the shore of the Bay of Quinté, originally claimed by the Mississaga Indians as a landing-place, and called by them Saganashcogan, where they usually received their presents from Government, demanding a yearly acknowledgment from its settlers for their possessions. The late J. W. Myers afterwards claimed it under a 99 years' lease, said to have been granted to him by that tribe; hence the creek or river running through the adjacent lot took the name of Myers' Creek, described in a grant to one Singleton, as Singleton's River. Since the town has been laid out, it has assumed the new and more appropriate name of the River Moira. * * *

In the year 1800, the village was laid out by Samuel Wilmot, Esq., King's Surveyor, under the immediate orders and instructions of Government, appropriating lots for a jail and court-house, churches, chapels, and for other public buildings; granting to individuals who had made improvements, the several lots they occupied. The main streets are 66 feet wide, called Front, Pinnacle, Park, and Rear Streets, intersected by cross streets of the same width."

Dr. Rolph speaks of the Township of Madoc and its mineral wealth: "The ore to be smelted is the magnetic oxide, and will produce about 70 per cent. of iron. This extensive and valuable bed of ore is on lot No. 11, of the 5th Concession, and was bought of the Canada Company, who, with a liberality rarely to be met with, have sold it to the present owners, at an advance beyond the ordinary price of lands in the neighbourhood, on condition only that they should improve it. This township contains other valuable minerals, such as beds of fine marble, zinc, lead, and probably copper, which might be worked to great profit. These, added to as fine a soil as the world produces, pure and abundant streams of water, fine timber, and a healthy country, all conspire to render Madoc, at this time, as desirable a location for the farmer, the capitalist, and the man of science, as any in the Province."

Peterborough is thus described: "This village stands on a fine elevated sandy plain, and in a very central situation in the District; it is divided by the River Otonabee, and is immediately adjoining and above the small lake. It commenced in 1825, under the superintendence of the Hon. Peter Robinson, who lived with a large body of Irish emigrants for some time. It is beautifully wooded with choice trees. A very good and substantial frame bridge has been erected across the Otonabee at this place. It contains a population of 1,000 persons, and continues still improving, &c., &c." He dwells on the importance of this situation, on the water communication between Lake Simcoe and the Bay of Quinté.

In Fothergill's Almanac of 1839, and in preceding issues of the same periodical, we have a "Sketch of the present state of Canada, drawn up expressly for this work by Charles Fothergill, Esq." I extract a sentence giving statistics of Upper Canada in 1839: "The settled parts of Upper Canada contain 500,000 souls. The largest towns are Toronto and Kingston, of which Toronto is the most populous, containing 12,500 inhabitants (1839)."

The following will give an idea of the facilities for travelling in 1839: "The navigation from Quebec to Buffalo, with all the present interruptions, may be performed in a week; and from thence to the River St. Clair, either to Detroit, or Sandwich, in three days. From thence into the Lakes Huron, Michigan, and Superior, the impediments are few and trifling. From the Island of Anticosti, at the mouth of the St. Lawrence, to the head of Lake Superior, we have a navigation of an extent little less than 3,000 miles, the greater part of which is ship navigation, and may be run over, with all the present obstacles, during the summer months, at the rate of about 80 miles per day; and that through the greatest extent of fertile country to be found, in continuity, in any part of the world, and a climate highly favourable to agricultural labour."

Though the present railway system, at least of the Grand Trunk, had not yet been thought of, a railroad is, nevertheless, projected. We have it mentioned at the close of some unavailing, but curious, lamentations over the cession of Michigan to the United States in by-gone times:—"Ever since the emigration from the Eastern to the Western States of the Union by the route of Lake Erie, the Canadians have been constantly twitted by tourists and others with the contrast of superiority exhibited on the Detroit frontier over that of our own opposite to it, forgetting that it could not have been otherwise, since we were fools enough to cede the Michigan territory to our rivals, and not only give them the *landing-place*, but the *grand portage* itself, to boundless regions. Having committed this incalculably mad and egregious error, could we wonder that the shores of our beautiful little peninsula, directly *in view*, but *out of the line*, remained commercially desolate. All that the magnificent undertaking of the WELLAND CANAL has done, or all that it ever can do, will not make amends to the Western and London Districts for the great loss sustained in the cession of Michigan, since it can merely transfer the shipping from one lake into the other. But there is a measure which would go far to recompense the evil that has been inflicted. It has been much talked of; but, as yet, little has been done in it. We mean the Lake Huron Railroad from Toronto. There will be no end to the advantages arising from this national work, if it is undertaken on the scale and in the spirit in which such public works should be undertaken. Enterprising merchants at Oswego have long regarded this great measure as one of superlative importance."

In 1846, Mr. Wm. Henry Smith published at Toronto, his "Canadian Gazetteer," comprising statistical and general information respecting all parts of the Upper Province or Canada West, &c.

To collect the materials of his work, Mr. Smith travelled about, personally visiting the parts described, "walking," he says in his preface, "over more than 3,000 miles of ground, through both the heats of summer and the snows of winter." He gives a brief but careful record of the population of each town, township, and village, the value of the ratable property, the leading features of each locality as regards soil and climate, and the average value of land.

About four years after the appearance of the Gazetteer, Mr. Smith published his more elaborate work, entitled "Canada, Past, Present, and Future, being a Historical, Geographical, Geological, and Statistical Account of Canada West." Again did our author make a perambulation of the country, and gather in a copious store of useful information. Again, in his preface, Mr. S. alludes to the toils undergone: "The journey through a new country in search of statistical information is not, by any means, a path of roses," he says. "And to arrive at the necessary amount of facts within a given time, requires a constant exertion of both body and mind, and a resolution to encounter and to conquer all those various accidents by flood and field that travellers are heirs to—drenching showers, snow storms, mud holes, dust, broiling sun, thunder storms, tough beef steaks, damp beds, loss of luggage, and breakages."

Mr. Smith's greater work contains ten County Maps, and one General Map of Canada West, clearly drawn in outline on stone. Three introductory chapters contain a carefully-compiled history of the discovery and early settlement of Canada, and a special notice of the population, resources, trade, and commerce of Upper Canada. And at the end of the work, after a seriatim description of the counties and towns, there is a general account of the natural productions of the country, animate and inanimate, animal, vegetable, and mineral; and of its climate.

A few years after the publication of Mr. Smith's Canada, Past, Present, and Future, viz., in 1871, Mr. Lovell's Dominion Directory appeared, which virtually was also a Gazetteer, with admirable sketches of the villages, towns, and cities; and an abundance of introductory matter, containing a general history of the country, and of its progress. This volume is very bulky—a royal 8vo. of over

2,500 pages. The publisher humorously styles it, on the outer cover, in gold letters, a "Pocket Gazetteer of Canada."

In 1873, appeared Lovell's Gazetteer of British North America, containing the latest and most authentic descriptions of 6,000 cities, towns, and villages; 1,500 lakes and rivers, with tables of routes. Edited by P. A. Crossby. All this being accomplished in a small 8vo. volume of less than 600 pages, the space allotted to each locality is small, and the information very much condensed. It is, nevertheless, minute and satisfactory. The statistics have been gathered with great care.

In the introduction the proposed Canadian Pacific Railway is thus referred to: "Heretofore Canada has been to the traveller little better than a *cul de sac*, as he could only journey as far as the extremity of Lake Superior; but when the entire Dominion can be traversed from the Atlantic to the Pacific, he will be enabled with ease to take a rapid survey of these wide spreading dominions belonging to the British Crown, and measure their political and commercial importance. He will then become convinced that the Dominion is rich in coal measures, slate quarries, gold, silver, copper, iron, and almost every mineral of commercial value; that the climate is favourable to health, and that there are millions of acres of grain-raising and pasture lands awaiting colonization in the fertile belt of the North-West and British Columbia."

The following are given as the limits of the Dominion: "It is bounded east by the Atlantic Ocean, Davis Strait, and Baffin's Bay; west, by Alaska, the Pacific Ocean, and Queen Charlotte's Sound; north, by the Arctic Ocean; and south, south-east, and south-west, by the United States. Area, 3,330,162 square miles, 393,996 square miles larger than the United States. Of this immense area, nearly equalling in extent the Continent of Europe, about 700,000 square miles are covered with water."

With this notice of the latest Gazetteer of Canada, I draw this part of my paper to a close. The great handiness of Mr. Lovell's volume is surprising, when the breadth of area which it covers is considered, and the mass of information which it contains.

The occasion of the present rapid notice of early topographical Sketches and Gazetteers of Canada, particularly Western Canada, was, as I have already said, the republication in the Canadian Journal of the first Gazetteer of Upper Canada, published in 1797, by David William Smith. In each successive instalment of that work in the Journal, I have added annotations, explanatory of the names attached to the several localities, thinking that it would be a matter of some interest to intelligent persons to be acquainted with the source of the appellation by which their neighbourhood or their own place of abode, was generally known, which appellation is occasionally, in some sense and degree attached to themselves also.

The Gazetteer of 1797 is, of course, a book of moderate size, and the list of names to be remarked upon, not extensive. To annotate in a similar way, the whole of a modern Gazetteer would be a different thing; yet an addition of the kind referred to, would, doubtless, be an enhancement to the value of the work in an historical point of view. For many years to come in Canada, there will be new areas to be surveyed and set off into townships, and new local names to be found and applied. Wherever it is possible to make use of the aboriginal Indian names, it is plainly in good taste to retain them. Uncouthness of form and sound may be frequently got rid of by certain modifications, in accordance with principles of euphony and structure obtaining in the English language. It is in this way, that Niagara, Acadia, Canada itself, and many other beautiful proper names, have acquired their present form. Algoma, Muskoka, Manitoba, are other more recent instances. Spadina, here in Toronto—and the word Toronto itself, may be also mentioned. The retention of the old French names, attached to former distant outposts of traffic, &c., is to be commended. But a favourite method of designating newly surveyed townships, adopted in the Crown Lands Department of late years, as in the past too, is the application thereto of the names of ministers, or ex-ministers, of the Crown, Judges, Chancellors, Civil Engineers, and other public characters of the country. It has become, indeed, a kind of perquisite of high office for the holder to have his name inscribed on the map as the designation in all future time of a township, village, or county. To the articles in Gazetteers from time to time hereafter, it will be of use to add brief annotations on such names. We may all know very well who Mr. Malcolm Cameron, for example, was; but the inhabitants of the areas distinguished by his name will, perhaps, not be so fortunate, and they may be desirous of indulging a not unnatural curiosity on the point.

MAP LITERATURE OF CANADA.

In 1872, there was published in Paris by Tross, a well-known bookseller, a work entitled "Notes Subsidiary to the History, Bibliography, and Cartography of New France, and adjoining countries from 1545 to 1700." The compiler was the author of the *Bibliotheca Americana Vetustissima*, Mr. Harisse, if I mistake not. The division of the book, embracing Cartography, contains a description of (1) 76 inedited, and (2) 111 engraved maps, or plans. Most of the inedited maps, &c., are among the public archives of France. Some of the most important of them have been copied for the Canadian Government, and the Canadian Institute at Toronto possesses tracings from portions of six of them: (1) Of a map of 1643 of Nouvelle France, in which Lake Erie is scarcely distinguishable. (2) Of a map of 1670, shewing the route of the French Missionaries Dollier and Galinée. (In this map, the spectator is supposed to be standing on the north side of the great lakes, and to be looking south. Hence, at first sight, the map has the appearance of being upside down. Fort Frontenac is not yet established. Quinté is spelt Kenté). (3) Of Joliet's map (about the same date as the preceding), on which Lake Ontario figures as Lake Frontenac. (It bears an address from Joliet to the Comte de Frontenac). (4) Of a map of 1688, in which the Bay of Quinté is called Lac St. Lion. (This map also looks upside down. No Fort Frontenac is marked). (5) Of a map subsequent to the erection of Fort Frontenac. (Lake Erie is here called Teiocharontiong). (6) Of a map of the Saguenay country, by the Jesuit Laure (1731). It is dedicated to the Dauphin. Among the engraved maps in Tross' catalogue are included several published in Italy, Holland, and England. One dated in 1680—a general map of North America—is described, and dedicated to Charles II. The maps given by Hennepin and Lahontan, in their respective books, are also included.

The list in the above-mentioned work gives no maps dated subsequently to 1700. I do not observe in this list the maps figured in Ramnusio's Collection of Voyages and Travels, printed in Venice in 1556, which must have been copied from even older maps. I place on the table the volume of Ramnusio, which has the maps of the New World, and of New France, and the one that shews the plan of the aboriginal Hochelaga, or Montreal of the time of Jacques Cartier.

The rude primitive sketches from which these delineations were made, were derived in great measure from the verbal reports of the natives, whose own knowledge of the interior of the continent, in any comprehensive sense, was vague, and whose language and gestures would often, of course, be greatly misapprehended. With the map in Ramnusio of "New France, Newfoundland, Island of Demons, &c.," may be compared Janssonius' Amsterdam map, entitled "Novi Belgii Novæque Angliæ necnon Partis Virginiæ Tabula," wherein the waters of the St. Lawrence and the Ottawa are seen curiously connected together far back in the interior of the country, doubtless as reported by the natives and coureurs-de-bois.*

I shew a General Map of North America of the year 1762, by John Rocque, Topographer to the King. On it are delineated "the new roads, forts, and engagements, taken from actual surveys and operations made in the army employed there from 1754 to 1761." On this map Toronto is marked, and the word is spelt exactly as we spell it. On this map are several curious memoranda of concessions of territory on the north side of the lakes, by the Iroquois of the south side, to the British authority. Also, a map engraved by T. Bowen, in Benjamin Martin's "Miscellaneous Correspondence" for the years 1755-56, published in London in 1759, evidently derived from the same sources as Rocque's map. The "bounds of Hudson's Bay by the treaty of Utrecht" are marked,

* Generally, in these primitive maps, the lakes and rivers partially explored by the European, are made to appear of exaggerated dimensions, while the parts known only as yet from hearsay, are comparatively dwarfed and distorted Hence Lahontan's famous map of the Rivière Longue is by no means to be summarily rejected It was maps of this kind that Cluverius had before him in 1629, when compiling his "Introductio ad Universam Geographiam" Cluverius' notice of Canada is as follows:—"Canada à fluvio cognomine dicta, insula an pars continentis. parum adhuc constat Quantum ejus cognitum est, dividitur in Estotilandiam, Corterealem, Terram Laboratoris et insulas adjacentes, ingentis magnitudinis: quarum præcipuæ, Golesme, Beauparis, Mont de Lions, et Terra Nova, eadem et Terra de Baccalaos dicta, ob ingentem hujusmodi piscium in ejus pelago multitudinem, qui etiam naves transeuntes retardant" The sailor's hyperbole, here given as a grave fact, throws light on the origin of many historical marvels. The soil, climate, productions, and inhabitants of Canada and New France are thus described:—"Solum Canadæ quantumvis accerrimis frigoribus obnoxium, eximie tamen fertile, aurique metallis dives; incolæ satis ingeniosi et artium mechanicarum peritissimi, pellibus amicti degunt: ceterum Galliarum regis imperio subjecti. Nova Francia (this is distinguished from Canada) à Gallis Regis Francisci primi auspiciis detecta, præter raras segetes et legumina quædam, omnium rerum inops, ā feris ac quibusdam in locis anthropophagis, in universum idolatricis gentibus incolitur. Pars tamen ejus, quæ ad mare accedit Norimbega ab urbe cognomine dicta, cœlo potitur salubri soloque fœcundo." Norembega appears to have denoted the New England region; and the name has been thought by some to have come from a vague local reminiscence of the Norwegian origin of settlements on the coast in that direction.

and the "Northern bounds of New England by Charter of Nov. 3rd, 1620, which extend westward to the South Sea."

A fine inedited MS. map of the Province of Quebec, as well as of all known Canada at the time, on a large scale, by Major S. Holland, is preserved in the Crown Lands Department at Toronto. A reproduction of this document in facsimile would be an acceptable boon.

David W. Smith's Gazetteer was drawn up to accompany a map of Upper Canada, published by authority in London in 1799, by W. Faden, Geographer to the King and Prince of Wales. This was the first engraved map of Upper Canada. The second edition of this Gazetteer was put forth to accompany another map of Upper Canada, published in London by the same Faden in 1813. The publication of the second edition was superintended by Governor Gore, who was in London at the time.

Bouchette's map, published in 1815, accompanied by his first work, "A Topographical Description, &c.," was one of Lower Canada only. But his map published in 1831, to which his quarto was a companion, was one of both Provinces; and of this, which is a splendid work of art, a copy lies on the table. This may be regarded as the standard map up to the year 1852, when Col. Bouchette's son, Joseph Bouchette, the Second Deputy Surveyor-General, published a large general map of all the British Provinces, according to the Treaties of 1842 and 1846. This map exhibits workmanship of the first-class, and was executed in London. In 1862, Tremaine's large map of Western Canada appeared, and in the same year its rival, Tackabury's map; both exhibiting clearly and beautifully, all the new surveys, &c. These were both most creditable Canadian productions.

The British Admiralty also put forth, many years ago, a series of charts for the navigation of the lakes, constructed by Admiral H. W. Bayfield. Many elaborate maps, too, have appeared in connection with the Geological Survey of Canada. And there have been separate maps executed of the several counties of Western Canada by Mr. Rankin and others, and engraved by Ellis and Rolph, of Toronto.

Two official reports presented to the Ontario Parliament in 1872 and 1873 respectively, have furnished those who are interested in early Canadian maps, with reproductions of several valuable documents not easily accessible before.

1. Mr. Mills' Report on the Boundaries of the Province of Ontario, has attached to it copies of the following:—(1). John Senex's Map,

A. D. 1710; (2). Map of North America, by William Delisle, Amsterdam, A. D. 1739; (3). Jeffery's Map of the north part of North America, A. D. 1762; (4). Peter Bell's Map of the British Dominions in North America according to the Treaty of 1763, A.D. 1772; (5). D'Anville's Map of North America, A. D. 1775; (6). Governor Pownall's Map of North America, A. D. 1776; (7). Kitchen's Map of North America, shewing the boundaries of Canada after the Treaty of 1783, A.D. 1794; (8). Map of North America, shewing the territories claimed by France in 1756, with the French forts marked; (9). Map of the boundary line between the Northern Colonies and the Indians, established by the Treaty of Fort Stanwix, 1768; (10). Map of the French Settlements in Illinois, by Thomas Hutchins, Captain, 60th Regiment.

2. Mr. Chas. Lindsey's "Investigation of the Unsettled Boundaries of Ontario, presented to Parliament in 1873," supplies us with copies of (1) Carte des nouvelles découvertes dans l'Ouest du Canada dressée sur les memoires de M. de la Vélandrie et donnée au Dépôt de la Marine, par M. de la Galissonière, 1749. (2) Carte du Canada ou de la Nouvelle France, &c., par Guillaume Delisle, 1703. (3) A new Map of North America, by H. Moll, 1708.

The year 1875 will mark an era in the Cartography of Canada, as it was in that year that our map literature culminated in two complete Canadian Atlases, each containing maps in minute detail of all the Provinces of the Dominion.

(1.) The Atlas compiled and edited by Mr. H. F. Walling, executed chiefly in lithography by able artists at Montreal and Toronto, and published by Mr. G. N. Tackabury. There are contained within this Atlas one hundred and thirty maps, or plans, including maps of Europe, and the United States of North America. The shape of the book is the large square folio which is customary with Atlases on a considerable scale. The delineation, shading, and lettering of the several plates are perspicuous, and generally agreeable to the eye; but here and there the colouring would be more pleasing, had it been more delicate. In some of the plates the fine division lines between the 200 acre lots have been somewhat indistinctly printed. The maps of the Parry Sound and Muskoka Districts are fine specimens of workmanship, the labyrinthine intricacies of the coast-lines, and the innumerable minute islands being particularly well represented. The map of British Columbia shews, in a striking manner, the mountainous character of that region, and the curious way in which its western coast is penetrated and zigzagged through with fiords. Preceding the Atlas proper, are 97 pages, of three columns each, occupied with carefully written essays on subjects proper to be discussed in such a work. Dr. H. H. Miles, of Lennoxville, gives a résumé of the Civil History of the Dominion. Dr. Sterry Hunt treats of its Topography and Physical Geography. The Geology of Upper and Lower Canada has been undertaken by Mr. Robert Bell, that of the other Provinces by other equally competent hands. Drs. Nicholson and Ellis contribute an interesting chapter on our Zoology. Dr. Canniff gives a lucid history of Steam Navigation in Canada. Dr. Hodgins has described our system of Public Education. Our Railways are discussed at great length, and our Climatology is not overlooked.

(2.) Walker and Miles' New Standard Atlas of the Dominion of Canada. This is a folio volume, 14 × 18 inches in size. It contains elaborately constructed and beautifully executed maps of the Provinces of Ontario, Quebec, New Brunswick, Nova Scotia, Newfoundland, Prince Edward Island, Manitoba, and British Columbia, on a large scale; maps of the Coal Regions, the Lumber Districts, and Timber Lands, and the Military Defences; a chart of the world, shewing the relative positions of the Dominion, and the other British Possessions, and the Ocean Steamships' connections on both sides of the Continent with the Railway systems of Canada. Preceding the maps are fifty 3-column pages of printed matter, giving briefly the most recent statistical information in regard to all the Provinces of the Dominion, their Railways, their Post Offices, their Banks, their Geology and Mineral productions, with lists, and descriptions of the cities and chief towns. On the title-page is a well-executed shield, combining the arms of the Provinces of Ontario, Quebec, New Brunswick, Nova Scotia, and British Columbia. The whole work is dedicated, by permission, to the Earl of Dufferin.

A remarkable lithograph Railway Map of the Province of Ontario was published at Toronto in 1876, at the office of the *Nation* newspaper. By means of heavy black tracings it shewed the railways in existence and the railways in prospect. It was intended to be, to the public eye, a kind of *reductio ad absurdum* of the multitudinous schemes for new lines of railway which were being perpetually started, irrespective of the actual necessities of the population, and which the Government was asked to subsidize.

LIST OF PLANTS

COLLECTED IN THE VICINITY OF THE TOWN OF BARRIE.

BY H. B. SPOTTON, M.A.

RANUNCULACEÆ.

Hepatica acutiloba, D. C.
Thalictrum dioicum, L.
" cornuti, L.
Ranunculus abortivus L.
" sceleratus, L.
" recurvatus, Poir.
" Pennsylvanicus, L.
" bulbosus, L.
" acris, L.
Caltha palustris, L.
Coptis trifolia, Salisb.
Aquilegia Canadensis, L.
Actæa spicata, L., var. rubra, Mx.
" alba, Bigel.

MENISPERMACEÆ.

Menispermum Canadense, L.

BERBERIDACEÆ.

Caulophyllum thalictroides, Mx.
Podophyllum peltatum, L.

NYMPHÆACEÆ.

Brasenia peltata, Pursh.
Nymphæa tuberosa, Paine.
Nuphar advena, Ait.

SARRACENIACEÆ.

Sarracenia purpurea, L.

PAPAVERACEÆ.

Chelidonium *majus*, L.
Sanguinaria Canadensis, L.

FUMARIACEÆ.

Dicentra cucullaria, D. C.
" Canadensis, D. C.
Corydalis glauca, Pursh.
" aurea, Willd.

CRUCIFERÆ.

Nasturtium *officinale*, R. Br.
" palustre, D. C.

CRUCIFERÆ—*Continued.*

Dentaria diphylla, L.
Cardamine pratensis, L.
Sisymbrium *officinale*, Scop.
Brassica *Sinapistrum*, Boissier.
Capsella *Bursa-pastoris*, Mœcnh.

VIOLACEÆ.

Viola blanda, Willd.
" Selkirkii, Ph. Goldie.
" cucullata, Ait.
" canina, L., var. sylvestris, Regel.
" rostrata, Pursh.
" Canadensis, L.
" pubescens, Ait.

CISTACEÆ.

Lechea minor, Lam.

HYPERICACEÆ.

Hypericum pyramidatum, Ait.
" *perforatum*, L.
" corymbosum, Muhl.
Elodes Virginica, Nutt.

CARYOPHYLLACEÆ.

Saponaria *officinalis*, L.
Silene *noctiflora*, L.
Lychnis *Githago*, Lam.
Stellaria *media*, Smith.
Cerastium *vulgatum*, L.

PORTULACACEÆ.

Portulaca *oleracea*, L.
Claytonia Virginica, L.

MALVACEÆ.

Malva *rotundifolia*, L.
" *moschata*, L.

TILIACEÆ.

Tilia Americana, L.

LINACEÆ.

Linum *usitatissimum*, L.

GERANIACEÆ.

Geranium Carolinianum, L.
" Robertianum, L.
Impatiens fulva, Nutt.
Oxalis acetosella, L.

ANACARDIACEÆ.

Rhus typhina, L.
" toxicodendron, L.

VITACEÆ.

Vitis cordifolia, Mx.

RHAMNACEÆ.

Rhamnus alnifolius, L'Her.

SAPINDACEÆ.

Acer spicatum, Lam.
" saccharinum, Wang.
" dasycarpum, Ehr.
" rubrum, L.

POLYGALACEÆ.

Polygala paucifolia, Willd.

LEGUMINOSÆ

Trifolium *pratense*, L.
" repens, L.
Medicago *Lupulina*, L.
Desmodium acuminatum, D. C.
Lathyrus palustris, L., var. myrtifolius, Muhl.
Apios tuberosa, Mœnch.

ROSACEÆ.

Prunus Americana, Marshall.
" Virginiana, L.
" serotina, Ehrhart.
Spiræa salicifolia, L.
Agrimonia Eupatoria, L.
Geum strictum, Ait.
" rivale, L.
Waldsteinia fragarioides, Tratt.
Potentilla Norvegica, L.
" anserina, L.
" palustris, Scop.
Fragaria Virginiana, Ehrhart.
Dalibarda repens, L.
Rubus odoratus, L.
" triflorus, Richardson.
" strigosus, Mx.
Rubus occidentalis, L.
" villosus, Ait.
Rosa *rubiginosa*, L.
Cratægus coccinea, L.
Pyrus arbutifolia, L., var. erythrocarpa.

SAXIFRAGACEÆ.

Ribes cynosbati, L.
" floridum, L.
" rubrum, L.
Parnassia Caroliniana, Mx.
Mitella diphylla, L.
" nuda, L.
Tiarella cordifolia, L.
Chrysoplenium Americanum, Schwein.

CRASSULACEÆ.

Penthorum sedoides, L.

ONAGRACEÆ.

Circæa Lutetiana, L.
" alpina, L.
Epilobium angustifolium, L.
" palustre, L., var. lineare.
" coloratum.
Œnothera biennis, L.
Ludwigia palustris, Ell.

LYTHRACEÆ.

Nesæa verticillata, H. B. K.

UMBELLIFERÆ.

Sanicula Canadensis, L.
Cicuta maculata, L.
" bulbifera, L.
Sium lineare, Mx.
Cryptotænia, Canadensis, D. C.
Osmorrhiza brevistylis, D. C.

ARALIACEÆ.

Aralia racemosa, L.
" nudicaulis, L.
" trifolia, Gray.

CORNACEÆ.

Cornus Canadensis, L.
" stolonifera, Mx.
" alternifolia, L.

CAPRIFOLIACEÆ.

Linnæa borealis, Gronov.
Lonicera parviflora, Lam.
" ciliata, Muhl.
" oblongifolia, Muhl.
Diervilla trifida, Mœnch.
Triosteum perfoliatum, L.
Sambucus Canadensis, L.
" pubens, Mx.
Viburnum Lentago, L.
" acerifolium, L.
" lantanoides, Mx.

RUBIACEÆ.

Galium triflorum, Mx.
" circæzans, Mx.

RUBIACEÆ—*Continued.*

Galium boreale, L.
Cephalanthus occidentalis, L.
Mitchella repens, L.
Houstonia purpurea, L., var. longifolia.

VALERIANACEÆ.

Valeriana sylvatica, Richards.

COMPOSITÆ.

Eupatorium purpureum, L.
" perfoliatum, L.
" ageratoides, L.
Aster corymbosus, Ait.
" macrophyllus, L.
" Tradescanti, L.
" Novi-Belgii, L.
" puniceus, L.
Erigeron Canadense, L.
" bellidifolium, Muhl.
" Philadelphicum, L.
" strigosum, Muhl.
Solidago, Canadensis, bicolor, L.
Inula *Helenium*, L.
Rudbeckia laciniata, L.
" hirta, L.
Bidens connata, Muhl.
" chrysanthemoides, Mx.
Achillea millefolium, L.
Leucanthemum *vulgare*, Lam.
Tanacetum *vulgare*, L.
Artemisia *absinthium*, L.
Gnaphalium decurrens, Ives.
" polycephalum, Mx.
Erichthites hieracifolia, Raf.
Senecio *vulgaris*, L.
Centaurea *cyanus*, L.
Cirsium lanceolatum, Scop.
" muticum, Mx.
" *arvense*, Scop.
Lappa *officinalis*, Allioni.
Nabalus albus, Hook.
Taraxacum, dens-leonis, Desf.

LOBELIACEÆ.

Lobelia cardinalis, L.
" syphilitica, L.
" inflata, L.

CAMPANULACEÆ.

Campanula aparinoides, Tursh.

ERICACEÆ.

Gaylussacia resinosa, Torr. and Gr.
Vaccinium oxycoccus, L.
Epigæa repens, L.
Gaultheria procumbens, L.
Cassandra calyculata, Don.

ERICACEÆ—*Continued.*

Andromeda polifolia, L.
Kalmia glauca, Ait.
Ledum latifolium, Ait.
Pyrola rotundifolia, L.
" secunda, L.
Moneses uniflora, Gray.
Chimaphila umbellata, Nutt.
Monotropa uniflora, L.

PLANTAGINACEÆ.

Plantago *major*, L.
" *lanceolata*, L.

PRIMULACEÆ.

Trientalis Americana, Pursh.
Lysimachia thyrsiflora, L.
" stricta, Ait.
" ciliata, L.

LENTIBULACEÆ.

Utricularia vulgaris, L.

OROBANCHACEÆ.

Epiphegus Virginiana, Bart.

SCROPHULARIACEÆ.

Verbascum *Thapsus*, L.
Linaria, *vulgaris*, Mill.
Chelone glabra, L.
Mimulus ringens, L.
Veronica Americana, Schw.
" serpyllifolia, L.
Pedicularis Canadensis, L.

VERBENACEÆ.

Verbena hastata, L.
" urticifolia, L.
Phryma leptostachya, L.

LABIATÆ.

Mentha Canadensis, L.
Lycopus Virginicus, L.
Calamintha clinopodium, Benth.
Monarda fistulosa, L.
Nepeta *cataria*, L.
Brunella vulgaris, L.
Scutellaria galericulata, L.
" lateriflora, L.
Marrubium *vulgare*, L.
Leonurus *cardiaca*, L.

BORRAGINACEÆ.

Echium *vulgare*, L.
Echinospermum *Lappula*, Lehm.
Cynoglossum *officinale*, L.
" Morisoni, D. C.

HYDROPHYLLACEÆ.

Hydrophyllum Virginicum, L.

CONVOLVULACEÆ.

Calystegia sepium, R. Br.
" spithamæa, Pursh.

SOLANACEÆ.

Solanum *dulcamara*, L.
" *nigrum*, L.
Datura *stramonium*, L.

GENTIANACEÆ.

Gentiana crinita, Froel.
" Andrewsii, Gris.
Menyanthes trifoliata, L.

APOCYNACEÆ.

Apocynum androsæmifolium, L.

ASCLEPIADACEÆ.

Asclepias cornuti Decaisne.
" incarnata, L.

OLEACEÆ.

Fraxinus Americana, L.
" sambucifolia, Lam.

ARISTOLOCHIACEÆ.

Asarum Canadense, L.

PHYTOLACCACEÆ.

Phytolacca decandra, L.

CHENOPODIACEÆ.

Chenopodium *album*, L.
Blitum capitatum, L.

AMARANTACEÆ.

Amarantus retroflexus, L.

POLYGONACEÆ.

Polygonum amphibium, L., var. terrestre, Willd.
" *Persicaria*, L.
" amphibium, L., var. aquaticum, Willd.
" Virginianum, L.
" aviculare, L.
" *convolvulus*, L.
Rumex *obtusifolius*, L.
" *Acetosella*, L.

THYMELEACEÆ.

Dirca palustris, L.

ELÆAGNACEÆ.

Shepherdia Canadensis, Nutt.

EUPHORBIACEÆ.

Euphorbia Cyparissias, L.

URTICACEÆ.

Ulmus fulva, Mx.
" Americana, L.
Laportea Canadensis, Gaudichaud.
Pilea pumila, Gray.
Cannabis *sativa*, L.

CUPULIFERÆ.

Quercus alba, L.
Fagus ferruginea, Ait.
Carpinus Americana, Mx.

BETULACEÆ.

Betula lenta, L.
" papyracea, Ait.
Alnus incana, Willd.

SALICACEÆ.

Salix cordata, Muhl.
" livida, Wahl., var. occidentalis, Gray.
Populus tremuloides, Mx.
" balsamifera, L.

CONIFERÆ.

Pinus resinosa, Ait.
" strobus, L.
Abies nigra, Poir.
" alba, Mx.
Larix Americana, Mx.
Thuja occidentalis, L.
Taxus baccata, L., var. Canadensis, Gray.

ARACEÆ.

Arisæma triphyllum, Torr.
Calla palustris, L.
Acorus calamus, L.

TYPHACEÆ.

Typha latifolia, L.
Sparganium eurycarpum, Engelm.
" minimum, Bauhin, Fries.

ALISMACEÆ.

Triglochin maritimum, L.
Alisma plantago, L., var. Americana, Gray.
Sagittaria variabilis, Engelm.

ORCHIDACEÆ.

Orchis spectabilis, L.
Habenaria viridis, R. Br., var. bracteata, Reich.
" hyperborea, R. Br.

ORCHIDACEÆ—*Continued.*

Habenaria rotundifolia, Richards.
" psychodes, Gray.
Goodyera pubesceus, R. Br.
Spiranthes Romanzoviana, Chamisso.
" cernua, Richards.
Calopogon pulchellus, R. Br.
Calypso borealis, Salisb.
Corallorhiza innata, R. Br.
Cypripedium parviflorum, Salisb.
" pubescens, Willd.
" spectabile, Swartz.
" acaule, Ait.

IRIDACEÆ.

Iris versicolor, L.

SMILACEÆ.

Smilax herbacea, L.
" hispida, Muhl.

LILIACEÆ.

Trillium grandiflorum, Salisb.
" erectum, L.
" erectum, L., var. Album, Pursh.
" erythrocarpum, Mx.
Medeola Virginica, L.
Zygadenus glaucus, Nutt.
Uvularia grandiflora, Smith.
Streptopus roseus, Mx.
Clintonia borealis, Raf.
Smilacina racemosa, Desf.
" stellata, Desf.
" trifolia, Desf.
" bifolia, Ker.
Polygonatum biflorum, Ell.
Lilium Philadelphicum, L.
Erythronium Americanum, Smith.

PONTEDERIACEÆ.

Pontederia cordata, L.

CYPERACEÆ.

Scirpus validus.
" atrovirens, Muhl.
Eriophorum polystachyon, L.
Carex crinita, Lam.
" irrigua, Smith.
" plantaginea, Lam.
" Emmonsii, Dew.
" tentaculata, Muhl.
" intumescens, Rudg.

EQUISETACEÆ.

Equisetum arvense, L.
" limosum, L.

FILICES.

Adiantum pedatum, L.
Pteris aquilina, L.
Asplenium Filix-fœmina, Bernh.
Phegopteris polypodioides, Fée.
" Dryopteris, Fée.
Aspidium thelypteris, Swartz.
" spinulosum, Swartz, var. intermedium.
" cristatum, Swartz.
" marginale, Swartz.
" acrostichoides, Swartz.
Cystopteris bulbifera, Bernh.
Struthiopteris Germanica, Willd.
Onoclea sensibilis, L.
Osmunda regalis, L.
" cinnamomea, L.
Botrychium Virginicum, Swartz.

LYCOPODIACEÆ.

Lycopodium lucidulum, Mx.

SYNOPSIS OF THE FLORA OF THE VALLEY OF THE ST. LAWRENCE AND GREAT LAKES,

WITH DESCRIPTIONS OF THE RARER PLANTS.

BY JOHN MACOUN, M.A., *Botanist to the Geological Survey.*

AND

JOHN GIBSON, B.A., F.G S., F.B.S.E.

PHÆNOGAMIA. Flowering plants.

I. DICOTYLEDONÆ OR EXOGENÆ. Dicotyledons or Exogens.

Sub-class I. ANGIOSPERMÆ. Angiosperms.

A. POLYPETALOUS EXOGENS.

RANUNCULACEÆ.

CLEMATIS, L. Virgin's Bower. Traveller's Joy.

C. verticillaris, DC. Whorl-leaved Clematis.

Indigenous. Trailing over Laurentian and limestone rocks from New Brunswick (G. F. Mathews) to Thunder Bay (Macoun). Quebec (Brunet). Montreal, and Belœil Mountain (Maclagan). Hamilton, Ontario (Logie). Westward to the Saskatchewan River (Bourgeau). Quesnelle, Cariboo (Macoun). Rocky Mountains and N. W. Coast to lat. 54° (Torrey and Gray). N. to lat. 56° (Macoun).

C. Virginiana, L. Virginian Clematis.

Indigenous. River banks and low grounds along streams. New Brunswick (G. F. Mathews). Nova Scotia (Prof. Lawson). Quebec and Ontario, common. Thunder Bay, Lake Superior (Macoun). Lake Winipeg (Drummond). Columbia River (Douglas). Common. July to September.

ANEMONE, L. Anemone. Windflower.

A. parviflora, Michx. Small-flowered Anemone.

Indigenous. Wet rocks. Labrador (Brunet, Pursh, T. & G). Gaspé (Dr. Bell). Anticosti (A. L. Verrill). North shore of Lake Superior (Agassiz). Valleys of Athabasca and Peace River (Macoun). North to Arctic Sea, lat. 70°; Kotzebue Sound (Hooker). Rare. June, July.

A. multifida, DC. Red Windflower.

Indigenous. Rocks and gravelly banks. Gulf of St. Lawrence (Goldie). Gaspé (Dr. J. Bell). Pic River, Lake Superior (Macoun). Nipigon and Slave

Lake (Dr. Schultz, Prof. Lawson). Westward across the plains to the Rocky Mountains (Macoun). Rare. June.

A. cylindrica, Gray. Cylindrical-headed Anemone.

Indigenous. Dry sandy plains and pine barrens. Kingston, Ont. (Prof. Lawson). Belleville and Rice Lake plains (Macoun). Hamilton (J. M. Buchan). Between Snake Hill and Pembina (Dr. Schultz, Prof. Lawson). Plains of the Saskatchewan (Bourgeau). Rare. May, June.

A. Virginiana, L. High Anemone.

Indigenous. Woods, fields, and barren hill sides. Abundant from Gaspé (Dr. Bell) to Fort William, Lake Superior (Macoun). Between Snake Hill River and Pembina (Dr. Schultz, Prof. Lawson.) St. Joachim (Provancher). Western plains, through Peace River Valley to the Rocky Mountains (Macoun). Abundant. June to August.

A. Pennsylvanica, L. Round-headed Anemone.

Indigenous. Mud flats and low rocky places along rivers and streams. Abundant from New Brunswick (Mathews) to Thunder Bay, Lake Superior (Macoun). Lake Nipigon, Saskatchewan and McKenzie Rivers (Prof. Lawson). Edmonton, through Peace River Valley to Rocky Mountains (Macoun). North to Arctic circle (Hooker). Abundant. June to August.

A. nemorosa, L. Var. quinquefolia, L. Wood Anemone.

Indigenous. Rich shady woods. Kent Co., New Brunswick (Mathews, Dr. Fowler). Common at the Saguenay (Provancher) Co. Hastings (Macoun). Hamilton (Logie). Kaministiquia River, Lake Superior; Lake of the Woods (Macoun). Lake Winipeg (Richardson). Plains of the Saskatchewan (Bourgeau). British Columbia and Peace River (Macoun).

A. narcissiflora, L. Narcissus-flowered Anemone.

Indigenous. Rocky places. Borders of the River Restigouche (Brunet). N. W. America (Menzies) to Kotzebue Sound, Unalaska (Fisher, Torr. & Gray). Villous, leaves palmately 3-5 parted, segments cuneiform, incisely many-cleft, lobes linear, acute; involucre somewhat similar, sessile, leaflets 3-5 cleft; pedicels several, unbeled, leafless, 1-flowered; flowers white, carpels without tails, much compressed, roundish oval, glabrous (T. and G.; Pursh; Hooker, T. p. 8).

HEPATICA, Dillen. Hepatica. Liver-leaf.

H. triloba, Chaix. 3-lobed Hepatica.

Indigenous. Rich woods. Very common in Ontario, but infrequent eastward. Isle of Orleans (Brunet). Point Levis, Quebec (Dr. Thomas). Windsor, Nova Scotia (Prof. How). Petit Cap St. Joachim (Provancher). River Winipeg (Capt. Back, Prof. Lawson). Rocky Mountains, lat. 55° (Drummond). Abundant. May.

H. acutiloba, DC. Acute-leaved Hepatica.

Indigenous. Rich shady woods. Abundant in Ontario, but of local occurrence. Point Levis (Brunet). Woods near Prescott (B. Billings). Abundant in Counties Northumberland and Hastings (Macoun). Kingston, Ont. (Prof. Lawson). London, Ont., scarce (Saunders). Hamilton (Logie). Sitka, Pacific Coast (Bongard). Abundant. May.

THALICTRUM, Tourn. Meadow Rue.

T. anemonoides, Michx. Rue Anemone.

Indigenous. Open woods. As yet reported only from the Niagara Peninsula. St. Davids, Niagara District (Dr. Maclagan). Vicinity of Niagara Falls (Hooper). Oaklands, Hamilton (Logie). Rare. May.

T. dioicum, L. Early Meadow Rue.

Indigenous. Rich damp woods. Very abundant from Anticosti (A. E. Verrill) and Labrador (Brunet) to Thunder Bay, Lake Superior (Macoun). Between Severn and Trout Lake (Gov. McTavish). Fort Simpson, McKenzie River (Prof. Lawson). Manitoba and Peace River Valley (Macoun). May.

T. Cornuti, L. Tall Meadow Rue.

Indigenous. Low grounds along streams and amid the gravel of river beds. Extends from Newfoundland (J. Richardson), Anticosti (Verrill), and Labrador (Brunet) to Thunder Bay, Lake Superior (Macoun). Assinaboine River (Dr. Schultz, Prof. Lawson). Westward through Peace River Valley to the Rocky Mountains (Macoun). Abundant. May.

T. alpinum, L. Alpine Meadow Rue.

Indigenous. Rocky grounds. Stem simple, nearly naked; leaves 2-3 ternate; leaflets roundish, somewhat lobed, crenately toothed; flowers perfect in a simple raceme, nodding; filaments filiform; anthers oblong-linear; carpels, few, ovate, corsile; stigmas thick and pubescent; stems 2′—8′ high (Sereno Watson, in Clarence King's Expedition of the 40° parallel).

Island of Anticosti (Pursh and Verrill). Newfoundland (In herb. Banks). Behring's Strait (S. Watson). Rocky Mountains (Parry). Rare. Fruits in September.

RANUNCULUS, L. Crowfoot. Buttercup.

R. aquatilis, L. Var. trichophyllus, Chaix. White Water Crowfoot.

Indigenous Lakes and streams of slow current and muddy bottom. New Brunswick (Mathews). Along the White River, Quebec (Brunet). In Ontario is abundant from Prescott (Billings) to the Kaministiquia River, Lake Superior (Macoun). St. Tite (Provancher). Saskatchewan (Bourgeau). Peace River (Macoun). Arctic America (Hooker & Arnott). Common. July to October.

R. multifidus, Pursh. Yellow Water Crowfoot.

Indigenous. Ditches and muddy pools. New Brunswick (Dr. Fowler). Windsor, Nova Scotia (Prof. How). Conway's Creek, Prescott (Billings). Abundant at Belleville (Macoun). Glandford, Ont. (Logie). Malden (Maclagan.) Manitoba, westward to the Rocky Mountains (Macoun). Saskatchewan (Bourgeau). Extreme Arctic America, Kotzebue Sound (Hooker). Common. May.

R. multifidus, Pursh. Var. repens., Hooker. Kidney-leaved Buttercup.

Creeping; lower leaves many-cleft, with linear segments; the upper ones reniform, palmately many cleft; carpels in small globose beads; flowers quite small and bright yellow. Creeping over the muddy bottom of creeks and partially-dried ponds, North Hastings and Northern Townships of Addington, July, 1870 (Macoun). In pools west of the Assinaboine River, Rocky Mountains, and Peace River (Macoun).

R. Flammula, L. Var. reptans. Flame Crowfoot.

Indigenous. Among gravel and sand by lakes and rivers. Extends from Newfoundland (T. & G.) New Brunswick (Mathews). Labrador (T. & G.) to Lake Superior (Macoun). Rivière Chaudière (Brunet). Abundant along the Rivers Moira and Trent, and by the shore of Lake Ontario. Toronto, Laprairie (Prof. H. Croft). St. Joseph's Island, Muskoka (Prof. Ellis). Lake Winipeg and Athabasca River (Gov. McTavish, Prof. Lawson). Saskatchewan River (Bourgeau). Lake Athabasca (Macoun).

R. Cymbalaria, Pursh. Seaside Crowfoot.

Indigenous. Salt marshes and the seaside. Musquodoboit River, Nova Scotia (Prof. Lawson). Windsor, Nova Scotia (Prof. How). Fredericton (Dr. Robb). New Brunswick (Rev. Dr. Fowler). Anticosti (Verrill). Bay of Fundy (Mathews). Gaspé Bay (Dr. Bell). St. Joachim and Rimouski (Brunet). Fort William, Thunder Bay, Lake Superior (Macoun). Lake Winipeg (Barnston). From Lake Superior westward to Peace River Valley (Macoun). Arctic Sea, lat. 68° (Torr. & Gray). West coast of Newfoundland (Dr. Bell). Throughout British Columbia (Macoun).

R. Cymbalaria, Pursh. Var. alpina, T. & G. Alpine Crowfoot.

Very small; leaves 3-toothed at the apex; scape 1-flowered (Torr. & Gray).
Indigenous. Rocky shores. Island of Anticosti (Brunet). Sea shore, Rivière-du-Loup (Dr. Thomas). Rare. August.

R. pygmæus, Wahl. Diminutive Crowfoot.

Stem erect, never creeping, 1′—2′ high, 1-flowered; leaves glabrous, 3-5 cleft; radical ones petioled, cauline ones sessile; calyx glabrous, longer than the somewhat reflexed petals; heads oblong; carpels sub-globose, not margined at the back, pointed with a short-hooked style.
Indigenous. Rocks. Labrador (Pursh). Arctic America and Rocky Mountains, in lat. 55° (T. & G.) Unalaska, Kotzebue Sound (Hook. & Arnott, in bot. Beechey). Mount Selwyn, 6,000 feet above the sea, lat. 56° N. (Macoun). Arctic. August.

R. nivalis, L. Arctic Crowfoot.

Radical leaves on long petioles, dilated, lobed, the lobes somewhat ovate; cauline ones nearly sessile, palmate, stem erect, about 1-flowered, shorter than the obovate entire petals (Torr. & Gray).
Indigenous. Rocks. Coast of Labrador (Hooker). Kotzebue Sound (Beechey). Rocky Mountains of B. N. America to Alaska (S. Watson). August.

R. affinis, R. Brown.

Radical leaves petioled, usually pedately multifid; cauline ones sub-sessile, digitate, with broadly linear lobes; stem erect, few-flowered; carpels with recurved beaks in oblong cylindrical heads, more or less pubescent throughout.
Indigenous. Rocks. Isle of Grues (Brunet). Melville Island and northeast coast (Hooker). Rocky Mountains and Kotzebue Sound, as variety leiocarpus, which is the western form. August.

R. rhomboideus, Goldie. Rhomboid-leaved Crowfoot.

Indigenous. Dry sandy hills and plains. Near Montreal (Dr. Holmes). Sandy plains near Castleton; Murray Town Hall, Northumberland County, Ont. (Macoun). Sand hills on the banks of the Humber (Prof. Lawson).

Lake Simcoe (Goldie). Near London, Ontario (Saunders). Toronto (Prof. Croft). Sandy plains of the Rivière aux Sables, County Lambton (Gibson). Lake Winipeg (Barnston). Saskatchewan River (Bourgeau). Lake of the Woods (Macoun). Abundant. May.

R. abortivus, L. Small-flowered Buttercup.

Indigenous. Pasture fields, woods, and roadsides. Very abundant. Extends from Newfoundland (Verrill), Belœil (Dr. Bell), New Brunswick (Dr. Fowler), Anticosti (Verrill), through Quebec and Ontario to Thunder Bay, Lake Superior (Macoun). Lake Winipeg (Barnston). Fort Garry (Dr. Schultz, Prof. Lawson). Plains of the Saskatchewan (Bourgeau). Common. May, June.

R. abortivus, L. Var. micranthus, Nutt.

Indigenous. Margins of ponds and lakes. North shore of Lake Superior (Agassiz). Along the canal at the Sault Ste. Marie, north of Lake Huron (Macoun). Very rare. June, July.

R. sceleratus, L. Noxious Buttercup.

Indigenous. In ditches and ponds. From Belœil Mountain (Dr. Bell), and New Brunswick (Mathews), through Quebec and Ontario to Sault Ste. Marie (Macoun). Rainy and Slave Lakes (Capt. Back, Prof. Lawson). Lake Winipeg (Barnston). Saskatchewan (Bourgeau). Manitoba to the Rocky Mountains (Macoun). B. N. America, lat. 67° (Hooker). Common. June, July.

R. recurvatus, Poiret. Hook-fruited Buttercup.

Indigenous. Shady, wet woods. Labrador (Hooker), Kent County, New Brunswick (Dr. Fowler), through Quebec and Ontario to the Kaministiquia River, Lake Superior (Macoun). Pied du Cap Tourmente (Provancher). Prescott, Ont. (Billings). Nicolet and Chippewa, Ont. (Dr. Maclagan). Toronto (Prof. Croft). Sulphur Springs, near Ancaster, Ont. (Logie). Banks of Cove, London, Ont. (Saunders). Huron County, Ont. (Gibson). Lake of the Woods (Macoun). May, June.

R. Pennsylvanicus, L. Bristly Buttercup.

Indigenous. Moist meadows and borders of streams. New Brunswick (Mathews). District of Montreal (Brunet). Rivière du Loup (Thomas). Abundant, River Rouge (D'Urban). Wastes, Prescott (Billings). Nicolet and Chippewa (Maclagan). Moist meadows and borders of streams, Central Canada; Owen Sound; Prince Arthur's Landing, Thunder Bay, Lake Superior (Macoun). St. Catherines (Saunders). Toronto (Croft). Fort Garry, (Dr. Schultz, Prof. Lawson). In the wooded country from Lake Superior to the Rocky Mountains (Macoun). West Coast of Newfoundland (Dr. Bell). Athabasca River, lat. 57° N. (Macoun).

R. fascicularis, Muhl. Bundle-rooted Buttercup.

Indigenous. Dry gravelly soil in open woods. Reported from Somerset by Provancher (Dr. Lawson). Belleville, Trenton, and Toronto (Macoun). Kingston Mills, Chippewa, and Malden, (Maclagan). London (Saunders). Hamilton (Logie). Common in Western Ontario (Gibson). Lake Winipeg (Hooker).

R. repens, L. Running Buttercup.

Indigenous. Overflowed places along streams and rivers. New Brunswick (Mathews). Rivière du Loup, not common (Dr. Thomas). Common near

Quebec (Brunet). Near Prescott (Billings). Central Canada (Macoun) 10 miles up the Kaministiquia River, and Current River, Thunder Bay; and Sydenham River, Owen Sound, Ont. (Macoun). Common at London (Saunders). Common at Hamilton (Logie). Chippewa and Malden (Maclagan). Introduced. Form not known in Ontario, but found in the Eastern Provinces. On the Saskatchewan River (Bourgeau). Westward through Peace River Valley to the Rocky Mountains (Macoun). McKenzie River (Barnston). West coast of Newfoundland (Dr. Bell).

R. acris, L. Yellow Weed.

Introduced. Very common in meadows, pastures, dry roadsides. Newfoundland (J. Richardson). Nova Scotia (Prof. How.) Central Canada (Macoun). Toronto (Prof. Croft). Hamilton (Logie), Co. Huron, Ont. (Gibson). Garden River, Sault St. Marie, and Fort William, in such abundance as to monopolize the ground (Macoun). Lake Manitoba (Dr. Schultz, Prof. Lawson). Vancouver Island and British Columbia (Macoun).

Myosurus, L. Mouse-tail.

M. minimus, L. Mouse-tail.

Indigenous. Generally found on alluvial soil overlying flat rocks. At the Ferry House, and east of Albert College, Belleville. As yet reported from no other district of British North America. Vancouver Island (Macoun).

Caltha, L. Spring Cowslip.

C. palustris, L. Marsh Marigold.

Indigenous. Common in swamps, marshy meadows, and by streams. Extends from Newfoundland, Straits of Belleisle (Richardson), Mingan and Anticosti (Verrill), through Quebec (Brunet), and Ontario, to Thunder Bay, Lake Superior (Macoun). Saskatchewan Plains (Bourgeau). From Lake of the Woods to the Rocky Mountains (Macoun). West coast of Newfoundland (Dr. Bell). May.

C. natans, Pallas.

Indigenous. "Stem procumbent, floating; leaves reniform—cordate, crenate, with the lobes somewhat approximated, obscurely crenate towards the base, toothed towards the summit; sepals oval; carpels with a straight beak" (Torr. & Gray). Creeping on the surface of deep sphagnous swamps in the wooded central districts of B. N. America from Canada to lat. 60° N., rare (Dr. Richardson). Flowing stream 20 miles west of Fort Edmonton; Peace River, Methy River, near Methy Portage, lat. 56° (Macoun).

Coptis, Salisbury. Gold Thread.

C. trifolia, Salisb. 3-leaved Gold Thread.

Indigenous. Low damp woods and cedar swamps. Halifax County, Nova Scotia (Prof. Lawson). Kent County, New Brunswick (Dr. Fowler). Labrador (Brunet). Anticosti (A. E. Verrill). Gaspé Basin (Dr. Bell). Nicolet, Montreal, Kingston and Port Robinson, Ont. (Dr. Maclagan). Belleville (Macoun). Hamilton (Logie). Lake Huron, Ont. (Gibson). Lake Superior, Shore of Little Slave Lake (Macoun). N. W. America, Sitka and Unalaska (Hooker). Methy Portage (Macoun).

AQUILEGIA, Tourn. Columbine.

A. Canadensis, L. American Columbine.

Indigenous. Rocky hill sides and open woods. Common from Isle of Orleans (Dr. Thomas), Belœil Mountain (Dr. Bell), through Quebec (Brunet), and Ontario, up to the Kaministiquia River, Lake Superior (Macoun). Lake Winipeg (Capt. Back, Prof. Lawson). Saskatchewan Plains (Bourgeau). Hudson's Bay (Hooker). Not found north of 56° N. according to Barnston. California to Alaska, according to S. Watson.

A. brevistyla, Hooker.

Indigenous. Rocky grounds. Stems low, 6′—8′ high, spreading; leaves biternate; leaflets 3-lobed, crenate, 6″—9″ long; crenatures ovate, rotund; flowers small, blue, about 6″ long including the spur; sepals oblong-ovate; petals a little exceeding the stamens; spurs hooked at the tip; styles shorter, included (Fl. of Colorado by T. C. Porter and J. M. Coulter). Western Canada (Drummond). Lake Nipigon, chiefly near Lake Superior (Gov. (McTavish, Prof. Lawson). Native of Western Canada (Richardson). Rocky Mountains (Bourgeau). Telegraph Trail, Upper British Columbia; Peace River, lat. 56° (Macoun).

A. vulgaris, L. Common Columbine.

Introduced from Europe. Spur of the petals incurved, capsules hairy, stem leafy, many-flowered; leaves nearly glabrous; styles as long as the stamens (Hooker's British Flora). Abundant in the grounds at the Prince's Lodge, Halifax County, and in spots along the railway line, and Windsor Road (Prof. G. Lawson). Bass River, Kent Co., New Brunswick (Rev. Dr. Fowler). June.

DELPHINIUM, Tourn. Larkspur.

D. Consolida, L. Field Larkspur.

Introduced from Europe. Banks of the St. Lawrence, west of Prescott, Ont. (Billings). Gardens and wheat fields near Belleville, Ont. (Macoun). June, July.

HYDRASTIS, L. Herb Yellow Root.

H. Canadensis, L. Orange Root.

Indigenous. Rich shady woods. Mirivin's Woods, near Prescott, rare (Billings). Malden, Ont. (Dr. Maclagan). Township of Williams, Ont. (Saunders). Co. of Norfolk (Dr. Nichol, Montreal.) It seems to be almost wholly confined to the Western Peninsula. May.

ACTÆA, L. Baneberry.

A rubra, Bigel. Red Baneberry.

Indigenous. Extends, in great abundance, from Newfoundland (Richardson), to Lake Superior (Macoun), and across the Continent through the wooded country to the Rocky Mountains (Macoun). West coast of Newfoundland (Dr. Bell).

A. alba, Bigel. White Baneberry.

Indigenous. Rich woods and flats of streams. Extends in abundance from Nova Scotia (Dr. How), Anticosti (A. E. Verrill), through Quebec and Ontario to the Kaministiquia River, Lake Superior (Macoun); and across the Continent through the wooded country to the Rocky Mountains and westward to the Cascades (Macoun). May.

CIMICIFUGA, L. Snakeroot.

C. racemosa, Elliott. Black-rooted Snakeroot.

Indigenous. Rich woods. Cayuga, Grand River (Maclagan). Co. Norfolk, Ont. (Dr. Nichol). Near St. Thomas, Ont. (Macoun.) So far reported only from the western portion of Ontario. Rare. July.

MAGNOLIACEÆ.

LIRIODENDRON, L. Whitewood. Tulip Tree.

Magnolia acuminata, L.

At the Falls of the Niagara. (Provancher, Wood).

L. Tulipifera, L. Whitewood.

Indigenous. Sunny hillsides, rich woods. St. Catharines, Ont. (Saunders). Vicinity of Hamilton, on Dundas road (Logie). Niagara Falls (Maclagan). St. Thomas and Chatham, Ont. (A. T. Drummond). Bosanquet Township, County Lambton, a few miles south of Kettle Point; Township of Tuckersmith, Huron County, Ont., its most northern point in America (Prof. Gibson). June.

ANONACEÆ.

ASIMINA, Adanson. North America Papaw.

A. triloba, Duval. Common Papaw.

Indigenous? Banks of streams in rich soil. On the road to Queenston, Niagara District, Ont. (Prof. J. B. Cherriman.)

MENISPERMACEÆ.

MENISPERMUM, L. Moonseed.

M. Canadense, L. Canada Moonseed.

Indigenous. Low rich woods and along streams. Montreal—Isle de Jesus—(Brunet). Common in woods, near Ottawa (Billings). Vicinity of Belleville, and Owen Sound, Ont. (Macoun.) Two miles west of London (Saunders). St. Catharines and Malden (Maclagan). Vicinity of Hamilton, not common (Buchan). Lake Winipeg (Bourgeau). Lake St. Charles, Quebec (Provancher).

BERBERIDACEÆ.

BERBERIS, L. Barberry.

B. vulgaris, L. Common Barberry.

Introduced from Europe. Waste places. New Brunswick (Rev. Dr. Fowler). Point Lévis, Quebec (Brunet). Not authoritatively reported from Ontario. Newfoundland, (Morrison, Hooker). June.

CAULOPHYLLUM, Michx. Blue Cohosh.

C. thalictroides, Mx. Cohosh. Pappoose-root.

Indigenous. Rich woods. Gilmour's Woods, Quebec (Brunet). Common in woods, Prescott (Billings). Abundant in rich woods, Belleville, Ont., and Owen Sound, Ont. (Macoun). Kingston, Chippewa and Malden, Ont. (Maclagan.) Mountain side near Hamilton (Logie). Common near London, Ont. (Saunders). Woods, County Huron, Ont. (Prof. Gibson). Common. May.

JEFFERSONIA, Barton. Twin-leaf.

J. diphylla, Pers. Twin-leaf. Rheumatism-root.

Indigenous. Woods and rich soils. Near Napanee, Ont. (Rev. A. Scott). Point Peter, and near Consecon, Prince Edward Co., Ont. (Macoun). Banks of the river, near Cove, common, London, (Saunders).

PODOPHYLLUM, L. May-apple. Mandrake.

P. peltatum, L. May-apple.

Indigenous. Rich shady woods and pastures. Very common throughout Ontario, but as regards Eastern Canada has only been reported from Montreal Mountain by Brunet and Maclagan. May.

NYMPHÆACEÆ.

BRASENIA, Schreber. Water Target.

B. peltata, Pursh. Common Water-shield.

Indigenons. Borders of lakes, ponds, and slow streams. Point St. Charles, Montreal (Brunet). Abundant in lakes and ponds, River Rouge, Quebec (D'Urban). Lakes and ponds north of the Counties Addington, Hastings, Peterborough and Victoria, Central Canada (Macoun). Lakelet, Howick Township, Huron Co., Ont. (Prof. Gibson). Near Rainy Lake, Dawson route (Macoun). Rare. July.

NYMPHÆA, Tourn. Water Nymph.

N. odorata, Aiton. Fragrant Water Lily.

Indigenous. Still waters of rivers, lakes, and ponds. Common everywhere to the Lake of the Woods. June to September.

N. odorata, Aiton. Var. minor, Sims.

Indigenous. Shallow water. In a small lake south-east of Marmora Village, County Hastings, Ont., July 18, 1867. South Lake, Township of Snowdon, Peterborough County, July 29, 1868 (Macoun). Rare. July.

N. tuberosa, Paine. Tuber-bearing Nymphæa.

Indigenous. Still water. Found in all the marshes along the Bay of Quinté, and abundant in mud flats along Lake Ontario, from Presqu'ile eastward, and is suspected by the writers to be the "Nymphæa," of Burlington Bay, as reported by Messrs. Logie and Buchan. At Lakelet, Howick Township, County Huron, Ont. (Gibson). Easily distinguished from N. odorata by its scentless flowers. Frequent. July.

NUPHAR, Smith. Yellow Pond Lily.

N. advena, Aiton. Spatterdock.

Indigenous. Ponds, ditches, pools, and rivers. Very common through Eastern and Western Canada. Found in Lake of the Woods, Little Slave Lake, and westward to the Rocky Moutains (Macoun). Cariboo, Labrador (Butler). West coast of Newfoundland (Dr. Bell). Athabasca River, lat. 57° (Macoun).

N. luteum, Smith. Var. pumilum, Gray. Small Yellow Pond Lily.

Indigenous. Tranquil water. New Brunswick (Dr. Fowler). Saguenay River, and Lake St. John (Brunet). Lakes and ponds, Rivière du Loup (Dr. Thomas). Nation River, railway crossing (Billings). Black Creek, Hastings County; North River, and Crow Lake, Belmont Township, Peterborough County (Macoun). North Shore of Lake Superior (Agassiz). East of Rainy Lake (Macoun). River Saskatchewan (Bourgeau). Subarctic America (Dr. Richardson). Sitka (Bougard). June, July.

SARRACENIACEÆ.

SARRACENIA, Tourn. Pitcher-plant.

S. purpurea, L. Side-saddle Flower. Pitcher-plant.

Indigenous. Peat bogs and swamps. New Brunswick (Dr. Fowler). In swamps, Quebec (Brunet). Between Ottawa and Prescott (Billings). Bogs and beaver meadows, River Rouge (D'Urban). North of the Counties Frontenac, Hastings, Peterborough, Victoria, and Northumberland; Point Rich, Owen Sound; North Shore of Lake Superior (Macoun). Common in Ontario and Quebec. Cockburn Island, Georgian Bay (Dr. Bell). Height-of-Land Portage, Dawson route; West of the N. Saskatchewan (Macoun). Saskatchewan plains (Bourgeau). Hudson's Bay (T. & G.) West of Little Slave Lake (Macoun). West coast of Newfoundland (Dr. Bell).

PAPAVERACEÆ.

PAPAVER, L. Poppy.

P. somniferum, L. Common Poppy.

Introduced from Europe. New Brunswick (Dr. Fowler). Waste places near Belleville, Ont. (Macoun). Waste places, County Huron, Ont. (Gibson). Toronto (Prof. Croft). Rare. July.

Papaver nudicaule, L.

Coast of Labrador, and west to the Rocky Mountain, Unalaska.

CHELIDONIUM, L. Celandine.

C. majus, L. Celandine.

Introduced from Europe. Waste places. Quebec, St. Foy's Road (Dr. Thomas). Three Rivers, Quebec (Brunet). Desett's Woods, near Prescott (Billings). Montreal (Maclagan). Roadsides, Brighton, Picton, and Belleville (Macoun). Mountain side near Hamilton (Logie). Not uncommon at London, Ont. (Saunders). Dundas, Ont. (Prof. Ellis). May to September.

SANGUINARIA, Dillen. Blood-root.

S. Canadensis, L. Canadian Blood-root.

Indigenous. Rich woods and borders of fences. Rivière du Loup, not very common (Dr. Thomas). Quebec, common (Brunet). Clearings on crystalline limestone, River Rouge (D'Urban). Montreal; Wolfe Island and Malden, Ont. (Maclagan). Rich woods, Ottawa (Billings). Common in Central Canada and Owen Sound (Macoun). Mountain side, Hamilton (Logie). London, Ont., common (Saunders). County Huron (Gibson). Centre of St. Joseph's Island, Lake Huron) Dr. Bell. Saskatchewan plains (Bourgeau). May.

FUMARIACEÆ.

ADLUMIA, Rafinesque. Fumitory.

A. cirrhosa, Raf. Alleghany Vine. Cypress Vine.

Indigenous. Wet woods and rocky hills along rivers. River du Loup, rare (Dr. Thomas). Temiscouta Portage (Maclagan). Vicinity of Kingston, Ont. (Brunet). Woods, Heeley Falls, Northumberland County; and woods east of Belleville; Owen Sound (Macoun). Hamilton, Ont. (Logie). Gore Bay, Georgian Bay (Dr. Bell). N. W. America (T. & G.)

DICENTRA, Berkhausen.

D. cucullaria, DC. Dutchman's Breeches.

Indigenous. Rich low woods. Common in rich woods from New Brunswick and Nova Scotia, through Quebec and Ontario, to Lake Huron.

D. Canadensis, DC. Squirrel Corn.

Indigenous. Rich rocky soil and shady woods. Frequent throughout Ontario and Quebec.

D. eximia, DC. Purple, Choice Dicentra.

Indigenous. Rocky woods. This plant is inserted solely on the authority of Brunet's Catalogue (Catalogue des Plantes Canadiennes), "Plante tres-rare. Environs de Montréal. Plante envoyée par M. J. Lyman, Pharmacien." Probably the D. formosa of the Gardens. Its presence in Canada is doubted by Provancher.

CORYDALIS, Vent.

C. glauca, Pursh.

Indigenous. On rocks, chiefly Laurentian. New Brunswick (Dr. Fowler). Woods of St. Foy, Quebec (Brunet). 16-Island Lake, and Huckleberry Rapids, River Rouge (D'Urban). Exposed rocks, Brockville; Chelsea, Quebec (Billings). Kingston Mills, Ont. (Maclagan). Laurentian rocks, Co. Hastings; abundant north shore of Lake Superior (Macoun). Island East of Thessalon River (Prof. Bell). St. Joseph's Island, McLeod's harbour, Cockburn Island, Sidgrave's Cove, Georgian Bay (Dr. Ball). Rocky banks of the Maitland and Saugeen Rivers (Gibson). Dawson route, near Lake Shebandowan; Fort Assinaboine on the Athabasca; Telegraph Trail, Upper British Columbia (Macoun). Saskatchewan Plains (Bourgeau). Cacouna, Q. (Prof. Croft). Yale, on the Fraser River; Methy Portage (Macoun).

C. aurea, Willd. Golden Corydalis.

Indigenous. Rocky woods. Rocky woods along the Restigouche River (Brunet). Rocky banks and sandy fields, Seymour; banks of the Trent and Moira Rivers (Macoun). Maitland Valley, Co. Huron, Ont. (Gibson). Cockburn Island, McLeod's Harbour, Georgian Bay (Dr. Bell). North shore of Lake Superior (Agassiz). Michipicoten Island and Dawson route, Lake Superior; Fort Edmonton; Fort Assinaboine on the Athabasca; Dunvegan, Peace River, (Macoun). Plains of the Saskatchewan (Bourgeau). Saguenay River, Quebec (Provancher).

FUMARIA, L. Fumitory.

F. officinallis, L. Officinal Fumitory.

Introduced from Europe. Waste places and about dwellings. Quebec (Brunet). Gardens at Picton, P. E. County, Ont. (Macoun). Burlington Beach (Logie). County Huron (Gibson). July, August.

CRUCIFERÆ.

NASTURTIUM, R. Br. Water-cress.

N. officinale, R. Br. Water-cress.

Introduced from Europe. Cold streams and ditches. Rivulet, Castleton; small stream, Rice Lake plains; Campbellford, Northumberland Co.; ditches at Picton, P. E. Co.; along the Sydenham River, Owen Sound (Macoun). Near London, Ont. (Saunders). Galt (Miss Crooks, Logie). Niagara Falls (Maclagan). Stanley, Co. Huron, Ont. (Gibson). North-west coast (Scouler). May to September.

N. palustre, DC. Marsh Cress.

Indigenous. Alluvial lands, ditches and swamps. Very abundant from the Mouth of the St. Lawrence to Lake Superior. North Saskatchewan; Little Slave Lake; Dunvegan, Peace River (Macoun). Plains of the Saskatchewan River (Bourgeau). Arctic America (T. & G.)

N. palustre, DC. Var. hispidum, Gray.

Indigenous. Inundated banks of rivers and streams. New Brunswick (Dr. Fowler). Detroit River (Maclagan). Vicinity of Hamilton (Buchan).

N. lacustre, Gray. Lake Cress.

Indigenous. In mud along river-banks. River Trent at Myersburgh; in Crow Bay, and abundant in still water between Heeley's Falls and Hasting's Village; River Trent, Ont. (Macoun). Canada (Dr. Holmes). Grand River, Malden, (Maclagan). Near Prescott, Ont. (Provancher).

N. Armoracia, Fries. Horse-radish.

Introduced from Europe. In gardens and waste places. New Brunswick (Dr. Fowler). Wastes, Quebec (Brunet). Wastes and gardens, abundant, Belleville (Macoun). Common, London (Saunders). Rare. June, July.

DENTARIA, L. Pepper-root.

D. diphylla, L. 2-leaved Pepper-root.

Indigenous. In cedar swamps, wet meadows, and around springs. New Brunswick (Dr. Fowler). Quebec and Isle of Orleans (Brunet). Rivière du

Loup and St. Modeste (Dr. Thomas). Rocky woods, River Rouge (D'Urban). Montreal, St. Valentine, Smith's Falls, Kingston, and Chippewa (Maclagan). Prescott, abundant (Billings). Woods, Belleville, Ont. (Macoun). Mountain side (Hamilton). Bayfield River, Huron Co., Ont. (Gibson). May.

D. Maxima, Nutt. Many-leaved Dentaria.

Indigenous. In shady moist places. Found at Galt by Miss Crooks (Logie). Having seen no specimens of this species from Canada, we are extremely doubtful of its existence in Western Ontario, and are of the opinion that the plant so designated by Logie is the D. laciniata, and that the D. heterophylla reported from Hamilton by J. M. Buchan is the same plant. May.

D. laciniata, Muhl. Cut-leaved Dentaria.

Indigenous. Rich shady woods and low grounds. Valley of the St. Francis, rare (Brunet). Ameliasburgh, P. E. County, Ont. (Macoun). Banks of Cove, common, London (Saunders). Mountain west of Hamilton (Logie). Chippewa, Navy Island and Malden (Maclagan). Penetanguishene (Hooker, Fl. Bor. Am.) Rare. May.

Cardamine, L. Spring Cress.

C. rhomboidea, DC. Spring Cress.

Indigenous. Wet meadows and springs. Meadow near Stinson's Mills; wet woods east of Belleville (Macoun). Wet places, common (Saunders). Galt (Kate Crooks). Malden, Ont. (Maclagan). Rare. May, June.

C. rhomboidea, DC. Var. purpurea, Torrey.

Indigenous. Moist woods and springs. London, Ont. (A. T. Drummond). Woods west of Hamilton (Logie). Rare. May, June.

C. rotundifolia, Michx. Mountain Water-cress.

Indigenous. Cool shaded springs. Chippewa and St. Catharines (Maclagan). Hudson's Bay, Rocky Mountains, Lake Superior (Torr. & Gray). Rocky Mountain defiles, lat. 52° to 51° N. (Drummond). Rare. May.

C. pratensis, L. Cuckoo Flower.

Indigenous. Wet meadows and swamps. Swamps, Labrador and Quebec (Brunet). Near Ottawa and Prescott Railway; vicinity of Prescott Junction (Billings). Three miles south of Ottawa (Billings). Meadows and swamps, Belleville (Macoun). Near Millgrove, Ont. (Logie). Shore along Lake Burwell, Co. Lambton, Ont. (Gibson). Whisky Island, Georgian Bay (Dr. Bell). Arctic Islands, Behring Straits, and Hudson's Bay (G. Barnston). May, June.

C. hirsuta, L. Common Bitter Cress.

Indigenous. In rivulets, springs, and ditches. Very common from mouth of the St. Lawrence through Quebec and Ontario to Lake Superior. Fort Assinaboine on the Athabasca; Little Slave Lake; Dunvegan and Fort St. John, Peace River (Macoun). Arctic Sea coast (Barnston). Arctic America (Torr. & Gray). British America (Richardson). West coast of Newfoundland (Dr. Bell). Throughout the season.

C. hirsuta, L. Var. sylvatica, Gray. Bitter Cress.

Indigenous. Dry rocks, especially Laurentian. Rocks of the Montmorenci Falls (Brunet). Dry Laurentian rocks at Shannonville, Ont. (Macoun). Galt

Ont. (Miss Crooks). Jones' Falls, Ont. (Maclagan). Sturgeon Lake, Dawson route (Macoun). Rare. June to August.

ARABIS, L. Wall Cress. Rock Cress.

A. alpina, L. Alpine Rock Cress.

Indigenous. Stem branching, somewhat diffused, and, with the leaves, clothed with a villous branched pubescence; leaves many-toothed; radical ones somewhat petioled; cauline cordate, clasping; peduncles nearly glabrous, longer than the calyx (Hook. Fl. Bor.-Am. I. p. 42). Reported only from the coast of Labrador on Hooker's authority. Forteau Bay, Labrador (Butler).

A. lyrata, L. Rock Cress.

Indigenous. Rocky banks and sandy hills along the great lakes. Niagara Falls, whirlpool (Maclagan). Not common, London? (Saunders). Shore of Lake Huron, at Fishing Islands; Shore of Lake Superior from Sault Ste. Marie to Pic River; Lake Shebandowan; Lake of the Woods; Fort Assinaboine, on the Athabasca? (Macoun). McLeod Lake, British Columbia, lat. 55° N. (Macoun). Rare. June, July.

A. petræa, Lam. Rock Cress.

Indigenous. On rocks. Crevices of rocks, about five miles north of Michipicoten harbour, Lake Superior (Macoun). Cockburn Island, Lake Huron, (Dr. Bell). Canada (Hooker). Arctic America and N. W. Coast (Torr. & Gray). Unalaska (Chamisso). Rare. July.

A. hirsuta, Scopoli. Hairy Rock Cress.

Indigenous. Rocky banks and sandy plains. New Brunswick (Dr. Fowler). Moist rocks. Falls of Montmorenci (Brunet). Sea shore, Rivière du Loup (Dr. Thomas). Rice Lake plains; banks of the Moira and Trent; Owen Sound, Ont; dry banks up the Kaministiquia, Lake Superior (Macoun). Galt, Ont. (J. M. Buchan). At Cove, near London (Saunders). Banks of Rivière aux Sables, Co. Lambton, Ont. (Gibson). Saskatchewan plains (Bourgeau). Fort Assinaboine, on the Athabasca; Dunvegan, on the Peace River (Macoun). Hudson's Bay coast; shores of the Pacific to Sitka (G. Barnston). May to July.

A. lævigata, DC. Smooth Rock Cress.

Indigenous. Rocky woods and low grounds. Rocks, Heeley Falls, Seymour, Co. Northumberland; Gibson's Mountain, Prince Edward Co.; Shannonville; Woods; Royston Park, Owen Sound (Macoun). London, Ont. (Saunders). Malden, Ont. (Maclagan). Valley of Rivière aux Sables, Co. Lambton, Ont. (Gibson). North shore of the St. Lawrence above Quebec (Barnston). June, July.

A. Canadensis, L. Sickle-pod.

Indigenous. Rocky hillsides. Laurentian rocks at Shannonville, Ont.; hills rear of Picton, Prince Edward Co.; woods near Fenelon Falls, Victoria Co. (Macoun). Vicinity of Hamilton (Logie). Maldon, Ont. (Maclagan). Bosanquet Township, Co. Lambton, Ont. (Gibson). Fort Edmonton, north Saskatchewan River (Macoun). June, July.

A. hesperidoides, Gray.

Indigenous. Borders of streams. Has only been reported from the vicinity of London, Ont., by Mr. W. Saunders. June.

A. perfoliata, Lam. Smooth Tower Mustard.

Indigenous. Rocky woods and meadows. New Brunswick (Mathews). Counties Hastings and Northumberland, Ont.; 15 miles up the Kaministiquia, Lake Superior; Owen Sound, Lake Huron (Macoun; Amherstburg and islands in Detroit River (Maclagan). Whisky Island, Lake Huron (Dr. Bell). North shore of Lake Superior (Agassiz). Valley of the Saskatchewan (Bourgeau). Fort Assinaboine on the Athabasca; west of Little Slave Lake (Macoun). Hudson's Bay to the Rocky Mountains (Hooker). Upper British Columbia (Macoun). June.

A. Drummondii, Gray.

Indigenous. Rocky banks of rivers and wooded banks of streams. Rocky banks of the Moira and Trent Rivers, Ont.; Gibson's Mountain, Prince Edward County; up the Kaministiquia River, Lake Superior; Fishing Islands, Lake Huron (Macoun). Near Prescott, Ont. (Billings). Rideau Canal, Kingston Mills, Islands in Detroit River (Maclagan). Whisky and Mississagui Islands, Lake Huron (Dr. Bell). Fort Edmonton, North Saskatchewan; Fort Assinaboine on the Athabasca; Portage between Little Slave Lake and Peace River; Peace River west of the Rocky Mountains, and the Telegraph Trail Upper British Columbia (Macoun).

A. retrofracta, Graham.

Indigenous. Plant erect, more or less canescently pubescent; radical leaves lanceolate, linear, sparingly hirsute, petioled, toothed or nearly entire; cauline leaves sagittate-amplexicaul or simply clasping; stems several, from one root, 10′—18′ high, virgate, branching near the summit; flowers, light rose-colour or nearly white, small, nodding; petals oblong-oval, the limb exserted; siliques linear, elongated, more or less reflexed; seeds in two rows, margined. This plant is readily distinguished from A. Drummondii by its shorter and retrofract pods. Reported by Prof. Gibson from Portage du Fort, Ottawa River. California to Arctic Circle (S. Watson). Hudson's Bay to Rocky Mountains, and N. to lat. 68 (Hooker). Abundant west of Rocky Mountains (Macoun). June.

Barbarea, R. Brown. Water Cress.

B. vulgaris, R. Brown. Yellow Rocket.

Introduced. Roadsides and fields. Vicinity of Quebec (Brunet). New Brunswick (Dr. Fowler). June to August.

B. vulgaris, R. Brown. Var. Stricta, Andrz.

Indigenous. Shores of Lake Huron and Superior. Owen Sound Bay; Chicken Bay, east shore of Lake Huron; north shore of Lake Huron; north shore of Lake Superior from Thunder Bay to Sault Ste. Marie (Macoun). Mississagui Island, south side of St. Joseph's Island, Whisky and Cockburn Islands, Lake Huron (Dr. Bell). Saskatchewan plains (Bourgeau). Edmonton, North Saskatchewan (Macoun). Oregon, and N. W. America (T. & G.) Sitka (Bougard). Vancouver Island; Peace River Valley (Macoun). June, July.

B. praecox, R. Br. Tongue Grass. Scurvy Grass.

Introduced from Europe. New Brunswick (Dr. Fowler). Canada (Goldie in Hooker). Cultivated in gardens. North-western America to lat. 68°, N. (Barnston). June, July.

Erysimum, L. Worm-seed Mustard.

E. cheiranthoides, L. Worm-seed Mustard.

Indigenous. Moist grounds along streams, in gardens, and cultivated fields. Montreal (Maclagan). Prescott Junction, rare (Billings). Gardens and waste places around Belleville (Macoun). Near London, Ont. (Saunders). Hamilton, roadsides (Logie). Bosanquet, Co. Lambton, Ont. (Gibson). Newly-cleared lands, Owen Sound; 11 miles up the Kaministiquia, Lake Superior; Telegraph Trail, Upper British Columbia (Macoun). Pacific coast, lat. 47° N. (Barnston). Banks of the McKenzie River, lat. 67° N. (Hooker). Fort Francis, Dawson route (Macoun). July to September.

Hesperis, L. Sweet Rocket.

H. matronalis, L. Sweet Rocket.

Introduced from Europe. In waste places, escaped from gardens, Belleville (Macoun). Shore of Lake Huron (Dr. Todd, *vide* Hooker). June.

(*To be Continued.*)

CANADIAN INSTITUTE.

ANNUAL REPORT OF THE COUNCIL FOR THE YEAR 1874-75.

The Council of the Canadian Institute beg leave to submit their Annual Report of the proceedings of the Institute for the past year, and to congratulate the Institute on the fact of a noticeable increase in the attendance and interest of the members at the ordinary meetings.

During the year a large number of papers and communications of varied scientific, literary, and historical interest have been read, a list of which is annexed.

There is also annexed a statement of the financial position of the Institute, by the Treasurer, together with the certificate of the Auditors, and an appendix which sets out in detail the titles of the various gifts of books, pamphlets, and papers received by the Institute during the year, as well as of the various periodicals and journals received by way of exchange for the *Canadian Journal*, or by way of subscription by the Institute.

The Council have also to report that during the year they had under consideration a project for the erection of a new building for the use of the Institute.

A scheme was matured and adopted by the Council, under which it was provided that if the Institute should obtain promises of contributions which (if added to the available funds of the Institute) would amount to $10,000, the work should be proceeded with.

It was found that a suitable building could be erected on the present site, and completed for the sum of $16,000, and that without completing the Lecture Room it could be erected and otherwise completed for $11,000.

The amount of contributions promised upon a canvass for that purpose amounted in the aggregate to about the sum of $2,000.

As the amount promised did not realize the sum required by the scheme adopted, the determination of the question of proceeding with the erection of the new building, under the circumstances, was remitted to a special general meeting of the members of the Institute held on the 6th of July last, which resolved to record its thanks to Mr. Loudon for his exertions in procuring plans and estimates for the proposed new building, and promises of contributions for its erection, and to earnestly invite the members to follow up his exertions with a view to commencing the building in the spring and, if possible, to complete the entire plan, including the Lecture Room.

All of which is respectfully submitted.

MEMBERSHIP.

The present state of Membership:

Members at commencement of Session, Dec. 1, 1874	339
Members elected during the Session, 1874-'75	9
	348

Deduct.

Deaths during the year, 1874-'75	2	
Withdrawn	4	
	—	6
Total, November 30th, 1875		342

Composed of

Honorary Members	5
Life Members	18
Corresponding Members	4
Ordinary Members	315
Total	342

COMMUNICATIONS.

The following valuable and instructive papers and communications were read and received from time to time, at the ordinary meetings held during the session.

December 5, 1874.—Rev. Dr. McCaul, LL.D., on "Ancient Persia and Parthia, illustrated by Numismatics."

December 12, 1874.—Communication from John Paterson, Esq., accompanied by a specimen of perforated stone found near Coboconk.

December 12, 1874.—Prof. H. A. Nicholson and Dr. W. H. Ellis, M.A., on "A Remarkable Fragment of Fossil Wood from the Rocky Mountains."

December 19, 1874.—Annual Report of the Council of the Canadian Institute.

December 19, 1874.—Rev. Dr. Scadding exhibited several old Maps of North America, with remarks thereon.

January 16, 1875.—Prof. Daniel Wilson, LL.D., on "A Summer Ramble among the Antiquities of Ohio, U. S."

January 23, 1875.—Prof. H. H. Croft, D.C.L., on "Messrs. Gibson and Macoun's Report on the Botany of the eastern shore of Lake Huron."

January 30, 1875.—Rev. Dr. Scadding, on "A Review of Oxford and Cambridge Historical Autographs."

February 6, 1875.—Dr. W. H. Ellis, M.A., on "Nitro-Glycerine; its properties and application."

February 13, 1875.—A. Elvins, Esq., on "Rainfall and Storm Cycles."

February 20, 1875.—M. Cummings, Esq , M.A., on "The Primitive History of the Ionians," by the Rev. Prof. Campbell, Montreal.

February 27, 1875.—Rev. Dr. Scadding, on "The early Gazetteer and Map Literature of Western Canada, with several old Gazetteers and Maps relating to the early history of Canada."

March 6, 1875.—J. M. Buchan, Esq., M.A., on "The Flora of Hamilton."

March 6, 1875.—H. B. Spotton, M.A., on "The Flora of Barrie."

March 13, 1875.—Prof J. Loudon, M.A., on "The Properties of Light."

March 20, 1875.—Mr. Elwin, on "A new theory of the Aurora Borealis, illustrated by Electrical Experiments."

March 27, 1875.—Prof. E. J. Chapman, Ph.D., on "The Sub-division of the Province of Ontario, into several Geological areas."

April 3, 1875.—Prof. D. Wilson, LL.D., on "The Man of the Mammoth Period."

April 3, 1875.—W. Oldright, M.A., M.D., on "Hints to dwellers in City Houses."

CANADIAN INSTITUTE, IN ACCOUNT WITH S. SPREULL, TREASURER.

1874.	*Debtor.*		
Dec. 8.	To paid Western Assurance, premium on $5,000		$100 00
8.	" Hart & Williamson, account 1874, omitted		63 00
1875.			
Jan. 9.	" Mr. Cumming, Assist. Secretary and Librarian		50 00
Apr. 10.	" *Mail* account, Advertising		17 20
10.	" *Globe* account, Advertising		16 00
10.	" Bain's account, *Blackwood* and Reviews		18 00
10.	" James Myles, account Firewood		28 50
17.	" Hart & Rawlinson, account 1875		63 00
May 10.	" Provincial Building Society, Instalment		130 00
July 14.	" Copp, Clark & Co., to account printing *Journal*		250 00
Sep. 17.	" *Globe*, Advertising		9 70
18	" Royal Insurance, Premium on $1,800 (Building)		22 50
Nov. 5.	" Copp, Clark & Co., to account		200 00
30.	" Librarian, Salary	$364 00	
30.	" Wood and Coal	43 20	
30.	" Stationery, Postages and P. O. Box	12 75	
30.	" Express Charges	14 05	
30.	" Oil, &c., Lighting	7 04	
30.	" Repairs	7 35	
30.	" Waggon hire	0 50	
30.	" Balance due by Assist. Secretary	11 00	
			459 89
30.	To Balance forward		862 55
			$2,290 34

1874.	*Creditor.*		
Dec. 1.	By Balance		$803 51
31.	" Interest on Deposit to 31st December		29 20
1875.			
Feb. 3.	" Government Allowance		750 00
Apr. 10.	" Half-yearly Dividend on Stock		120 00
June 30.	" Interest on Deposit to 30th June		37 74
Oct. 10.	" Half-yearly Dividend on Stock		90 00
Nov. 30.	" Balance due by Assist. Secretary to Treasurer	$68 46	
30.	" Subscriptions	170 00	
30.	" Rents	120 00	
30.	" *Journals* sold	51 43	
30.	" Cash from Treasurer to Assist. Secretary	50 00	
			459 89
			$2,290 34

1875.
Dec. 1. By Balance in Deposit Provincial Building & Savings Society, $862 55

TORONTO, 1st December, 1875.

SAMUEL SPREULL, *Treasurer.*

The undersigned Auditors have compared the vouchers for the above items of these accounts, with the Cash Book, and find them to agree. The balance in the hands of the Treasurer is $862 55.

W. J. MACDONELL,
JOHN PATERSON, } *Auditors.*

TORONTO, Nov. 30th, 1875.

APPENDIX.

BOOKS AND PAMPHLETS RECEIVED IN EXCHANGE FOR THE CANADIAN JOURNAL.

1. Report of Progress of the Geological Survey of Canada, 1873-74.
2. Transactions of the Nova Scotian Institute of Natural Sciences, Halifax, 1873-74.
3. The Canadian Entomologist, vol. vii, 1875.
4. Report of the Entomological Society, Province of Ontario, 1874.
5. The Pharmaceutical Journal, vol. ix, 1875.
6. The Journal of Education, vol. xxviii, 1875.
7. Report on the Stevenson Phosphate Location, Townships of Portland and Buckingham (2). By E. J. Chapman, Ph.D.
8. Dawson's, A. M., Report on the Geology and Resources of the Forty-ninth Parallel, 1875.
9. The Great Dominion. By E. J. Jenkins, M.P.
10. Third Report of the Meteorological Office, Dominion of Canada, 1873.
11. Reports of the Meteorological, Magnetic, and other Observatories of Canada. Supplement No. 4.
12. Abstracts and Results of Magnetic, and Meteorological Observations of the Magnetic Observatory, Toronto, 1875.
13. Speech of Lord Dufferin, Governor-General of Canada, on the Dominion.
14. The Canadian Militia. By Capt. R. J. Wicksteed, 1875.
15. Proceedings of the Royal Geographical Society, vol. xviii, 1874.
16. Journal of " " " vol. 42 & 43.
17. Proceedings of the Society of Antiquarians of Scotland, vol. vii, Part 2; vol. viii, Part 1.
18. Journal of the Royal Geological Society of Ireland, vol. iv, Part 1.
19. List of Members of the Royal Geological Society of Ireland, 1873-74.
20. Quarterly Journal of the Royal Geological Society, vol. xxix, Part 4; vol. xxx, Parts 1, 2 & 3.
21. Proceedings of the Literary and Philosophical Society of Liverpool, 1873-74.
22. Report of Council of the Art Union, London, 1875.
23. Annual Report of the Manchester Science Students' Association, 1873.
24. Report of the Proceedings of the Cobden Club, 1874.
25. List of Members of the Anthropological Institute of Great Britain and Ireland.
26. Transactions Royal Society of Edinburgh, vol. xvii, Part 2, 1873-74.
27. Journal Linnæan Society; Botany, Nos. 77, 78, 79, 80; Zoology, Nos. 58, 59.
28. Report Belfast Naturalists' Field Club, 1873-74.
29. Guide to Belfast. By ditto.
30. European Mail, February, 1875.
31. British Trade Journal, January and July, 1875.
32. Journal of the Society of Arts.
33. Proceedings of the Royal Society of Edinburgh, 1874.
34. Memoirs of the Geological Survey of India, vol. x, Part 2; vol. xi, Part 1.
35. Palæontologia Indica (Fauna of Fluviatile Deposits), vol. 1, Part 1.

36. Records of the Geological Survey of India, vol. vii, Parts 1, 2, 3, 4.
37. American Journal of Science and Arts, vol. ix, 1875.
38. Journal of the Franklin Institute, vol. xcix, 1875.
39. Memoirs of the Boston Society of Natural History, vol. ii, Part 4, Nos. 2, 3; Part 3, Nos. 4, 5.
40. Proceedings of the Boston Society of Natural History, vol. xvii, Parts 1, 2, 3, 4; vol. xviii, Part 1.
41. Eighth Annual Report of the Trustees of the Peabody Institute.
42. Proceedings of the Academy of Natural Sciences, Philadelphia, 1874-75.
43. Annals of the Lyceum of Natural History, New York, vol. xi, Nos. 3-6, 1875.
44. Bulletin of the Essex Institute, vol. vi, Nos. 1-12.
45. Proceedings of the American Antiquarian Society, 63 & 64, 1875.
46. Transactions of the Academy of Science, St. Louis, vol. iii, No. 2.
47. Occasional Papers of the Boston Society of Natural History; the Spiders of the United States, ii, 1875.
48. Accidents, Emergencies and Poisons.
49. Mémoires de la Société Royale Des Antiquaires du Nord, 1850-60, 1866.
50. La Question de L'Equidomoïde et des Cristalloïdes Géométriques. By Le Cte. Leopold Hugo, 1875.
51. Annales des Mines, tome 6, Part 5; tome 7, Part 2, 3.
52. Bulletin de la Société Géologique, Paris, tomes xix, xx, xxi.
53. Cosmos, di Guide Cora, Torino, vol. ii, Nos. 4, 5, 6, 7, 8, 9; vol. iii, No. 1.
54. Vierzehnter Bericht über die Thatigkeit des Offenbacher Vereins fur Naturkunde, 1873.
55. Abhandlungen heransgegeben vom Naturwissenschaftichen Vereine zu Bremen, 1873, 1874, 1875.
56. Verhandlungen des Vereins für Naturwissenschaftliche unterhaltung, zu Hamburgh, 1871-1874.
57. Ueber die Wasserabnahine in den Quellen, Flüssen und Strömen. Wien, 1873.
58. Beilage No. 3, 4 zu den Abhandlungen des Naturwissenschaftlichen, Vereins zu Bremen, 1874. Bremen.
59. Dreizehnter Bericht uber die Thatigkeit des Offenbacher Vereins fur Naturkunde im Vereinsjahre, 1871-1872.
60. Forhanlinger i Videnskabs-Selskabib i Christiania, 1872-73.
61. Nyt Magazin for Naturvidenskaberne, 1873, 1874.
62. Jættegryder og Gamle Strandlinier I Fast Klippe, 1874, Christiania.
63. Om Skuringsmærker, Glacialformationen Tenasser og Strandlinier, 1873, Christiania.
64. Grundtrœkkene I Den Ældste Norske Proces, 1874, Christiania.
65. Enumeratio Insectorum Norvegicorum, 1874, Christiania.
66. Die Ægyptischen Denkmäler in St. Petersburg, Helingfors, Upsala, und Copenhagen, 1873, Christiania.
67. Clavis Poëtica Antiquæ Linguæ Septemtrionalis. Hafniae.
68. Norske Fangst-Skipperes Opdagelse of Kong Karl-Land, 1872.
69. "Alberts" Expedition ti Spidsbergen I November og December, 1872, Christiania.

70. Om Visse Virkinnger of Stromme paa Vandets of Luftens Temperatur, 1873, Christiana.
71. Tillæg Til Aarboger for Nordisk Oldkyndighed og Historic Aargang, 1866, Kjöbenhaven.
72. Det Kongelige Vorste Frederiks Universitets, 1873, Christiania.
73. Postola Sögur, 1874, Christiania.

The following publications have been subscribed for by the Institute, and received during the year:—

The Edinburgh Review.
The Westminster Review.
The London Quarterly Review.
The British Quarterly Review.
The Contemporary Review.
The Fortnightly Review.
The Saturday Review.
Blackwood's Magazine.
The London Lancet.
The Medical Times and Gazette.
The British and Foreign Medico-Chirurgical Review.
The American Journal of Medical Sciences.
The Half-yearly Abstract of Medical Sciences.
The Medical News and Library.

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THE EASTERN ORIGIN OF THE CELTS.

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I do not purpose giving a review of Pritchard's well-known book upon this subject, or of any theory yet proposed, but the results of independent investigation from an entirely new standpoint. In various papers laid before the Institute, as well as in others which have appeared elsewhere, I have undertaken to prove the great importance, in an ethnological point of view, of the genealogies of the first book of Chronicles.[1] It is among these that I find the eponyms of various Celtic peoples; and the concurrence of their names in various countries, from India in the east to Britain in the west, has enabled me to open up one of the most interesting fields of ethnological research. The Sumerians and Accadians are at present occupying the attention which Pelasgians and Etrurians once held, and it is, therefore, with no little satisfaction that I find the Celtic origines shedding light upon the history of these ancient peoples. It will be remembered that the Celts have ever claimed a Scythian ancestry, and, therefore, it need not be surprising to find them related to the old Scythic or Turanian stock of Babylonia.

1 The Horites, Canadian Journal, May, 1873.
The Shepherd Kings of Egypt, Canadian Journal, April and August, 1874.
The Primitive History of the Ionians, Canadian Journal, May, 1875.
The Origin of the Phœnicians, British and Foreign Evangelical Review, July, 1875.
The Hornets of Scripture, Presbyterian Quarterly and Princeton Review, October, 1875.
The Traditions of the People of Mexico and Peru identified with the Mythology of the Old World, Comptes Rendus du Congres International des Americanistes, Nancy, 1875.

The eponym of the Celts is in the Bible called Gilead; not he who was a descendant of the patriarch Joseph, but a much older personage, who named the region on the Jordan long years before the birth of that son of Israel.[1*] The genealogies of the Gentile and of the Israelite Gilead are confounded in our present text of the book of Chronicles.[2] Etymologically, Gilead is the hard, rough, stony region,[3] suiting admirably the character of the place thus named, and according with two tracts, a smaller and a greater, to which it was transferred, Homer's "Rocky Calydon," and "Caledonia stern and wild." The Gileadites were represented in the region of the Euphrates by the Chaldeans or Kaldai, a tribe—the leading tribe it is said—of the great Accad family.[4] Originally a mountain race, they came from the borders of Armenia, in which country Khaldi, or Gilead himself, was the supreme god.[5] The ancient British word Culdee, like Chaldean, is not primarily a religious, but an ethnic designation. Galatian and Celt are two later forms of the name Gilead. It is to be remarked, however, that Gilead has, for its third literal constituent, the Hebrew *Ayin*, which, although frequently rendered by a vowel, is, in transliteration into the Greek, and into some of the languages of the cuneiform inscriptions, generally represented by *g*, or some similar letter.[6] Gilead thus becomes Gilgad, and appears in this form in Calicut, Calycadnus, Chalcedon. The emphasizing of this third letter weakened, in certain cases, the power of the final *d* or *t*, so that Cilicia, Chalcis, Gallœci, and similar terms, arose out of it. Chalcitis, Chalcidice, and like words, however, serve to lead back to the original root.

Thus far I had proceeded in my work of investigation some time ago, but had despaired of arriving at anything definite, for want of further materials, believing that the Bible genealogies of Gilead related to the Israelite of that name. This belief was staggered when I studied the list of Babylonian monarchs discovered by Mr. George Smith, and utterly overthrown when further investigation gave me the results which I now set forth. An early Babylonian king, about whom at present nobody knows anything but the name, was Ulam Buryas.[7] Ulam is so rare a name, as anyone who consults

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1* Gen. xxxi. 47. Jacob made use of an existing name. Gen. xxxvii. 25.

2 Compare Numb. xxvi. 30, and 1 Chron. vii. 17.

3 Gesenii Lexico in loc.

4 Rawlinson's Herodotus, App. Book 1, Essay xi.

5 Anthon's Clas. Dict., Art. Chaldæa. Rawlinson's Herodotus, App. Book 1, Essay x.

6 Vide proper names in Septuagint and Babylonian tablets.

7 Records of the Past, Vol. v. p. 79.

a dictionary of proper names may see for himself, that I felt justified in connecting tentatively the Babylonian monarch with a grandson of Gilead bearing an identical name, especially as he is called the son of Peresh, which bears no very distant resemblance to Buryas.[8] I do not say that he was the same person, although I think it more than probable. Happily the coincidence led to a knowledge of facts which by no means depend upon it for their weight.

The sons of Gilead were Peresh and Sheresh. The elder of these had two sons, Ulam and Rakem; and Ulam had a son Bedan. Peresh, the horseman, is not an Israelite name, and at once, in form and etymology, directs us to Persia. Rakem, however, has Celtic connections. The word means *striped, woven of variously-coloured threads,* and accords with the Celtic *breac, brykan,* which have the same signification. The prefixed *b* is what I have so far called the Coptic article, but as I have no ground for believing that the Gileadites were ever in Egypt, it is better to regard it as an early prefix common to many languages.[9] That I am doing no violence to etymology in introducing such a prefix in this place, will appear when I anticipate by mentioning that the Hyrcanii of Persia were called Barcanii or Paricanii. Ulam and Bedan are of uncertain etymology in Hebrew, but are significant enough in Celtic.

Independently of Gilead and the Celtic relations already indicated, the name Peresh is sufficiently near to the Bible name for Persia to call for a comparison. I need hardly say that the word is itself Persian as well as Semitic, and retains, in that language, the meaning "horseman," while it designates the Persians proper. Pezron, in his "Antiquities of Nations," is the only writer whom I have found suggesting a connection of Persians with Celts, although many have united the former people with the Germans.[10] Susiana, nearest to Chaldea, is regarded as an early abode of the Persians, and its Elymais as the Elam by which the Scriptures at times designated Persia.[11] Elymais, however, I maintain to have been Ulam originally, inasmuch as in it we find the Ulai river, which is the

8 1 Chron. vii. 16.

9 The Coptic Element in Languages of the Indo-European Family, Canadian Journal, Vol. xiii. Nos. 4 and 5.

10 The Antiquities of Nations, more particularly of the Celtæ or Gauls, by M. Pezron, London, 1706.

11 Persia, in Scripture, is called Elam and Paras. The former name is that of a descendant of Shem.

only Bible proper name that etymologically agrees with Ulam.[12] Sura, Aracca, Brixia, Urzan, and Badaea, may represent Sheresh, Rakem, and Bedan. What is wanting in Susiana, however, Persis supplies. Persis, named after Peresh, and still, as Fars, denoting the horse, contained Elymaei, or the descendants of Ulam, the son of Peresh. The Rhogonis river is a well-marked trace of Rakem; and, still more remarkable, the rare word Bedan is represented by Batthina, situated upon a lake not far from Persepolis. The Mesembria Chersonesus, lying off the coast of this province, is no less a sign of original Celtic occupation than that which Humboldt found in the Thracian Mesembria.[13] Media tells the same story. The Gelœa Mountains may or may not relate to Gilead, but Pharasia, Elymais, Rhagiana, and Batana, set forth Peresh, Ulam, Rakem, and Bedan. Rakem rises into independent existence in Hyrcania, the people of which, as I have already stated, were called Barcanii and Paricanii. As a mountainous country, we shall yet find it reproduced in many mountain tracts.[14] Its district, Syracene, should indicate amicable relations between Rakem and his uncle Sheresh. There were Parsii in Gedrosia, and, although Ulam is unrepresented, Rakem appears to have left distinct traces in Rhogana, Rhagiana, and the Paricanii, while Bedan furnished Badis in the extreme west. In Aria, also, there were Calatii or Gileadites, with Parsii of Peresh and Arachoti, who may have been of Rakem. Parsii, Elamites, and Hyrcanians, with Syracenians, thus seem to have been the chief inhabitants of the Persian empire proper. The descendants of Bedan were not sufficiently removed from the centre to rise to the dignity of a nation, and the name of Gilead, except in Aria, was merged in those of his children.

It would accord with the notions of the Sanscritists to derive this and all other families of civilized men from the mountains of northern India.[15] The Gileadites are found in India, but plainly as immigrants from Persia. They were the Calatii of the Ganges, of whom

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12 Dan. viii. 2. It is the classical Eulæus.

13 Anthon's Class. Dict., Art. Mesembria.

14 Such were Rhagiana in Media; Argæus and Arganthonius of A. Minor; Aracynthus of Ætolia; Arachnæus in Argolis; the region of the Hercuniates in Pannonia; Eryx in Sicily; and the Hercynian Wood in Germany.

15 Nothing can be more absurd than to derive populations from an extremity rather than from a centre. Sanscrit, valuable as it is for comparative purposes, affords the explanation of nothing. Its high development as a language makes it of as little value for such a purpose as the Greek and Latin tongues.

the Prasii, who occupied so much of northern India, were a great division.[16] The ancient Parisaria and the modern Calcutta near the mouths of the Ganges, represent also Peresh and Gilead. But the Ganges itself bears the name Padæi, and Herodotus mentions an important Indian tribe, so called, dwelling with the Calatii.[17] This is the posterity of Bedan rising into notice, and beginning that system of river-naming which Padus, Baetis, and other western streams exhibit. Baetana, or Patna on the Ganges, or Padæi, indicates Bedan's right to be considered its eponym; and Bhotan, the home of the ancient Badasae, seems to perpetuate his memory in the East. The Budini generally relegated to Sarmatia, and who have been supposed Germanic or Celtic, were probably Bedanites.[18]

Returning to our point of departure, which was Susiana, and proceeding westward, we find in Chaldea, the land of the Gileadites, *par excellence.* A large class of its inhabitants were the Orcheni, who were doubtless the same as the Hyrcanians, or descendants of Rakem.[19] Ulam does not appear, but Pudna represents Bedan. In Babylonia, Peresh is represented by Bursia and Perisabora, Sheresh by Sura, and Rakem by Arsiana. Mesopotamia is more full. Gilead, Peresh, Sheresh, Ulam, and Bedan, are easily recognizable in the related Chalcitis, Persa, Porsica, Sareisa, Alamus, Alama, Batnæ, Betonsa, and Aphadana. Armenia was the original home of the Chaldees or primitive Celts,[20] and there, accordingly, we discover Chaliat, Parisa, and Arsene, on which Patansana was situated, just as Arsacia is a lake of the Rhagianæ in Media, and Batthina lies on the lake of Persis. Arsiana and Arsene are softened forms of Hyrcania or Orchœne, representing Rakem. Strabo tells us of Chaldeans in Irak Arabi.[21] These were no doubt the Chaulothæi of Arabia Felix, near whom were found Saraceni, the descendants of Sheresh, and probably the Saracens of a later time. On the Red Sea, the family of Gilead left ineffaceable records in the country of the Elamitæ, with the maritime and inland towns Pudni (Badanatha ?) and Vodona. Palestine I pass over, as in it our sources are given.

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16 Herodot iii 38, 97. Strab xv. 1, 36.

17 Herodot iii 99. Wheeler, Geography of Herodotus, 310.

18 Rawlinson's Herodotus, iv 108 note.

19 Vide Bryant, Analysis of Ancient Mythology, i 261. This ingenious writer connects the Orchoeni with the Hyrcanii of Persia, and the Germans of the Hercynia Silva.

20 Rawlinson, in his Herodotus, i. 181 note, seems to look upon the Armenian Chaldeans as a colony, thus disagreeing with Michaelis, Adelung and Fuerst.

21 xvi. 1, 6.

Syria, however, carries on the Celtic stream to the north and west, furnishing, as landmarks in its progress, Chalcidice, Elemais, the region of the Urchœnses,[22] and Batnæ, with which the large nation of the Patena, mentioned in the cuneiform inscriptions, and placed in northern Syria, must be connected.[23] It is interesting to find Bedan developing into a nation at about equal distances to the east and north-west from the original Persic centre. From Syria the Celts passed into Cilicia and Cappadocia, unless the colonists of the latter province came direct from Armenia. Cilicia itself is a form of Gilead, in which the emphasizing of the *ayin* has caused the rejection of the final *d*. The river Calycadnus, however, exhibits the full dimensions of the word. The learned Bochart, whose etymologies I would not always vouch for, was, I think, right in rendering Celenderis as the land of Gilead.[24] Clitæ is a shortened form of the same. Sheresh and Ulam may appear in the Sarus and Holmi, and Rakem in Trachea. Cappadocia supplements Cilicia. To the Sarus it adds Siricis for Sheresh. Rakem once more denotes a mountain range in Argæus. Diana Perasia, worshipped at Castaballa, may denote some connection with his father Peresh. But Bedan is unmistakable in Badinum, Podandus, and Ptanadaris, the latter a word resembling Celenderis. There were Chaldæi in Pontus, as Strabo and Stephanus of Byzantium inform us, who were no doubt immigrants from Armenia. Galatia indicates a returning wave of the Celtic tide in its westward course. Its Trocmi were probably Rakem's people, with an initial *T* that we shall yet meet with, and the Epetobriges are the Bedanites, with the addition of the Celtic *brig*. Many writers connect the Phrygians with the Brigantes, but for this I have absolutely no data.[25] The Pitanæi, of Lycaonia, were of Bedan. Bithynia, however, is altogether Celtic or Gileadite. Here Bedan appears as in Bhotan and Patena, superseding the Elymæi of his father and the Parsii of his grandfather with his own name. The Bebrycians, or ancient Bithynians, were of Peresh, and their name connects with the Greek Buprasium and the Gallic Bibracte, the initial *B* being in each case reduplicated. Prusa also, I am convinced, was far older than the historical king Prusias, and represented a simpler form of Peresh.[26] Elæum may have been

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22 Bryant, Analysis, i. 260.

23 Vide Map of Western Asia in the Assyrian Period, Rawlinson's Herodotus, Vol. i.

24 Gilead eretz. Bochart, Canaan.

25 Anthon's Class. Dict , Art Brigantes.

26 Strabo (xii. 4. 4) states that Prusias, the founder of Prusa, fought against Crœsus. This, at least, is evidence of its antiquity.

a reminiscence of Ulam; but Arganthonius Mons keeps up the Hyrcanian connection. Clitæ and Chalcedon unite the Bithynians with Gilead. There are other geographical names related to those already mentioned, in Mysia and Lydia; such as Pirossus, Elœa with Pitane, Pytna and the Hyrcanian Plain,[27] but these are sporadic, and do not belong to the main stream of migration.

Passing into Europe, Thrace betrays affinity with Bithynia. Its Celletæ were doubtless the founders of Chalcedon in Bithynia, who also built Byzantium and Selymbria. The latter word presents a Celtic form that has already appeared in the Mesambria of Persis. Selym, however, is a sibilant form of Ulam, and exhibits the Elymæi preparing for their western name of Ulam-briges or Allobroges. Gallaica was the name of the coast on which it was found. Salmydessus or Halmydessus may be another form of the same name. Byzantium, from its connection with Chalcedon, and geographical relations with Bythias and the Bathynias river, would seem to be a corruption of Bedan. I am inclined also to give this honour to the Bistones who dwelt between the eastern part alluded to and the west of Thrace, where Siris and Prasias commemorated Sheresh and Peresh. The *s* which precedes the *t* of Bistones is adventitious in other Greek words taken from oriental languages, as in *bistakion* from the Hebrew *beten*, the pistachio. Macedonia contained a large district called Chalcidice, as well as many other Gilead-like names. Baerus, to the north of Gallicum, might indicate Peresh. But, opposite Chalcidice, Pydna, near the region of Elymea, seems to reproduce the geographical nomenclature of Persia, Mesopotamia, Arabia, and Syria.[28] Almona, farther north, may be another form of Ulam, and the Erigon, near at hand, is plainly the river of Rakem. Although it sheds no light upon the family of Gilead, the following connection may indicate the correctness of my inductive process. In Macedonia, near Elymea, Ægestæa appears, which is the same name as the

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27 The Hyrcanian Plain is said to have been named by the Persians after their conquest of Asia Minor

28 It is certainly not a little remarkable to find names so similar in constant union.

In Susa	we have	Elymais and Badæa.
In Persis	"	Elymæi and Bathina.
In Media	"	Elymais and Batana.
In Arabia	"	Elamitae and Pudna.
In Syria	"	Elemais and Batnæ.
In Macedonia	"	Elymea and Pytna.
In Sicily	"	Elymii and Pittineo.

Also in Eubœa and Arcadia are Elymnium and Elymia with other Gileadite connections.

Persian Segestan, Segeste, of Pannonia, Segeste of Liguria, and Egesta of Sicily, all of which countries have most intimate relations with the Elamite family of Gilead.[29]

Greece contained Celtic elements, especially in the closely allied populations of Ætolia and Elis. There were Gileadites, however, in Thessaly. Elatea may possibly be a form of Gilead's name, but Calathama suits better with the original. Piresia and Pyrasus should represent Peresh, and Trachin, Rakem. But the best evidence of Elamite occupation is the river Apidanus or Salambria, answering to the Bathynias in the neighbourhood of Selymbria, and the Padæi of India, to the north of which appears Selampura.[30] Ulam, with the *brig* termination, is here connected with his son Bedan. Potniæ, of Magnesia, establishes the identity of Bedan and Apidanus. In Epirus our search will be found not so successful. It also had an Elatæa; and Ulam might have been the original of Elæa, or better still, of Aulon, with which the Hebrew meaning of the word agrees; while Batiæ suggests Bedan. What is wanting in Epirus, however, may appear in Illyria. Gilead is there set forth by Claudanum and the Callicœni. The Perisadyes and Sesarethii no doubt exhibit Peresh and Sheresh. Ulam appears with a *D* prefix in Delminium, and perhaps in Dalmatia. Putamnus, Epidamnus, and Bassania, are three different forms of Bedan; and Dyrrachium, the other name of Epidamnus, must have come, like Trocmi, from Rakem. Evidence will yet appear for accepting Bassania and Dyrrachium in this connection. Already I have suggested the unity of Gilead and rocky Calydon in Ætolia. Chalcis, the modern Galata, near at hand, confirms it. Olenus may give us Ulam, but Aracynthus Mons and Trichonis Palus are alike memorials of Rakem, the former connecting with Hyrcania, Argæus, Arganthonius, &c., and the latter with the Trocmi and Dyrrachium. The Apodoti, with the town Phytæum on the Palus, commemorate Bedan. Phocis has Elatea, Trachin,

29 The Sicilian Egesta was closely connected with the Elymii The Segustani of Gaul, who dwelt in the immediate vicinity of the Allobroges, exhibit the same phenomenon.

30 The termination bria, bora, pura, appears at the very commencement of our researches. There was a Mesambria off the coast of Persia; a Selampura in India; a Perisabora, or ancient Presburg, in Babylonia. We find the same form connecting Bedan in the Epetobriges of Galatia. Perisabora, Selymbria and Epetobriga show three descents, or Peresh, Ulam, and Bedan.

Bedan's name, which has maritime, or at least water significations in the Celtic languages, was fitly applied to rivers. Thus the Padæi, or Ganges; the Badus of Syria; the Bathynias of Thrace; the Apidanus of Thessaly; the Padus or Bodincus, the Padusa, the Bedesis, the Batinus of Italy; and the Bætis of Spain received their names from it.

and Pediœa; Bœotia has Holmia, Eleon, Delium, Potnia, and Peteon, with Orchomenos for Rakem, and Chalcis on the opposite coast of Eubœa for Gilead. There was also an Elymnium in Eubœa. On the Isthmus we find Chalcis, Piræus, Saron, and Olmiæ. Attica is fuller, in Chollidæ, Prasiæ, Piræus, Alimus, Halimusia, Erasinus, and Aphidna. Peloponnesus has a few traces of Celtic occupation. In Arcadia the Celadon, the Parrhasii, Elymia, and Orchomenos must refer to Gilead, Peresh, Ulam, and Rakem. Argolis contains another Celenderis, reproducing that of Cilicia, a Saron, an Elæus, a Troezen, and an Arachnæus Mons. In Elis, a region which mythology intimately connects with Ætolia, we find Chalcis and the Cladeus, with Buprasium, a Bebrycian form of Peresh. Messenia furnishes Pharis and Aulon; and Laconia contained Calathion, Prasiæ, Brysiae, Pharis, Delium, and Pitane. Among islands, the Calydnæ, and Celadussa or Rheneia of the Cyclades, were Gileadite, while Paros and Syros of the latter group, evidently received their names from the descendants of Peresh and Sheresh. Peparethus and Solymnia, off the Thessalian coast, seem to have been peopled by the Peresh and Ulam family. In Crete we find Prasus, Olus and Pytna.

Mœsia was largely Sarmatian, but in the east, Callatis, Trosmi (Trocmi) and Bizone (Byzantium) indicate Celtic occupation. Further west on the Danube, however, we meet with Almum and Bononia, setting forth Ulam and Bedan. The modern name of Bononia, which is but a restoration of its original designation, is Bodon, and thus we are furnished with a solution of the difficulties presented by the word Pannonia, which is preëminently the land of the Bedanites. All writers are agreed that Pannonia's most ancient population was Celtic.[31] There we find Coletiani. It contained a lake Perso, reproducing the lakes of Persis and Hyrcania, and on it Ulmum named after Ulam was situated; while Bassiana near at hand, by its modern name Bodonhely, justifies the association of the Illyrian Bassiana with Bedan. The river Parisus keeps up the Peresh connection; and another Ulmi and another Bassiana in the south proclaim the presençe of the Ulam and Bedan line of his family. Meanwhile Rakem appears, Hyrcanian-like, in the Hercuniates, a mountain race, and north of these is the Volceæ Palus, on which Tricciana recalls Trichonium on the Trichonian Lake of Ætolia.

[31] Vide Strab., vii. 5, 2 seq.

This Volceæ Palus must connect with the Volcæ or Arecomici (Hercuniates) of Gallia Narbonensis; with Lacus Vulsiniensis of Etruria, and the Volsci of Latium, which will yet be proved to have been centres of the Gileadites; with Vologesia of Babylonia north of the Orcheni; and with the Volsas Sinus of northern Caledonia.[31*] I do not know whether the Bolitæ on the borders of Aria belong to this Volcic family, nor can I at present tell how it and that of the Ægestani relate to the stock of Gilead. The fact of a repeated geographical connection is, however, evidence of some importance. Still another tribe, bearing the names Savadii in Persia, Sabæi in Arabia, Sophenes in Armenia, Sabæi in Cappadocia, Sapæi in Thrace, Savii in Pannonia, Suevi in Germania, &c., maintains constant geographical relations with the line of Gilead. Of these people also, at present I know nothing. The Varciones of western Pannonia are probably the same as the Hercuniates of the east, the sole difference between the names being that which we have already found between Barcanii and Hyrcanii. In Vindelicia, Vetoniana still furnishes a trace of Bedan, and Biriciana and Bragodurum may be forms of Peresh. The Alauni of Noricum were I think the people of Ulam, appearing in a Gallic and British form.[32] Vetoniana again carries forward the Bedanites; and Fasiana and Bidæum may be variations of the name. In the south of Rhætia we meet with the town Sarraca and the Ollius river as reminiscences of Sheresh and Ulam. The Brigantii of the northwest are the Barcanii of Rakem, the Galli Braccati, who were not so much the wearers of *braccæ*, which it is well to remember were articles of dress in use among Persians, Germans and Celts, but rather of the *brychan* or *brygan* which is the Scotch plaid of various colours, answering as no other word does to the Hebrew *Rakem*.[33]

Italy, it is generally conceded, contained a large Celtic element. In Venetia, however, Vedinum, a form of Bedan, is the only trace which at present concerns us, unless we suppose that some of the places bearing the name Julius received it from a Gallic ancestor of the people inhabiting them rather than from the Caesar of that

31* To these must be added the Velocasses of Gaul, who dwelt between the Caleti and Parisii.

32 The Alauni, who may be the Alans, do not appear as a nation, Alemanni and Allobroges being the names by which they were known; but Alauna and Allieni in Italy, Gaul, and Britain mark their course.

33 The Erse *breacaim*, meaning to speckle, variegate, chequer, embroider, is identical in meaning with the Hebrew *rekem*. Breacan, a plaid, in the same language, agrees with the Welsh *brychan*. It was the dress of the Brigantes or Rakemites.

name. This seems more than probable, and, if true, would refer us to Ulam. Gallia Cisalpina is more important. The Galli are themselves Gileadites. Brixia gives Peresh; Ollius and Allieni, Ulam; Regium and Bergomum, Rakem. But India is reproduced in the Padus or Bodincus, on which Padinum answering to Patna, was situated. Two other rivers, the Padusa and the Bedesis, with Fidentia, indicate the supremacy of the descendants of Bedan. Liguria also preserved Gilead's memory in Clastidium, and that of Rakem in Ricina and Rigomagus. Pedona, also called Dalmazzo, thus united the names of Bedan and his father Ulam, the latter designation answering to Dalmatia and Delminium and finding the parallel, if not the explanation, of its final *z* in Olmuz, the modern form of a Bohemian Ulmi. Bodincomagus and Potentia are other relics of Bedan. Etruria, the Volscian connections of which I have already indicated, exhibits relations with Gilead and Peresh in Calletanis, perhaps in Clusium, and in Perusia.[34] Not far from the latter place was Vettona of Umbria, which also contained Pittinum and Sarsina, thus adding Bedan and Sheresh. Rakem appears in Ricina of Picenum, and there also Bedan had memorials in the Batinus river, Pitinum and Potentia. Latium, where Volsci were found, showed its Celtic side in Collatia, Sora, Almo, Tarracina, and Pedum. Bedan's supremacy is still visible in Pitinum and Fidenæ of Sabinum; but his name undergoes a change that may indicate relations with the namers of Aphadana in Mesopotania, Apidanus of Thessaly, and Aphidne of Attica, in Aufidena and Æbutiana, which appear along with Calatia in Samnium. Campania repeats the tale of migration in Calatia and Betina; and Apulia, in Collatia, Galesus, and Batuntum. Lucania revived the memory of Sheresh in Siris, and added Potentia to the numberless records of Bedan. Rhegium of Bruttium must have been named by Rakem's descendants, as it was a Chalcidian colony.[35] In Sicily the long missing form of Ulam's name reappears in the neighborhood of Ægesta, where Elymus the Trojan left the Elymii.[36] Eryx near at hand may, as a mountain name and that of

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34 Perusia must have been an ancient seat of the Parisii. Trasimenus Lacus, answering to Trichonis, &c., and Tarquinii, seem with Perusia to suggest that the Tyrseni of Tarchon were Rakemites, which the original Rasena appears to confirm. The Vetulonii of Tuscany and its Lucumos serve to indicate, what other connections render certain, that the family to which Gilead belonged was that of Bethlehem, the name Lucumo coming from Lechem, and Vetulonia preserving the entire name. Bit Ulmas, of the cuneiform inscriptions, should connect with this line.

35 These Chalcidians were of Eubœa. Pausanias, iv. 23.

36 Strab. xiii. 1, 53.

a king of the Elymii related to Butes, set forth Rakem. Syracuse seems to indicate that Sheresh had the chief representation in the island,[37] but Gilead, Peresh, and Bedan were worthily commemorated in Galata, Pergusa, Bidis and Pittineo. Corsica had a Pitanus.

The western peninsula of Europe contained a large Celtic or Gileadite population. Gallia Cisalpina and northern India live again geographically in Bætica, for the Bætis, with its town Bæton, is the counterpart of the Padus with Padinum and the Padæi with Patna. Ulam accompanies Bedan in the two different forms Ulia and Selambina, while Regina and Urgaon, which should connect with the more northern province, show that the descendants of Rakem dwelt in harmony with those of his brother. In Lusitania there were Celtici. Arucci is a Spanish Eryx, and Brigantum indicates a western extension of the Brigantes. Elmantica or Salamanca doubtless arose from the presence of Ulam's descendants, which the Vettones or people of Bedan so plainly confirm. The very name of Tarraconensis, if its modern equivalent Aragon did not recall Rakem, would do so by its resemblance to Tricciana, Trichonis, and similar words already connected with him. The Callæci and Caladunum, Bergusia and Betunia link with his the names of Gilead, Peresh, and Bedan, while other memorials of himself are found in Barcina and Brigecium. In Gaul the Caletæ of Normandy preserve intact the Gileadite name. Not far from them dwelt the Parisii, whose city Paris was a western version of Persepolis and Parisaria of the Persii and Prasii, or a northern Perusia. Bibrax, Bibracte, and similar names exhibit a reduplication of the initial letter of the same word, such as we have found in Bebrycia and Buprasium. The Betasii bordering on Batavia were Bedanites of the same stock. In the west of Gaul, Alauna, Arægenus and Rigunea were memorials of Ulam and

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[37] As Sheresh is mentioned alone in the genealogy, it is difficult to trace his line, save by such analogies of form as Syracusæ and Pergusa present It is not impossible that the Serica of North-Eastern India, whence the Serici or Emodi Montes took their name, as well as the Serus river of what is now Siam which flowed through a region Chalcitis, indicate ancient seats of the family of Sheresh With these, Sariga in Margiana should connect, as well as Suragana in Bactriana The Bautes and Bautisus rivers of the Seres seem to unite them with the stock that named the Padæi, Padus, &c. These Seres, or workers in silk, seem fully identified with the Chinese. Bryant, in his Analysis, v 227, represents them as belonging to the Scythic family In the third volume of the same work (p. 425) he explains the fable of Arachnæ as arising from the skill in weaving of the Orchœni of Chaldea. Rakem, the inventor of tartan, may thus have been of the same stock as the silk workers of the far east. It is worthy of note that the Celtic for silk is *sirig*, *seiric*, and for the silkworm *seiriceau*. The Saracens were silk workers, as our English word *sarcenet* proves. It would be not a little remarkable to find th Chinese and the Celts of Europe so closely connected.

Rakem. Petenesca of the Helvetii answers to Bodencus, Betonsa, and other appellations of Bedan's descendants. In the south, the Volcæ or Arecomici, who have already been noticed as the progeny of Rakem, were found in close proximity to the Allobroges, whom I have identified with the Elamites of Ulam. Selampura, Selymbria, Salambria, exhibit the form of Ulam's name (Ulam-Buryas) out of which the term Allobroges was developed. A confirmation of this is found in a statement of Latham's that the termination in *ncus* which appears in Bodencus is characteristic of the Allobroges.[38] After quoting examples, he cites also Habitancum as showing a British analogy, in apparent ignorance that the latter name is peculiarly Allobrogic.[39] Alamon, Bergusium, Bautæ, and Batiana were towns in the region of the Allobroges and Arecomici, setting forth Ulam, Rakem and Bedan. Before dismissing Gaul it is worth observing that the tribe of Celtic barbarians led by Brennus was that of the Prausi, who were the Persii, Prasii or Parisii of Peresh,[40] and that some of their posterity were known as the Bathanati or people of Bedan.[41] In Bathanatus, the head of this family, we must find the Baton whom Strabo mentions as chief of the Pannonians.[42] The Gileadites passed into Britain and named the Caledonia Silva, beginning at Carlisle. In that region also we find Calatum, preserving the same name. There also the Parisii appear, and with them the Brigantes, while Alauna, Elius, Alone and Habitancum help to

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38 Ethnology of Europe, 52.

39 Habitancum in the north of Britain is a form uniting Apidanus or Aphaduna with Bodincus, and appears in a strongly marked Gileadite region. While the reminiscences of Bedan in the south of Britain exhibit no prosthetic letters, *e. g* Badon, Boduni, Bedan-ford, those in the north are always preceded by a foreign vowel, as in Habitancum, Ebuda, Epidii. A similar phenomenon is observable in Mesopotamia, Galatia, Thessaly, Ætolia, Attica, Illyria, and Samnium. Some minor ethnic difference may account for the variation.

40 Strab. iv. 1, 13.

41 Athenaeus, vi. 25.

42 Strab. vii. 5, 3. Brennus entered Pannonia, Pausan. x. 19. Phæthon, well known in classical story, whom Pausanias and others connect with Liguria and the Padus or Eridanus, was probably Bedan himself; his father Helius being Ulam, whose name the Greeks being ignorant of and receiving under the form Eulæus, thus converted into a well known word. The original Eridanus was the Jordan of Palestine. The connection of amber with this story is that of the Gaelic Ambrones. These I have connected with Zimran, the son of Keturah. Zimran in Hebrew means "a song," and is identical with the Celtic "amhran," bearing the same meaning. Amber is itself a Celtic word, "omar, omra, ombra." The Greek elektron is derived from Electra, a form of El Keturah, or the name of Zimran's mother with the Arabic article. Sacal, the Coptic for amber, seems to point to Eshcol, who, in all probability, was the brother of Keturah. The amber stones of the Celts in England and elsewhere were sacred monuments, and from them probably, small things taking their name from great, amber, as a sacred substance, received its designation.

establish the fact of an ancient occupation by the family of Peresh in all its branches. In the south-west about the Severn, the same stock appears, in Ariconium, another Alauna, and in the large tribe of the Boduni or Dobuni, to whom Badon or Bath belonged. Bedanford or Bedford, farther to the east, is an indication that Bedan's descendants once had a settlement there. Besides the name Caledonia, Galda or Galloway, and Glota, or the Clyde, kept up the memory of Gilead. Galda was also called Brigantum, and may have received its population from the Brigantes in the south of Ireland. A Caledonian Alauna represented Ulam, and the name of his son Bedan was still conspicuous in Epidia and Ebuda, with which the Volsas Sinus united the Volcæ of the continent. I am persuaded that the ancient British and Irish annals contain materials for restoring the history of the Gileadite line back to the times of their earliest achievements on the banks of the Euphrates.

Had I been framing a theory of Celtic migration it would have seemed suicidal to include in it notices of German tribes, but this is, by my inductive process, absolutely necessary. Certain it is that Persians and Germans have been shown to be closely allied; and ethnology has not yet settled the Cimmerian question on the side either of Germanic Cimbri or Celtic Cymri. The mountain tract of Hyrcania cannot be dissociated from the Hercynian Forest, and it is reasonable to believe that the enclosed Varisti were the posterity of Peresh. The Batini farther to the north were of Bedan. Olmuz of Bohemia is a memorial of Ulam, and Bamberg or Bedan-berg on the Maine, of his son. The Frisii of Batavia were the Parisii under Germanic influences, and the Byrchanis Insula off their coast, a link to bind Rakem to Peresh. The modern Jellum retains the name of Ulam, and Bedum, with the Baduhennæ Lucus and the word Batavia itself, indicate the high importance of Bedan. It is in Swabia however, which good authorities hold to have been originally Celtic, that the German branch of the Gileadites comes most prominently into notice.[43] The very names Baden and Wittenberg (Wurtemberg) present two different forms of Bedan. Baden itself, as Aquae Pannoniæ, confirms the connection; and the Lake of Constance, as Bodamicus Lacus or the Bodensee, puts it beyond all doubt. But the Brigantes dwelt upon this lake, and another name for it was Brigantinus Lacus, thus uniting Rakem with Bedan. The Vargiones

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[43] Latham's Ethnology of Europe, 197.

of this region were the Rakemites or Brigantes under another designation. Meanwhile Ulam is not lost sight of, for the modern Ulm retains what the ancient Alemanni once imposed in memory of their ancestor.[44] Even Scandinavia must have seen an offshoot of this great family, for Phirœsii dwelt there, and Ulea and Bothnia are among their geographical traces.[45]

There were Pharusii in Libya, and a Chelida. Barca of Cyrenaica and Pithon may also have set forth Peresh and Bedan.[46] Battus, even in the days of the ancient Pharaohs who preceded Moses, was the name of the chief ruler of Cyrene, and, although I cannot think that the original Bedan removed to so great a distance from the dominions of his father Ulam, in Babylonia or Susiana, the well-known presence of Celtic traces in northern Africa lead me to believe that a branch of the family of Peresh in the line of Bedan colonized Cyrene and adjoining regions on the Mediterranean coast.[47]

Let it not be supposed that I profess, in setting forth the migrations of the family of Gilead, to account for all the Celtic tribes. I have simply accounted for those who imposed upon the whole race, if men will call it so, the name of Celt. There were numberless other Celtic families that traced no descent from Gilead and his sons. One of the most important of these was that which descended from Zimran, the eldest son of Abraham by Keturah, who seems to have married Hammoleketh or The Queen, a sister of Gilead, and thus to have been counted as part of the Gileadite line.[48] How I have arrived at a knowledge of this fact I leave unstated for the present, as I propose devoting a paper to the subject. The Kaldai were the leading tribe of the Accad. The descendants of Zimran were the Sumerians. They accompany the Gileadites throughout their whole course. Samariana in Hyrcania; Comaria in India; the Sumerians of Assyria and Babylonia; the Zamareni of Arabia; Thymbrium of Phrygia; Chimæra of Lycia; Smyrna of Lydia; Thymbra of Mysia;

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[44] Latham does not consider the Alemanni to have been Germans, but a mixture of populations, with the Germanic element preponderating. They were clearly Elamite or of Ulam. The meaning "all men" or Allophylli is unreasonable.

[45] Ptolemy, ii 2, 33. These Phiræsii were Frisians or Parisii.

[46] According to Stephanus of Byzantium, Barca was founded by a Perseus, from whom probably it received its name.

[47] Lenormant & Chevalier's Ancient History of the East, i. 260.

[48] 1 Chron. vii. 18. My means for discovering the name of the husband of Hammoleketh are found in those of her three sons. In Greek, the name by which Zimran was best known is Amphiaraus. He was the Babylonian Smirm or Zmarus, and the ancestor of the Arabian Homeritae, as we learn from Sozomen.

Cimmerians of the Tauric Chersonesus; Tempyra of Thrace; Comarus, Tomarus, Chimerium, and Ambracia of Epirus; Camara and Cimarus of Crete; Ambre of Vindelicia; Umbranum of Gallia Cisalpina; Umbria with Camerinum; Camarina of Sicily; Samara, Camaracum, the Ambarri and Ambrones of Gaul; the Cymri of Britain; the Cimbri, Gambrivii and Ambrones of Germany; and Semeros of Libya, are a few of the traces of the Sumerian or Zimranite brethren of the Gileadites. Pezron saw plainly the connection indicated, and brought his Celts from Persia, where he found them as Comarians, whom he supposed to have been the descendants of the patriarch Gomer.[49] Gilead and Zimran, the ancestors of Kaldai and Sumeri, Celts and Cimmerians, were contemporaries, and must have flourished in the days of Isaac the son of Abraham. They were thus much later than the eponyms of the Egyptian Horites and Hycsos, and were themselves preceded in Babylonia by ruling families of Ionians and others.[50] Ulam-Buryas, if he really be Ulam the son of Peresh and grandson of Gilead, appears on the lists at the right period, or about 1600 B.C., from which date the Elamites might count their time of existence; the Persi preceding them by fifty and the Celts by a hundred years.[51]

It will be observed that I have abstained from introducing mythological data into my circle of comparisons, not because these are wanting, although it is true that they are not so abundant as in many other cases, but because the geographical evidence is so strong as not to stand in need of any such assistance. The mere concurrence of words so distinctive as Gilead, Peresh, Sheresh, Ulam, Rakem, and Bedan in a single locality, would be a remarkable coincidence. I cannot therefore imagine that the unworthy sneer at verbal similarity and false analogies, with which similar cases of induction have been treated, should continue to be visited upon the results here set forth, by any honest thinker. Men to whom theories are dearer than truth, and old prejudices than increase of knowledge, will find a way of escape out of mathematical demonstration. It is enough that scholars who can appreciate the nature of the evidence I have given will also appreciate the importance of the results obtained. It remains that I tabulate these results:

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49 Antiquities of Nations, Book i. ch. 3.

50 Vide the Horites, Canad. Journal, May, 1873. The Shepherd Kings of Egypt, Canad. Journal, April and Aug., 1874; and the Primitive History of the Ionians, Canad. Journal, May, 1875.

51 Vide the Early History of Babylonia, Transactions of the Society of Biblical Archæology, i. 1.

Scripture Genealogy.		Gilead.	Peresh.	Sheresh.	Ulam.	Rakem.	Bedan.
PERSIA—							
Susiana	=			Sura	Ulai Elymais	Aracca Brixia Tragonice	Badæa
Persis	=		Persepolis		Elymæi	Rhogonis	Batthina
Media	=	Gelœa?	Pharasia		Elymais	Rhagiana	Batana
Hyrcania	=			Syracene		Barcanii Paricanii	
Gedrosia	=		Parsii			Rhogana Rhagiana Paricanii	Badis
Aria, &c.	=	Calatii	Parsii	Sariga Suragana		Arachoti?	
INDIA	=	Calatii Calcutta Calicut Chalcitis	Prasii Parisaria	Serica Serus	Selampura		Padæi Badasæ Bætana Bhotan Patna
CHALDEA	=	Kaldai				Orcheni	Pudna
BABYLONIA	=		Bursia Perisabora	Sura		Arsiana	
MESOPOTAMIA	=	Chalcitis	Persa Porsica	Sareisa	Alamus Alama		Batnæ Betonsa Aphadana
ARMENIA	=	Chaliat	Parisa			Arsene	Patansana
ARABIA	=	Chaulothæi		Saraceni	Elamitæ		Pudni Badanatha Vodona
SYRIA	=	Chalcidice			Elemais	Urchœnses	Batnæ Patena
ASIA MINOR—							
Cilicia	=	Calycadnus Celenderis Clitæ		Sarus	Holmi	Trachea	
Pontus and Cappadocia	=	Chaldæi		Siricis		Argæus M.	Badinum Podandus Ptanadaris
Galatia	=	Galati				Trocmi	Epeto-briges
Bithynia	=	Chalcedon Clitæ	Bebryces Prusa		Elæum?	Arganthonius	
Other Provinces	=		Pirossus		Elœa	Pergamus Hyrcania	Pitane Pytna Pitanæi
THRACE	=	Celletæ Gallaica	Prasius	Siris	Selymbria Salmydessus		Bythias Byzantium Bathynias
MACEDONIA	=	Chalcidice Gallicum	Bærus		Elymea Almona	Erigon	Pydna
GREECE—							
Thessaly	=	Calathama	Piresia Pyrasus		Salambria	Trachin	Apidanus Potniæ
Epirus	=				Aulon		Batiæ
Ætolia	=	Calydon Chalcis (Galata)			Olenus	Aracynthus Trichonis	Apodoti Phytæum
Phocis	=	Galata				Trachin	Pediæa
Bœotia	=				Holmia Eleon Delium	Orchomenos	Potnia Peteon
Eubœa	=	Chalcis			Elymnium		
Attica	=	Chollidæ	Prasiæ Piræus		Almus Halimusia	Erasinus	Aphidna
Corinth	=	Chalcis	Piræus	Saron	Olmiæ		
Argolis	=	Celenderis		Soron	Elaeus	Arachnæus Troezen	
Arcadia	=	Celadon	Parrhasii		Elymia	Orchomenos	
Elis	=	Chalcis Cladeus	Buprasium				
Messenia	=		Pharis		Aulon		
Laconia	=	Calathion	Prasiæ Brysiæ Pharis		Delium		Pitane
Islands	=	Calydnæ Celadussa	Paros Peparethus	Syros	Solimnia		
Crete	=		Prasus		Olus		Pytna
MŒSIA	=	Callatis			Almum	Trosmi	Bizone Bononia or Bodon

ILLYRIA	=	Claudanum Callicœni	Perisadyes	Sesarethii	Dalmatia Delminium	Dyrrachium	Putamnus Epidamnus Bassiana
PANNONIA	=	Coletiani	Perso Parisus		Ulmi Ulmum	Hercuniates Varciones Tricciana	Bassiana or Bodon-hely
VINDELICIA	=		Biriciana Bragodurum				Vetoniana
NORICUM	=				Alauni		Vetoniana Fasiana
RHÆTIA	=			Sarraca	Ollius	Brigantii	
ITALY—							
Venetia	=						Vedinum
Gallia Cisalpina	=	Galli	Brixia		Allieni Ollius	Regium Bergomum	Padus or Bodincus Padinum Padusa Bedesis Fidentia
Liguria	=	Clastidium			Dalmazzo	Ricina Rigomagus	Bodincoma- gus Pedona Potentia
Etruria	=	Calletanis Clusium ?	Perusia			Tarquinii Trasimenus	
Umbria	=			Sarsina			Vettona Pitinum
Picenum	=					Ricina	Batinus Pitinum Potentia
Latium	=	Collatia		Sora	Almo	Terracina	Pedum
Sabinum	=						Pitinum Fidenæ
Samnium	=	Calatia					Aufidena Æbutiana
Campania	=	Calatia					Betina
Apulia	=	Collatia Galesus					Batuntum
Lucania	=			Siris			Potentia
Bruttium	=					Rhegium	
SICILY	=	Galata	Pergusa	Syracuse	Elymii	Eryx M Tyracinæ	Bidis Pittineo Pitanus
CORSICA	=						
SPAIN—							
Bœtica	=				Ulia Selambina	Regina Urgaon	Bætis Bæton
Lusitania	=	Celtici			Elmantica	Arucci Brigantum	Vettones
Tarraconensis	=	Callœci Caladunum	Bergusia			Aragon Barcius Brigecium	Betunia
GAUL—							
Narbonensis	=		Bergusium		Alamon Allobroges	Arecomici	Bautæ Batiana
Lugdunensis	=	Caleti	Parisii Bibracte		Alauna	Rigunea Arægenus	
Belgica	=		Bibrax Brisiacus M.			Rigomagus Brocomagus	Petenesca Betasii
Migratory	=	Galati	Prausi				Bathanati
BRITAIN—							
Max Caes.	=	Calatum	Parisii		Alaunus Alone	Brigantes	Habitancum
Other Prov.	=				Alauna	Ariconium	Badon Boduni Bedan-ford
Caledoñia	=	Galda Glota	Varæ or Forres ?		Alauna	Brigantum	Epidii Ebuda
Hibernia	=					Brigantes	
GERMANIA—							
Hermiones	=		Varisti		Olmuz	HercyniaSil.	Batini Bedan-berg
Ingævones	=		Frisii		Jellum	Byrchanis	Bedum Baduhennæ Lacus, Batavia
Istævones	=				Alemanni Ulm	Brigantes Brigantinus Lacus, Vargiones	Bodensee, or Bodamicus Lacus, Baden, or Aquæ Pannoniæ, Wittenberg
Scandia	=		Phirœsii		Ulca		Bothnia
AFRICA	=	Chelida	Pharusii Barca				Pithon Battus

[52] In the above list, in addition to the mountain tracts connected with Rakem and the rivers associated with the name of Bedan, we find rivers bearing the names of all the other members of the family, including Rakem. Gilead furnishes the Calycadnus, Celadon, Cladeus, Galesus, and Clyde; Peresh the Parisus; Sheresh the Serus, Sarus, and Siris; Ulam the Ulai; Salambria, Ollius, Almo and Alaunus; Rakem the Rhogonis, Erigon and Erasinus. Several of the names are found in connection with lakes; Batthina with a lake in Persis; Rhagiana with one in Media; Chaliat and Patansana with Arsene palus in Armenia; Phytaeum and Trichonium with Trichonis palus in Ætolia; Prasias palus in Thrace; Claudanum with a lake in Illyria; Ulmum with Perso Lacus, and Tricciana with Volceæ palus in Pannonia; Brigantia with Bodamicus or Brigantinus lacus in Germany; Perusia with Trasimenus lacus in Etruria; Petenesca with a lake of the Helvetii, &c. Important peoples are represented by the various names Gilead himself furnishes the Calatii, Chaldees, Galatians and Celts; Peresh the Parisii, Prasii, Bebryces, Parrhasii, Perisadyes, Parisii, Prausi, Frisii, and Pharusii; Sheresh, the Seres, Saraceni and Sesarethii; Ulam the Elamites, Elamitæ, Elymæi, Dalmatians, Alauni, Alemanni and Allobroges; Rakem, the Hyrcanii or Paricanii, Orchani, Trocmi, Hercuniates, Varciones, Brigantii, Rasena or Tyrseni, Arecomici and Hercynii; and Bedan, the Budii, Padæi, Patenae, Epetobriges, Bithynii, Apodoti, Pannonians, Vettones, Bathanati, Boduni, Epidii, Batavians, and Batini. Connected with the family of Gilead, perhaps as parts of that family descending from yet unknown ancestors, we have found the Egestæans and Volsci. They were of Segestan in Persia, where there were Elamites and Hyrcanians; Ægestæa in Macedonia, in proximity to Elymea and Pydna; Segeste in Pannonia, where were Perso, Ulmum and Hercuniates; Segeste in Liguria, between Ricina and Portus Erycis; Egesta in Sicily, in proximity to Eryx and the Elymi; Segustani in Gaul, near the Allobroges, Arecomici and Ambarri The Volsci have left similarly connected traces: Vologesia in Babylonia, north of the Orcheni; Volceæ Palus in Pannonia, on which was Tricciana of the Hercuniates; Vulsiniensis Lacus in Etruria, in which Tarquinii may give Rakem; Volsci in Latium, among whom was Tarracina; Volcae in Gaul, confounded with the Arecomici; Velocasses also in Gaul, north of the Parisii; Volsas sinus in Caledonia, opposite the Ebudes. It thus appears that the Segestani and Volsci were families of the Rakemites. Many other tribes will be found to occupy similar subordinate positions. Besides the descendants of Zimran, who furnish the Cymri, Cimbri, &c., those of the other sons of Abraham by Keturah will be found to have contributed to the Gallic stock. The Aquitani, for instance, were in all probability the progeny of Jokshan There is a form of Rakem's name which has been before us that calls for special notice. It is that which appears in Trachonitis, Tragonice, Trachea, Trocmi, Trachin, Trichonis, Trichonium, Troezen, Trosmi, Dyrrachium, Tricciana, Trasimenus, Tarquinii, Terracina and Tyracinae. Already we have found Rakem preceded by a P or B, as in the Paricanii and Brigantes. In ancient languages the letter *r* rarely occupies an initial position, and of the letters which are found to usurp this position in words originally commencing with *r*, the most common are *p* or *b*, and *t* or *d*. The latter may be the relic of the old Semitic particle or article *eth*; or of the Coptic *eit*, which answers to the Hebrew beth=the house of; or a simple determinative of locality common to all languages more or less. Thebes in Egypt was Te-Hapi. In Palestine Tachmonite, Taanach, Tiphsah come from Hachmon, Anak and Paseah respectively. The same phenomenon is observable in the Tyrseni, whose original name was Rasena.

It is somewhat strange that Trachea, Trachin, &c., in Greek should answer to Gilead in Hebrew, as denoting "a hard, rough, stony region." An analogous case, which may be a mere coincidence, appears in the Greek *chalcos*, brass, which is the root of many Gileadite names, such as Chalcis, Chalcidice, Chalcedon The word brass is Celtic, and appears as *pres*, *pras*, in the Welsh and Erse, which may represent Peresh, as chalcos represents Gilead. It is worthy of note that the Persian word is very similar to the Celtic The Chaldeans manufactured bronze, the ancient brass, from a very early period, and probably gave their name as Chalcidians or Prasii to the metal. The Chaldæi of Pontus were metallurgists. The Gauls and ancient Britons also wrought in metals.

ON THE LEADING GEOLOGICAL AREAS OF CANADA.

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(Continued from page 22.)

PROVINCE OF QUEBEC.

This Province may be subdivided geologically into four principal areas, comprising: (1) The Laurentide, or Northern Crystalline District; (2) The Upper St. Lawrence, or Western Palæozoic District; (3) The Appalachian, or Eastern Metamorphic District; and (4) The Anticosti, or Eastern Palæozoic Area.

(1.) *The Laurentide District.*—This is essentially a region of ancient crystalline strata—rocky and mountainous in character: an eastward extension of the Laurentian districts of Ontario, but with certain special features of its own. It comprises the wide expanse of territory lying between the Ottawa River and Labrador, with the exception of a comparatively narrow strip of country (occupied by Lower Palæozoic formations), extending along the St. Lawrence from the junction of the two great rivers to a point a short distance below the city of Quebec. It is traversed by the Laurentide Mountains, proper, which form within it several broken ranges curving roughly parallel with the course of the St. Lawrence. The more southern of these gradually approach the river, and run closely adjacent to it along the lower part of its course. The average height of the Laurentides, generally, is from about 1,200 to 2,000 feet, but at one or two points they reach an altitude of nearly 4,000 feet above the sea. Numerous rivers rise amongst them. Some of the more important comprise: the Rivière du Moine, the Gattineau, the Rivière du Lièvre, the Rivière Rouge, and the Rivière du Nord, flowing into the Ottawa; and the l'Assomption, Chicot, St. Maurice, Batiscan, Ste. Anne (Portneuf), Jacques Cartier, Montmorenci, Ste. Anne (Montmorenci), Murray, Saguenay, Moisie, and other eastern rivers, flowing into the St. Lawrence.

The rocks within this region consist mainly of Lower or typical Laurentian strata, overlaid in some few localities by feldspathic rocks of the Upper Laurentian or Labrador series. The Laurentian strata proper, are composed essentially of vast beds of micaceous and syenitic gneiss, hornblende rock, and quartzites, with interstratified bands of crystalline limestone and oxidized iron ores. Valuable deposits of the latter occur, especially, in the townships of Hull, Templeton, and Grenville, on the Ottawa. As a rule, these Lower Laurentian strata are more or less strongly tilted, corrugated, or otherwise disturbed. They are also very generally traversed by granitic or syenitic veins, and are broken through in places (more especially in Wentworth, Chatham, and Grenville, on the Lower Ottawa) by enormous masses of eruptive syenite and greenstone. The crystalline limestones very commonly contain numerous examples of diopside, phlogopite, zircon, sphene, and other crystallized silicates; and they are associated in many places with workable amounts of graphite and fluo-phosphate of lime, as in the townships of Buckingham, Portland, Lochaber, Grenville, &c. The Upper Laurentian or Labrador formation is represented principally by thick beds of anorthosite or feldspar rock, with associated feldspatho-pyroxenic beds and interstratified gneissoid rocks. Titaniferous iron ore is a frequent accompaniment of these higher strata, and in some localities, as at Baie St. Paul, it is present in large quantity. Whilst the Lower Laurentian strata occur throughout the district generally, the upper series has been recognized only in detached areas of comparatively limited extent. One of these is seen in the Counties of Argenteuil, Terrebonne, Montcalm, and Joliet, in the western part of the district; and others occur in the vicinity of the Montmorenci Falls; in the country about Baie St. Paul and Murray Bay; in the vicinity of Lake St. John on the Saguenay; and on the River Moisie, in the east. In addition to these crystalline formations, a few outlying patches of Silurian strata, consisting mostly of Trenton limestones and Utica shales, occur here and there within the Laurentide area. The largest of these Silurian outliers is seen around Lake St. John on the Upper Saguenay; and small exposures occur at one or two spots on the shore of the St. Lawrence, below Quebec, as at the Montmorenci Falls, Murray Bay, &c. Glacial boulders, clays, and gravels, with Post-Glacial sands and other superficial deposits—among which the titaniferous iron sands of the Lower St. Lawrence may be especially mentioned—are distributed more or less generally throughout the region. The glacial striæ of the district run most commonly either towards the south-east or south-west; but in some few localities their direction is almost north-and south, and in others, not far removed from east-and-west.

(2.) *The Upper St. Lawrence District.*—This is essentially a Silurian area, occupied—apart from some isolated eruptive-masses—by sandstones, limestones, and other strata, which retain their original sedimentary aspect, and occur, for the greater part, in undisturbed beds. It extends along both sides of the St. Lawrence from the western boundary of the Province to the neighbourhood of Quebec. In the west, it includes the Counties of Vandreuil and Soulanges, lying in the point of the triangular space immediately west of the junction of the Ottawa and St. Lawrence Rivers. From the County of Vandreuil, its northern boundary crosses the Ottawa, and then, keeping entirely on the north side of the St. Lawrence, runs along the southern edge of the Laurentide district already described, and gradually approaching the river, strikes it a short distance below Quebec. Its southern limit runs from the south-west corner of Huntingdon (south of the St. Lawrence), along the boundary-line between the Province and the State of New York, to a little beyond the River Richelieu at the northern extremity of Lake Champlain; and east of this, the district is bounded by the disturbed and metamorphic area of the Eastern Townships—its actual limit in this direction being a remarkable line of dislocation, with accompanying fault, running (as first traced out by Sir William Logan) from near the north-west end of Lake Champlain to the vicinity of Point Lévis, and from thence around the City of Quebec, along the north side of the Island of Orleans, and down the river to near the mouth of the Magdalen, where it enters and runs along the Gaspé shore.

The rock-formations of the district belong to three distinct series. The stratified rocks, proper, consist of representatives of the Potsdam, Calciferous, Chazy, Black River and Trenton, Utica, and Hudson River (Lower-Silurian) formations—with some small exposures, south of the St. Lawrence, of strata referred to the Middle Silurian, Medina group, and a few outlying patches of Upper-Silurian strata (belonging to the Lower Helderberg formation) in the vicinity of Montreal. These formations are broken through in places by large eruptive-masses of trachytic and trappean rock, forming a series of picturesque mountains, which rise abruptly from the generally level surface of the district in the more southern and western portions of its area; and in addition to these Silurian and eruptive rocks, Glacial and Post-Glacial accumulations, with deposits of comparatively modern origin, occur throughout the district generally.

The Potsdam beds consist of coarse conglomerates and fine-grained siliceous sandstones—the latter in many localities sufficiently pure for glass-manufacture and for the hearths of furnaces. The formation is largely displayed in Hemmingford Mountain, and over large portions of Huntingdon, Chateaugay, and Beauharnois, from whence it crosses the St. Lawrence, and spreads over a large part of Soulanges and Vaudreuil; and from thence, passing across the western end of the Island of Montreal and Isle Bizard, it wraps around a large outlying mass of Laurentian gneiss (forming Mount Calvaire on the north shore), and continues uninterruptedly along the edge of the Laurentide district as far east as the River Chicot, where the continuity of the strata is broken by a fault, and limestones of the Trenton formation are let down against the Potsdam beds. East of this point, the formation only appears at one or two places—notably on the St. Maurice, where it exhibits a slight thickness of nearly horizontal beds of conglomerate and sandstone, resting upon gneiss. Throughout its range, as far east as the Chicot, it is accompanied by sandy and dolomitic limestones of the Calciferous formation, and these cover large areas south of the St. Lawrence, and in the country around the junction of the St. Lawrence and Ottawa. East of this formation, on the south side of the St. Lawrence, limestones of the Chazy and Trenton series, and dark bituminous shales of the Utica formation, with succeeding sandstones and arenaceous shales of the Hudson River formation largely prevail—the latter, especially, east of Richelieu River. These formations cross the St. Lawrence, and range in regular sequence along the north shore between the Calciferous outcrop and the river bank. The intervening Island of Montreal, Isle Jésus, Isle Bizard, &c., consist essentially of Chazy, Trenton, and Utica strata—the Hudson River beds coming up farther east. The Chazy limestones of Caughnawaga and St. Doménique on the south shore, those of Ste. Geneviève on the Island of Montreal, of Isle Bizard, and of St. Lin on the north shore, yield marbles (red-spotted or uniformly red) of good quality. East of the River Chicot, which enters the St. Lawrence on the north shore, near the upper or western extremity of the expansion known as Lake St. Peter, the comparatively narrow strip of country between the Laurentian gneissoid rocks and the river margin is occupied almost entirely by Trenton, Utica, and Hudson River strata—one or two small exposures of the Potsdam formation on the St. Maurice and at St. Ambroise alone representing the lower beds as seen west of the Chicot fault. In this eastern portion of the district, the strata are tilted in many places at considerable angles, as near Pointe aux Trembles, Montmorenci Falls, &c., and their continuity at these spots is more or less disturbed by minor faults.

As stated above, the Silurian strata of the more southern and western portions of the Upper St. Lawrence district are broken through in places by trachytic and trappean masses, forming a series of isolated mountains which rise above the generally level surface of the country to elevations of from 600 to 800 feet. Most of these occur apparently upon a single line of fissure traversing the district in a general south-easterly direction. They comprise: (1) the Mountain of Rigaud in Vandreuil, composed partly of a purely feldspathic, and partly of a dioritic or hornblendic trachyte, porphyritic in places; (2) the Montreal Mountain, composed essentially of angitic trap or dolerite, but traversed by dykes of compact and granitic trachyte; (3) Montarville or Boucherville Mountain, also essentially trappean in composition; (4) Belœil, a dioritic and micaceous trachyte; (5) Monnoir or Mount Johnson (south of Belœil), of the same mineral character; (6) Rougemont, in Rouville County, a trappean mass like that of Montreal in general composition; and (7), the Yamaska Mountain, essentially a micaceous trachyte. The Mountains of Brome and Shefford belong to the same eruptive series, but lie within the metamorphic district to the east. In addition to these principal masses, many dykes of similar character traverse the surrounding strata; and some of these in the neighbourhood of Montreal and Lachine are intercalated with the soft shales of the Utica series, which have become more or less worn away, leaving the associated trap bands in the form of projecting ledges. Most of the rapids in this part of the St. Lawrence have been thus produced.

The superficial deposits of the district comprise Glacial boulders and related clays and gravels, with Post-Glacial and recent accumulations. Drift or Glacial deposits, proper, are of general distribution; and in some places, as on the Rigaud Mountain, the boulders form roughly parallel ridges of several feet in height. The Glacial striæ of the country have two prevailing directions—south-west and south-east respectively. The Post-Glacial deposits belong chiefly to two series, as first determined by Dr. Dawson of Montreal, a lower deep-sea formation, known as the "Leda Clay;" and a succeeding deposit, apparently a shallow-sea or shore-line accumulation, known as "Saxicava Sand." These occur widely within the district, and at various elevations. On the Montreal Mountain, beds of Saxicava sand, for example, form a series of terraces, one of which is at an altitude of nearly 500 feet above the present sea-level. Beauport, below Quebec, is another locality at which these deposits are well exposed; but they occur also, and over large areas, around Murray Bay, as well as on the Lower St. Maurice, and elsewhere. The more recent formations of the district comprise, principally, the bog iron ores and ochres of the St. Maurice and other localities on the north shore of the St. Lawrence; the great peat-beds of Lanoraye, Lavaltrie, St. Sulpice, &c., on the same side of the river; and those of Sherrington, Longueuil, and St. Doménique, with others, on the south shore. Most of these peat beds overlie deposits of shell marl.

(3.) *The Appalachian District.*—The term "Appalachian region" was first bestowed on this part of Canada by Dr. Sterry Hunt. The district forms, indeed, a prolongation into Eastern Canada of the Appalachian region of the United States. The Appalachian chain, with its tilted, contorted, and in great part metamorphosed, system of rocks, being continued into the Orford, Sutton, and other mountains of the Eastern Townships, and from these into the Notre Dame and Schickshock ranges of the St. Lawrence and Gaspé. The district is essentially a Palæozoic area, but disturbed and altered over most of its extent by metamorphic agencies. It includes the section of country known as the Eastern Townships, and also the peninsula of Gaspé and intermediate country. It thus comprises all that portion of the Province which lies east of the line of dislocation and fault, referred to under the preceding district. This line of fault extends from the north-east extremity of Lake Champlain in a general north-easterly direction, to a short distance west of Point Lévis, from whence, crossing the St. Lawrence, it curves round the back of Quebec, runs along the Island of Orleans, down the bed of the river to near the mouth of the latter, and finally traverses the north coast of the extremity of Gaspé. The strata along the outer edge of this line of fracture—in the Upper St. Lawrence district, described above—belong essentially to the Hudson River formation. They show (except on the Gaspé coast) no actual signs of disturbance; but on the east side of the line, an uplift has brought older strata (of the Calciferous or Quebec series) in seemingly conformable stratification against their flanks; and hence it has been conjectured, in explanation, that the Hudson River beds have been broken and partially reversed along the fault by this upward movement, the older strata overlapping them, and so following deceptively without any visible break in the sequence. The district is thus bounded (practically) by the River St. Lawrence on the north, and by the States of New York, Vermont, New Hampshire, and Maine, and the Province of New Brunswick, on the south. As regards physical features, it is more or less throughout of a mountainous character, but also, as a rule, of good fertility—differing altogether in this respect from the mountainous Laurentian region of the north shore. The average elevation of the Gaspé peninsula is about 1,500 feet, and that of the other portion of the district probably about 1,000 feet above the sea; but several peaks in the Schichshock ranges of Gaspé approach 4,000 feet in height, and the summits of some of the mountains in the Eastern Townships are apparently over 3,000 feet. Many lakes, but none of large size, occur within the latter portion of the district. Among these, Lake St. Francis lies at an elevation of 890 feet, and Lake Memphramagog at an elevation of 760 feet above the sea. In Gaspé, Lake Temiscouata and Lake Matapedia lie, respectively, at altitudes of 470 and 480 feet. The district abounds in rivers. Some of the principal comprise the Yamaska and St. Francis (as regards their upper courses), the Chaudière, with its tributaries, the Famine, Des Plantes, &c., and the Etchemin, in the more western portion of the district; and the Kamouraska, Rivière du Loup, Trois Pistoles, Rimouski, Métis, Matanne, Chatte, Ste. Anne, York, Cascapediac, Matapediac, and other rivers of the Gaspé peninsula, most of which flow in deeply excavated channels.

The rock formations of the district belong to three general groups: a series of Palæozoic strata, more or less altered in most localities; a series of eruptive, trachytic, and granitic rocks; and a series of Post-Cainozoic or superficial deposits.

The altered condition of many of the Palæozoic formations, and their disturbed condition generally, renders the determination of their exact age somewhat doubtful; but they appear to consist of representatives of Lower and Upper Silurian, Devonian, and Lower Carboniferous, formations.

The Potsdam formation has been recognized at points on the St. Lawrence, between the Chaudière and the Trois Pistoles, in Temiscouata; and a strip of the Hudson River formation, represented by a series of contorted sandstones, dolomites, and bituminous shales, occurs along the coast of Gaspé, between the River M rsouin and Anse à la Tierce. The more important strata of the district, however, comprise representatives of the Quebec group (see below), with the overlying Gaspé limestones and sandstones (Upper Silurian and Devonian formations), and the Lower Carboniferous Bonaventure-formation of South Gaspé. The Quebec group of strata occupies, apparently, a position between the Calciferous and Chazy formations of other localities, or otherwise represents the two series combined. It is subdivided into three formations—comprising in ascending order:—(i.) The Lévis formation, made up principally of black graptolitic shales or slates, containing numerous graptolites and other fossils; (ii.) the Lauzun formation, consisting in part of red and green shales, sandstones, and dolomites, but composed mostly of metamorphic strata, among which talcose and other magnesian rocks (chloritic schists, serpentines, &c.) largely predominate—the lower and upper portions of the series containing many bands of copper ore and other metalliferous deposits; and (iii.), the Sillery formation, consisting chiefly of red and green shales, sandstones, and dolomites, but including, in places, altered rocks in the form of crystalline schists and epidotic and gneissoid strata. The Lévis formation occurs prominently around the City of Quebec and Point Lévis, chiefly in the form of hard black shales dipping at high angles; but it is also seen around Richmond, on the St. Francis, and in the neighbouring townships, as well as around Phillipsburg, on the boundary line, and, again, east of the Chaudière. It is of much palæontological interest from the great number of graptolites obtained from its strata. The altered and metalliferous Lauzun division occurs more or less throughout the Eastern Townships, or between the north-east shore of Lake Champlain and the Chaudière River, generally. It is especially rich in copper ores; but contains, also, chromic iron ore, magnetic iron ore, specular iron schists, gold in quartz bands and veins, galena, serpentines and serpentine-marbles, roofing slates, and other economic substances. Its strata, as a rule, are much folded and disturbed, as well as altered chemically. The Sillery formation follows in most places the outcrop of the Lauzun beds, and the altered portions of its strata cannot always be sharply separated from the latter. In its unaltered state, it occurs, in the form of red and green shales, micaceous sandstones, and dolomitic beds, at Sillery Cove and Cape Rouge, near Quebec; and on the south shore, between the Chaudière and the vicinity of Point Lévis, and still more extensively in the country east of the Chaudière.

The "Gaspé-Limestone formation" is regarded as mainly equivalent in position to the Lower Helderberg series of western localities. Although composed chiefly of grey limestone strata, it is partly made up of a lower (perhaps Middle Silurian) series of black shales and slates; and some green and red shales are interstratified with its calcareous beds. The lower part of the formation occurs principally in the Eastern Townships of Orford, Melbourne, Westbury, &c., where it contains workable beds of slate, and is seen in places to overlie the Sillery formation unconformably; whilst the higher or more calcareous portion is chiefly developed in Gaspé. On the extreme eastern coast, as at Barry Cape, the Percé Rock, and elsewhere, the limestones present bold cliffs and pinnacles of rock, worn and hollowed by the action of the sea.

The "Gaspé-Sandstone formation," as shown by its fossils, is of Devonian age, representing most probably the Oriskany, Hamilton (or Lambton), and Chemung formations of western districts. It occurs in Dudswell, Burford, and other sections of the Eastern Townships, in the form of light or dark-coloured limestones or dolomites (rendered crystalline in places by metamorphism), which appear to merge more or less into the underlying "Gaspé-Limestone" beds. In Gaspé proper, where the formation occurs in its more typical aspect, it consists essentially of interstratified sandstones, shales, and conglomerates, holding in places many fossilized plant-remains. A thin seam of impure coal occurs also in these beds at Little Gaspé Cove; and petroleum springs ooze through the strata at Douglastown and elsewhere.

The "Bonaventure formation" represents the lower portion or base of the coal measures, but is entirely destitute of coal. Its strata are chiefly composed of conglomerates, with associated sandstones and red and greenish shales, some of which hold carbonized plant-remains;

and in many places they are penetrated by trap dykes. They rest unconformably on strata of the Gaspé-Sandstone series. The formation is seen principally on the eastern coast of Gaspé and on the opposite Island of Bonaventure, and still more prominently along the coast of the Bay of Chaleurs, where its average thickness was estimated by Sir William Logan, at no less than 3,000 feet.

The more important of the eruptive rocks occurring within the district, comprise :—(i.) The trachytic mountains of Brome and Shefford, agreeing in character with most of the eruptive mountains of the Upper St. Lawrence district, and belonging to the same linear series; (ii.) the granites of the Great and Little Megantic Mountains, and other granitic masses around Lake St. Francis, with those of Winslow, Hereford, Stanstead, Weedon, and other portions of the Eastern Townships' area; and (iii.), various trappean exposures of Eastern Gaspé and the Bay of Chaleurs. Most of these latter occur as interpenetrating and overlying dykes; but at some spots, trappean (or trachytic?) masses form mountains of high elevation, as seen in the "Conical Mountain" of the Cascapedia, and in others of similar character in the country between the Matapedia and the Restigouche.

The third series of formations referred to as occurring within the Appalachian district, consist of Post-Cainozoic deposits. These comprise :—(i.) Beds of auriferous gravel and magnetic sand; (ii.) boulder-clays, or drift deposits, proper; (iii.) beds of Leda clay and Saxicava sand; and (iv.) sundry superficial deposits of comparatively recent origin. The drift clays in many parts of the Eastern Townships and adjacent areas, are underlaid by (and also partially mixed with) layers of gravel and black magnetic sand containing, very generally, fine grains, and occasionally small nuggets, of free gold. These auriferous deposits have been recognized in the beds of most of the streams and rivers which flow through this section of the Province, and especially in the St. Francis, Chaudière, Famine, Rivière des Plantes, Etchemin, Gilbert, Metgermet, and Rivière du Loup. The Leda clay and Saxicava sand deposits are largely displayed on the Trois Pistoles, Cacouna, Rivière du Loup, Ste. Anne, Matanne, Métis, and other rivers. On the Métis (in Gaspé) a bed of Saxicava sand occurs at an elevation of 245 feet above the present sea level. The more superficial deposits of the district include the bog iron ores of Stanbridge, Farnham, Simpson, Ascot, Stanstead, Ireland, St.

Lambert, St. Vallier, Vallery, Cacouna, and other sites; the ochres of Durham; the shell-marls of Stanstead, New Carlisle, &c.; and the peat beds of the Rivière Ouelle, Rivière du Loup, Métis, Rimouski, and Madawaska.

(4.) *The Anticosti District.*—This division includes the large Island of Anticosti, in the St. Lawrence Gulf; the group of the Mingan Islands on the opposite northern shore; and a narrow strip of the latter lying around the mouth of the Mingan River, and extending eastward for several miles. It should also include, strictly, the strip of land along the Gaspé Coast, lying north of the line of dislocation described under the preceding division. It is essentially a region of unaltered and comparatively undisturbed Silurian strata. The Island of Anticosti extends in a general north-west and south-east direction, with a length of about 150 miles, and a breadth, in its broadest part, of about 35 miles, gradually tapering at the extremities. The northern coast presents bold ranges of cliffs, from 200 to 400 feet in height, cut through in places by deep water-courses. The interior of the island is thickly wooded, but is destitute of lakes and important streams. It appears to consist of a series of plateaux or broad terraces, gradually descending to the south shore. The latter, although showing in places high cliffs of drift clay, is mostly of a low and swampy character, and this part of the island is especially characterized by the presence of extensive beds of peat.

The Mingan Coast consists of arenaceous limestones and dolomites of the Calciferous formation, and similar strata on the islands are succeeded by Chazy beds composed of reddish and pale-grey limestones, with interstratified arenaceous shales. On the principal island (Large Island) of the Mingan group, light-coloured limestones, holding characteristic Lower Trenton or Black-River fossils, overlie the Chazy beds—the whole dipping, at a slight angle, southwards or towards the Gulf. The next exposure (in the regular sequence of Lower Silurian formations) occurs along the opposite north coast of Anticosti, and consists of greyish and other coloured limestones, with interstratified shales and conglomerates, having an inland or southerly dip of very slight amount. These beds belong to the upper part of the Hudson River formation, and it may thus be legitimately inferred that the intervening area of the Gulf is occupied uninterruptedly by other Hudson River beds, with Utica and Trenton strata cropping out successively from beneath them. In some of these

Hudson River strata, examples of the curious stem-like corals (*Beatricea undata*), resembling the petrified trunks of large trees, occur in considerable abundance. The succeeding area of the Island to the south, is occupied by argillaceous and other limestones, essentially of Middle Silurian age, the equivalents apparently of the Medina, Clinton, and Niagara formations of the West; but characteristic Niagara fossils are asociated in some of these strata with Hudson River and other Lower Silurian types.

The other rock-formations of the district consist of Post-Cainozoic deposits. Raised beaches, in the form of a series of terraces, extending to a height of about 100 feet above the sea, occur on some of the Mingan Islands; and other evidences of elevation are seen in the pillared rocks left here and there upon the surface, at heights of fifty or sixty feet above the present sea-level. Drift clays, holding limestone pebbles, overlie the calcareous strata of some parts of Anticosti, especially on the southwest coast, where they form cliffs of considerable height. But the more remarkable of the Post-Cainozoic formations of Anticosti are the great peat-beds, which cover large areas on the southern part of the Island. One of these extends in a narrow band along the south-east coast, between Heath Point and South Point, over a length of nearly eighty miles.

PROVINCE OF NEW BRUNSWICK.

The geology of New Brunswick, notwithstanding the numerous reports already published upon it, still remains, in a great measure, to be worked out. Viewed, however, in its broader or more general features, the Province may be looked upon as including two essentially distinct geological regions. These comprise: (1) the Western and Southern district, occupied for the greater part by granitic, and more or less altered rocks—the latter mostly of Pre-Silurian and Silurian age—with a few limited exposures of higher strata; and (2) the Eastern or Carboniferous district, occupied exclusively, or practically so, by subdivisions of the Carboniferous formation. If a line be drawn from near Bathurst, on Nipisiguit Bay (an inlet of the Bay of Chaleurs), to Lake Oromocto, in the south-east corner of York County, and another from this point, in an easterly or north-easterly direction (roughly parallel with the Bay of Fundy), to Chepody Bay, in Albert County, the two districts will be marked out with sufficient accuracy for general purposes. All the country west and south of these lines will belong to the first district; and the great triangular area extending east and north of the lines to the Gulf shore, will form the second or Carboniferous district.

(1.) *The Western and Southern District.*—The geological structure of this region is of a very complicated character. Most of its strata are in an altered or metamorphic condition, and are more or less broken up, contorted, and intermixed; whilst faultings and overturn dips are of frequent occurrence amongst them, thus adding, in many cases, to the general obscurity of their age. In the present state of our knowledge, the district is most conveniently described under two subdivisions, as below:

(*i*) *The Western Division.*—This may be assumed to include the country lying west of the line described above as running from Nipisiguit Bay to Lake Oromocto. It thus includes the Counties of Ristigouche, Victoria, and Carleton, with the chief part of York, and the north-west portion of Northumberland. Its surface consists very generally of extended plains, cut by numerous river-valleys, and heavily wooded throughout. The average elevation above the sea is, probably, under 500 feet, but isolated mountains in its more northern limits attain to elevations of from 1,500 to over 2,000 feet. The principal rivers comprise the head-waters and upper course of the St. John, with its numerous tributaries, including the Tobique, the Beccaguimic, &c.; and the upper portions of the Miramichi, Nipisiguit, and Ristigouche. The rock-formations within it consist principally of a series of micaceous and other slates, with quartzose and argillo-calcareous strata, dipping at high angles and greatly contorted in places; whilst over a broad tract of country, extending from Grand Lake on the Province boundary-line, in a general north-easterly direction to the vicinity of the Bay of Chaleurs, they are associated with long belts of granitic rock. The slates, quartzites, and other altered strata, are regarded mainly as Upper Silurian formations, from a few characteristic fossils discovered in some of their beds, but older formations (as seen in the Southern Division of the District) may perhaps occur among them. The granites are probably in chief part, if not wholly, of Devonian age. Copperpyrites, and beds of slaty hematite, occur in these altered strata in the neighbourhood of Woodstock; and veins of antimony ore in the Parish of Prince William, between Woodstock and Fredericton. The only other formations—apart from superficial deposits—recognized within this western section, consist of sandstones, shales, and conglomerates, with subordinate beds of limestone and gypsum, of Lower Carboniferous age. These occur as outlying portions of the great carboniferous district of the east. The most important of these outliers, none of which, however, contain any coal, occupies a comparatively large area on the Tobique River; and a smaller one lies on the St. John, between Fredericton and Woodstock.

(*ii.*) *The Southern Division.*—This geological area, although forming properly a portion of the Western Division described above presents certain points of difference in the apparently more complete series of rock-formations contained within it, and in the still greater signs of disturbance to which the older of these formations have been subjected. It comprises the region lying immediately along the north shore of the Bay of Fundy, and extends over the entire areas of Charlotte and St. John Counties, over part of Queen's County, and over large portions of the counties of King and Albert. The rock-formations recognized within its limits are as follows:

First, a series of gneissoid strata, with succeeding dioritic and chloritic slates, quartzites, ard related metamorphic beds, associated very generally with high belts of granitic and syenitic rock, and for the greater part, in a much disturbed condition. These crystalline and semi-crystalline strata are Pre-Silurian formations, and are regarded as of Laurentian and Huronian age; but the associated granites and syenites are probably Devonian. Elevated areas of this character occupy large portions of Charlotte and St. John Counties, and others occur in Queen's, King's, and Albert County—as seen in the Nerepis Hills, the Porcupine and Bald Mountain Ridges, the Quaco Hills, and elsewhere. Many of these granites and syenites are porphyritic; and some of them, especially the red varieties, furnish ornamental building-stones of much beauty.

A second series, composed of dark slates associated with beds of sandstone, forming a collection of strata known as the St. John's Group or Formation. These strata overlie crystalline beds of the supposed Huronian series; and they contain examples of Paradoxides, Conocephalites, and other trilobites of so-called "Primordial" type, with brachiopods, &c., characteristic of the same geological horizon. They are thus regarded as forming the extreme base of the Silurian series—including under this term the Cambrian strata of many geologists. As a rule, they are greatly folded and contorted, and they appear to be destitute of economic minerals. Outcrops occur, more especially, within and around the City of St. John, and in the valleys of the St. John, Kennebecasis, and Nerepis Rivers.

A third series, consisting mostly of grey shales and limestones, and siliceous conglomerates, with associated feldspathic and dioritic beds, containing in places some obscure fossils of Middle and Upper Silurian type. These higher Silurian strata occur chiefly on Foye's Island and the adjacent coast, on the shores of Oak Bay, &c., and along the granitic slopes of the Nerepis Hills in King's and Queen's Counties.

A fourth and higher series, composed of Devonian and Lower Carboniferous strata, represented essentially by shales, sandstones, and conglomerates, and characterized for the greater part by the presence of numerous fossil plants. The Devonian beds have been divided into five groups, known, in ascending order, as the Bloomsbury, Dadoxylon, Cordaite, Mispec, and Perry groups—the latter regarded as Upper Devonian. The lower and middle groups are principally developed around Carleton and other points on the west side of St. John's Harbour; at Mount Prospect and elsewhere in the valley of Little River; and also in Lancaster Parish and around Leprean Basin, where a thin seam of slaty anthracite has been observed in one of their beds. The Upper Devonian or Perry strata also appear at Point Leprean, but are chiefly exposed around the City of St. Andrews, where they extend over a comparatively large area The beds recognized as Lower Carboniferous are entirely destitute of coal, and in this southern part of the province they occur only in the form of detached outliers, of comparatively small extent—as on the west side of Grand Bay on the River St. John, the south side of Kennebecasis Bay, and around Quaco, on the Bay of Fundy.

A fifth series, composed of a few strips and patches of Triassic strata, essentially in the form of soft, red sandstones, but associated in places with a few layers of conglomerate. These strata occur sparingly near Quaco Village and elsewhere on the Bay of Fundy, and also on the north shore of the Island of Grand Manan, where the characteristic red sandstone of the series is overlaid by a light-grey siliceous bed holding copper ore, with an immense overflow of columnar trap covering the whole.

Finally, accumulations of boulder clay and gravel, with sands and other recent surface-deposits, are spread very generally over this southern portion of the district, which appears, moreover, to have been largely denuded and otherwise affected by glacial agencies. The more important of the recent formations are the peat bogs of the Mispec Barrens and Musquash Bay, in St. John's County, and those of Mace's Bay and other localities in Charlotte County, further west.

(2.) *The Eastern or Carboniferous District.*—This geological region occupies the central and eastern portions of New Brunswick, forming a large triangular area, the sides of which converge, respectively, from Nipisiguit Bay, on the Bay of Chaleurs, and Salisbury Cove, on Chinecto Bay, to a point in the vicinity of Oromoctoo Lake, near the boundary-line of York and Charlotte Counties. It presents, as a rule, a flat or gently undulating surface, drained principally by the Miramichi and branches, in its more northern and central portions; and by the St. John, with the Nashwauk, Salmon, Washademoxe, and other tributaries of the St. John, in the south. Its average height above the sea is probably about 400 feet. Its strata consist essentially of sandstones, calcareous and other conglomerates, and argillaceous shales; and they belong to the lower, middle, and upper subdivisions of the Carboniferous series. Seams of coal are confined entirely to the middle division—as elsewhere in the Carboniferous formations of the Maritime Provinces—but those hitherto discovered in New Brunswick are of comparatively slight thickness, the most important seam scarcely exceeding a couple of feet, whilst the greater number present a thickness of a few inches only.

The Lower Carboniferous division is made up principally of sandstones, shales, and conglomerates, characterized by a very generally prevailing red colour. Apart from outliers, it is confined, practically, to the inner edge of the metamorphic area which borders the present district on the east and south; and its strata in many places are folded among the metamorphic formations, and are also more or less broken up by faults, or are otherwise disturbed, as below Long Island, on the River St. John, and elsewhere. Coal, except in unimportant traces, is apparently altogether absent. In some localities, however, and notably in the Parish of Hillsborough, in Albert County, the remarkable bituminous substance known as "Albertite" occurs in these Lower Carboniferous strata, in the form of undoubted veins. This substance is a kind of solid bitumen—black, brittle, and highly lustrous. At the Hillsborough mines, it traverses—and for the greater part at a high angle of dip—calcareo-bituminous shales containing remains of fossil fishes (belonging to Palœoniscus, Holoptychius, and other genera), with overlying grey and red conglomerates, intercalated with beds of limestone and gypsum. At other localities, as at Markhamville, in Upham Parish, King's County, and near Shepody Mountain, in Albert County, the Lower Carboniferous strata contain important deposits of pyrolusite or black manganese ore. Finally, at Clarke's and McLeod's Mountains, north of Frederickton, and at Bald Mountain, near Cranberry Lake, and some other spots, the strata of this lower division are broken through by eruptive masses of trappean or trachytic rock.

The Middle Carboniferous strata consist essentially of sandstones, sandy shales, and conglomerates, of a prevailing gray colour. The series may be subdivided into two groups: a lower group, made up of rocks of a more or less coarse texture, destitute of coal—the equivalent of the millstone grit subdivision of Nova Scotia; and a higher group of conglomerates and sandstones of finer texture, intercalated with coal shales, layers or partings of clay, and thin seams of bituminous coal, representing the productive portion of the coal measures proper. The strata of both groups occur, as a rule, in nearly horizontal beds, or dip only at very moderate angles, rarely exceeding four or five degrees. Most of the coal seams hitherto discovered are under five or six inches in thickness, but one seam, known as the "surface seam," averages eighteen or twenty inches, and, in places, exceeds a couple of feet. It has been worked somewhat extensively as a source of local supply. These Middle Carboniferous beds appear to extend over the entire portion of Eastern New Brunswick, between the Gulf on the east, and the border of Lower Carboniferous and Metamorphic rocks on the south and west; but in some places the lower rocks have been exposed, by denudation, over limited areas; and at other spots, the beds in question have been covered by red and purplish shales, &c., of the Upper Carboniferous series.

The strata of the Upper, like those of the Lower, Division, are essentially composed of shales, sandstones, &c., for the greater part of a red or reddish purple colour, and destitute of coal. They overlie the Middle Series conformably, and appear to be associated more or less generally with the latter throughout the greater portion of the district.

PROVINCE OF NOVA SCOTIA.

This Province, as regards its more salient geological features, is divisible into two broad regions, comprising: (1.) The Southern Metamorphic District, occupied essentially by crystalline and granitic formations; and (2.) the Northern Carboniferous District, in which a number of Palæozoic, and for the greater part Carboniferous, areas, are separated more or less by belts and mountain ranges of syenites and other related crystalline rocks.

(1.) *The Southern Metamorphic District.*—This forms a long but comparatively narrow area, extending over the country along the entire southern coast of Nova Scotia proper, from a point between Yarmouth and Cape Sable, in the west, to Cape Canso and the south shore of Chedabucto Bay, in the east. Gradually contracting in width between these points, it includes small portions of Digby and Annapolis Counties, the whole of Shelbourne, and large portions of Yarmouth, Queen's, Lunenburg, Halifax, Hants, and Guysboro'. Its coast-line is deeply indented, and its interior, for the greater part, of a wild and rocky character. As regards its geology, it is essentially a metamorphic region, occupied by crystalline strata, with considerable areas of unstratified granitic rocks, the latter, apparently, of Post-Silurian age.

The crystalline strata appear to consist in part of Laurentian formations, and in part of altered higher beds, ranging into the Silurian series. They are composed mostly of gneiss, fine-grained in some localities and porphyritic in others, with associated mica-slates and quartzites, succeeded in many places by black or bluish-black argillites with well-marked slaty cleavage. These strata, as a rule, occur in highly-tilted or otherwise disturbed beds. Thin layers (or bedded veins?) of quartz, for the greater part auriferous, are present, more especially, in the middle and upper portions of this metamorphic series. The gold is mostly distributed through special zones or so-called "streaks," or "pipes," in these quartz deposits, and it occurs chiefly in the free state. In some places, however, it is also present in arsenical and common pyrites.* These quartz layers, as a rule, are under a foot in width. They are very commonly situated on anticlinals, with high angle of dip; and in many cases they are sharply

* Streaks or pipe-bands of this character are not uncommon in ordinary mineral veins. As regards Western Canada, the writer has pointed out their occurrence in certain lead veins in the township of Galway, in Ontario.

corrugated—the enclosing rock presenting, necessarily, a correspondingly convoluted structure. The more important localities, or "districts," in which these gold deposits have been recognized, are as follows:—(i.) The *Lunenberg* district, including the *Ovens* area, &c.; (ii.) the *Waverley*, *Oldham*, and *Renfrew* district, north of Halifax; (iii.) the *Uniacke* district; (iv.) the *Tangier* district; and (v.) the *Sherbrooke* and *Stormont* district, including *Wine Harbour*, *Country Harbour*, &c.

The granite areas lying within this southern metamorphic region have not yet been thoroughly explored, so that eventually many apparently isolated masses will probably be found to constitute connected bands. Those at present recognized occupy the following sites: The country around Barrington and Shelburne, north and north-east of Cape Sable; the more southern portions of Digby, Annapolis, and King's counties; the Aspatagoen promontory between Mahone Bay and Margaret Bay; the country around Halifax, especially north and west of the city; the lower portion of the Musquodoboit valley, and adjacent country to the east; the south shore of Chedabucto Bay and the country westward to the vicinity of St. Mary's River.

(2.) *The Northern Carboniferous District.**—This region extends along the Bay of Fundy, and throughout all the northern, central, and eastern portions of Nova Scotia, including the Island of Cape Breton.

In its general features it presents a number of detached Silurian (and Devonian?) areas, separated for the greater part by ridges and mountainous masses of syenites, and surrounded by areas of Carboniferous strata. The Silurian and Devonian rocks are mostly tilted at high angles, and are altered more or less by metamorphic action. The surrounding Carboniferous strata belong partly to the Lower division, but chiefly to the Middle or Productive portions of the series, and in many localities they contain important beds of bituminous coal, some of the seams being of unusual thickness. In addition to these strata, some comparatively narrow strips of Triassic sandstone, associated with vast trappean overflows, range along the Bay of Fundy and the shores (in part) of Cobequid Bay. Boulder clays and Post-Glacial deposits are distributed also throughout the region generally.

* The names given to these districts must not be taken in too limited a sense. The present region is named as above, because it is especially characterized, when viewed generally, by the presence of carboniferous strata.

Although regarded in the present outline as forming a single geological district, characterized as above, this northern portion of the Province may be provisionally subdivided, for descriptive purposes, into twelve subordinate areas. These follow each other, roughly, from west to east in the following order:—1. The Annapolis and North Mountains area, mostly Triassic and Trappean; 2. The Newport and Truro area, essentially Lower Carboniferous and Triassic; 3. The Cobequid Mountains area, essentially syenitic and slaty; 4. The Cumberland area, Middle Carboniferous (coal-bearing); 5. The Pictou area, Middle Carboniferous (coal-bearing); 6. The Egerton, Arisaig, and Porcupine Mountains area, essentially syenitic and slaty; 7. The Antigonish area, essentially Lower Carboniferous; 8. The Guysboro' area, Lower Carboniferous; 9. The Southern area of Cape Breton, essentially syenitic and slaty; 10. The Western Cape Breton area, mostly Lower Carboniferous, with some overlying coal-bearing beds; 11. The Sydney Cape Breton area, Middle Carboniferous (coal-bearing); 12. The Northern area of Cape Breton, syenitic and slaty.

1. *The Annapolis and North Mountains Area.*—This division extends along the south shore of the Bay of Fundy. It includes the North Mountains and the valleys of the Cornwallis and Annapolis Rivers, and is limited inland by the granitic slopes of the South Mountains. The strata which rest against the latter, consist essentially of altered and partially-altered slates of Upper Silurian or Devonian age. They dip away from the granite mass, and they are traversed generally by transverse cleavage-lines. Towards the north, as in Kentville and New Canaan, they are but little altered, and numerous crinoid stems and other apparently Upper Silurian fossils occur in their beds at these sites. A thick bed of granular iron ore on the River Nictau, farther south, also contains fossils. A few miles south of this stream, the continuity of the strata is interrupted by a granite spur, but beyond this, the slates reappear, although in a more altered condition, and extend broadly to the sea-coast, south of St. Mary's Bay. North of this granite spur, or along the valleys of the Annapolis and Cornwallis, the slates are bordered by a narrow strip of red sandstone country, apparently Triassic. The sandstone is mostly in the form of thin and slightly-inclined layers. These rest in places on highly-inclined strata of the Carboniferous series, but the latter are of quite subordinate occurrence in this area. Immediately west of the Triassic country, a broad belt of columnar and

amygdaloidal trap ranges continuously, in the form of a bold line of cliffs, along the shore of the Bay of Fundy from Bryer's Island to Cape Blomidon, with outlying patches in Partridge Island, &c., and at Cape d'Or on the opposite coast. A layer of tufaceous material marked by green cupreous stains, arising from the decomposition of imbedded bunches of copper-glance, occurs very generally between the sandstone and the overlying trap. Zeolites and other characteristic trap minerals are abundant in the latter at many spots.

2. *The Newport and Truro Area.*—This subdivision occupies the country around Minas Basin and Cobequid Bay, extending northwards to the Cobequid mountain range, southwards to the northern edge of the Atlantic metamorphic region, and eastward to the slopes of the syenitic ranges in the south-east of Colchester County. It thus includes the country around Windsor, Newport, Walton, Maitland, Truro, and Parrsborough, with the valleys of the Kennetcook, Shubenacadie, Stewiacke, and Musquodoboit rivers, more especially. Its strata belong, for the greater part, to the Lower Carboniferous series, and consist of red and other-coloured sandstones, dark shales holding numerous coal-plants and fish remains, marls, and limestones. The latter strata contain an abundance of Carboniferous brachiopods and other fossils; and in many places, as in the vicinity of Windsor, in the cliffs of the St. Croix River, at Newport and Walton, along the Shubenacadie, &c., they are associated with beds (and occasional veins) of anhydrite and gypsum. A few comparatively limited patches of Middle Carboniferous strata overlie these lower beds here and there along the edge of the Cobequid Range, and in places in the valleys of Kennetcook and Stewiacke, but they appear to contain merely thin seams of coal, of value only as a source of local supply. Both the north and south shores also of Cobequid Bay are bordered by soft red sandstones and conglomerates of assumed Triassic age. These rest unconformably on the prevailing Lower Carboniferous formations of the country; and in places, as at Gerrish's Mountain and elsewhere, they are overlaid by masses of amygdaloidal trap.

3. *The Cobequid Mountains Area.*—This section of the Province forms a wild but thickly-wooded mountainous district, of an average elevation of from 1,000 to 1,200 feet above the sea. It ranges, roughly, from Cape Chignecto in the west, to the Carboniferous district of Pictou in the east. Southwards it is bounded by the Newport and Truro area, and northwards by the Cumberland coal region. The Cobequid range is composed essentially of syenites and related

crystalline rocks, probably of Pre-Silurian age, with slates, shales, sandstones, and quartzites, dipping at high angles on its southern flanks. These latter formations are regarded as altered Silurian strata. In the township of Londonderry (Colchester county), more especially, they are traversed by veins of brown and red iron ore and ankerite.* One of these is remarkable for its continuity over a length of several miles. It is filled principally with ankerite, but carries large quantities of fibrous and botryoidal brown iron ore in some places, and micaceous red ore in others. The ankerite averages in metallic iron $11\frac{3}{4}\%$, the brown ore 56%, and the red ore nearly 69%, as deduced from a series of analyses by the writer. These ores, moreover, contain very little rock matter, and they are practically free from titanium; whilst sulphur and phosphorus are present in them in traces only.

4. *The Cumberland Area.*—This is one of the leading Carboniferous districts of the Province. It occupies in the County of Cumberland a large extent of country between the Cobequid Mountain Range on the south, and the Straits of Northumberland on the north Westward it runs into the Carboniferous area of New Brunswick; and in the east it merges into the Pictou area. Its strata consist of the Lower and Middle (or Productive) Carboniferous divisions. The latter hold numerous seams of coal, but most of these are of slight thickness. Workable seams occur, however, within the area, more especially in the Springhill coal basin, near the slopes of the Cobequid Range. The strata here dip northwards, or away from the mountain flanks; but in the central and northern, or north-western, portion of the area, they dip towards the south, thus forming a more or less regular trough or basin. On a portion of the northern edge of this trough (the strata dipping nearly S S W), the celebrated "South Joggins section" occurs. This is exposed along the eastern shore of Cumberland Basin, a continuation of Chegnecto Bay. It exhibits a continuous series of Lower and Middle Carboniferous beds, dipping S. 25° W., at an average angle of 19°, throughout a thickness of 14,500 feet, and containing seventy-six seams of coal, nearly all of which rest upon stigmaria under-clays. These coal seams for the greater part, however, average, individually, only a few inches in thickness; but two are of workable dimensions. One of these is the "Joggin's Main Seam," consisting, really, of two seams separated by a thin layer of

* See Dawson's Acadian Geology Also a detailed notice, with working plan, by Mr. Selwyn, Director of the Geol Survey, in the Report for 1872

shale, but worked as a single seam. It averages nearly five feet in thickness. In the associated sandstones and shales, upright and prostrate trunks of sigillariæ and lepidodendra—with other coal plants, shells of fresh water mollusca, and numerous fish scales—occur throughout the section. In these rocks, also, the remains of an extinct amphibian—the Dendrerpeton Acadianum of Owen and Wyman—belonging, apparently, to the perrenibranchiate section of the Urodela—were discovered by Dr. Dawson, in 1852; and reptilian tracks have been discovered subsequently. Some of the lower beds of this locality yield grindstones of high reputation. On the southern margin of this area, where the general dip of the strata is towards the north, seams of greater thickness have been recognized These lie east of the River Macan, in the Springhill coal country. Several seams of workable thickness have been discovered by trial pits. One exceeds 13 feet, and another 11 feet in thickness, the others ranging from 2 to 6 feet. The coal is a bituminous or gas coal, of excellent quality.

5. *The Pictou Area.*—This is the most important coal area of Nova Scotia proper. It lies directly east of the Cumberland Carboniferous district and the Cobequid mountain range, and thus comprises the country around Pictou Harbour, generally. It extends, however, southwards and eastwards to the older Palæozoic and Syenitic mountainous country, which ranges from the eastern borders of the Truro area through Egerton and Maxwelltown, and continues to the north coast in the Antigonish and Arisaig Hills. On these southern and eastern borders the area is occupied generally by various conglomerates, dark green and other-coloured slates and shales (many of which become opaque white by weathering), and some dark quartzites—all Pre-Carboniferous, but otherwise of doubtful age; and these are followed towards the north or north-west by grey and red sandstones and conglomerates, with a few limestone and gypsum beds, belonging to the Lower Carboniferous series. These lower formations are more or less tilted and disturbed, and they exhibit nearly opposite dips in different localities. The central and northern portions of the area are occupied by succeeding strata of the Middle or Productive series, with overlying beds of the Upper series in places along the coast. The general dip of these strata is northwards—*i. e.*, a little west or east of north—or towards Northumberland straits; but they are affected, over the more southern portion

of their limits more especially, by a series of faults, by which their relative positions are somewhat disturbed. The base of the Middle Division is a coarse red conglomerate, which outcrops immediately north of one of these lines of fault, and runs in a general easterly direction through New Glasgow, between the inlets or harbours of Pictou and Merrigomish. This dips generally towards the north, in which direction it is followed by the more typical coal strata (although these present little more than indications of workable coal seams), with strata of the Upper Division outcropping beyond them and so passing under the straits. South of the New Glasgow conglomerate and fault—the outcrop of the conglomerate being due to the latter—other beds of the Middle or Productive Division occur; and it is in these that the great workable coal seams of the Pictou area are situated. They are traversed by several faults running roughly east and west, or parallel with the northern or New Glasgow fault; and they are also partially disturbed by minor faultings, running more or less transversely to the latter. The coal seams lie principally in two main synclinals between the north and the extreme south fault—a breadth or distance of from three to four miles intervening between these. Two of the seams are of remarkable thickness. These are exposed principally on and near the East River in the district of the Albion and Acadia mines, a few miles south-east of Picton Harbour. One seam, known as the "Main Coal Seam," has an average thickness of about 36 feet; and a second seam, the "Deep" or "Cage-Pit" seam, lying 150 feet vertically beneath the main seam, is about 23 feet in thickness. These seams do not consist throughout of coal of uniform quality, but include subordinate layers of coarse coal and slaty coal, and also some thin seams of ironstone; the whole, however, being taken out together, and thus worked as a single bed. At the Albion mines the dip of the main seam is N E., at an angle of 18°–23°, and the thickness varies from 36 ft. 10 in. to 28 ft. 3 in. Several seams have been discovered below the Deep or Cage-Pit seam, varying in thickness from 3 feet to about 12 feet; and a 3½ feet seam occurs also above the Main seam Other seams have likewise been recognized by outcrops at Fraser's Mountain, and on Middle River, &c., within the present area. One of the lower seams, lying at a vertical depth of 580 feet below the Deep seam, consists of a layer or "bench" of ordinary bituminous coal, about 3 feet in thickness, resting on a layer of inflammable substance, somewhat resembling in character the Albertite of New Brunswick, and the Torbanite of Scotland. This substance has been named "Stellarite," by Professor How, from its property of emitting numerous sparks during combustion. It varies in the thickness of its bed, from five or six inches to about a couple of feet. Immediately beneath it there is another layer of a bituminous, or so-called "oil," shale, differing principally from the stellarite layer by its more shaly structure, and by the presence of a comparatively large amount of ash. The stellarite yields on an average about 120 gallons of crude oil per ton, and the oil shale about 60 gallons. In a band of impure ironstone, forming part of the Albion main seam, the skull and several teeth of a large Labyrinthodont—the *Baphetes planiceps* of Owen, were discovered some years ago by Dr. Dawson.

6. *The Egerton, Arisaig, and Porcupine Mountains Area.*—This area might be regarded as an eastern extension of the Cobequid Mountains, although separated from the latter by a narrow strip of Carboniferous country connecting the Truro and Pictou areas. Like the Cobequid Mountain area, it consists of high rocky land, made up of central ranges of syenitic rocks with altered Silurian (and Devonian?) strata, in the form of highly-tilted slates and quartzites, upon their flanks. It extends in a general north-easterly direction from near the head-waters of the Shubenacadie to within a few miles of Antigonish Harbour, where it subdivides into two branches, one of which terminates in the Arisaig Hills and in Cape St. George, and the other in the Porcupine Mountains on the Gut of Canseau. Some of the slates of this area, as those of Arisaig and other localities, contain Middle Silurian (?) fossils. The Antigonish Hills and Cape St. George in the north-east, and Cape Porcupine on the Gut of Canseau are composed, at least in their central portions, of vast masses of syenite and greenstone (probably of Pre-Silurian age) flanked by dark slates in highly-tilted and more or less contorted beds.

7. *The Antigonish Area.*—This extends over the greater portion of Sydney County, in Nova Scotia proper. It lies chiefly around Antigonish Harbour and the south shore of St. George's Bay, and thus includes the valleys of West River, South River, Pomket River, Black River, the Tracadie River, &c., and intervening breadths of country—the syenitic and altered rocks of Arisaig and Cape Porcupine bounding it, respectively, on the west and south. It is occupied essentially by strata of the Lower Carboniferous series, consisting of

sandstones, limestones, &c., with thick and widely-extended beds of pink and white gypsum. A slight development of the Middle Carboniferous series occurs in the more northern portion of the area, between the Pomket and Tracadie rivers, and extends under St. George's Bay; but only a few thin seams of coal appear to be present in its strata.

8. *The Guysboro' Area.*—This area lies around the north-west shore of Chedabuctoo Bay, and extends westward, in a gradually narrowing belt from the south entrance of the Gut of Canseau, entirely across the county of Guysboro' and along the valley of the west branch of the St. Mary's River. It is bounded on the south by the eastern extension of the Atlantic crystalline area, and northwards by the southern slopes of the Cape Porcupine and Egerton syenitic and metamorphic region. Its strata appear to belong entirely to the Lower Carboniferous division, and they are destitute of coal. They consist, in the more eastern portion of the area, very largely of dark and other limestones, traversed here and there by thin veins or strings of specular iron ore, and accompanied by various sandstones and conglomerates, the latter occupying the chief portion of the area westward. In many places, especially around the town of Guysboro', these Lower Carboniferous strata dip at high angles, and present a more or less altered aspect.

9. *The Southern Area of Cape Breton.*—This area ranges from Isle Madame across St. Peter's Bay, and along the entire south coast of Cape Breton. It may be defined in general terms as occupying all the more southern portion of the Island, or those portions of the counties of Richmond and Cape Breton which lie to the south and south-east of the Great Bras d'Or and the Mire River. Its geology to some extent has still to be worked out, but the area is occupied essentially by masses of porphyritic syenite and related rocks, associated with slates and other apparently altered strata, for the greater part of Palæozoic age, but including, probably, a few subordinate representatives of Pre-Silurian epochs.

10. *The Western Area of Cape Breton.*—This division lies immediately east of the Strait or Gut of Canseau. It extends from St. Peter's Bay over the western half of Richmond county, and northwards over the Bras d'Or Lake or Great Bras d'Or, and over the more western portion of the Little Bras d'Or. From these points it stretches to St. George's Bay and along the Gulf to beyond the Mar-

garie River. It thus includes the greater portion of Richmond county, with the more western portion of the county of Cape Breton, and the southern portions of Inverness and Victoria. The rocks within this section of country belong chiefly to the Lower Carboniferous series, but the area includes also some slight exposures of the Middle or Productive series, and several tracts of considerable size occupied by syenites and related rocks. The Lower Carboniferous strata consist of various beds of conglomerate, sandstone, limestone, and marl—the two latter associated in many places (as at Plaister Cove, Port Hood, and Mabou, on the Gut of Canseau; at Caribou Cove on the south coast; and at Baddeck and other points on the Little Bras d'Or) with beds and occasional veins of gypsum and anhydrite. These lower strata are succeeded here and there by small patches of the Middle Carboniferous series, containing seams of coal. These occur at Caribou Cove and on Little River (where the beds are much tilted and disturbed), and also on the Inhabitants River, in the south; and near Port Hood and Mabou in the north-west. The coal bed at Caribou Cove, as described by Dr. Dawson, is 11 feet 8 inches in thickness, but of inferior quality; and it shows an over-turn dip with the original underclay now forming its roof. At Port Hood several seams have been recognized, but these, apparently, are of no great thickness. The strata at this latter locality contain numerous stigmaria-roots in undisturbed position, together with other characteristic coal plants. In addition to these Carboniferous strata, this western portion of Cape Breton, as indicated above, includes some detached syenitic areas of considerable extent. The largest appears to range from the River St. Denys to within a short distance of St. George's Bay. Others of similar character—outliers of the great syenitic area of the northern peninsula of Cape Breton—lie in the immediate vicinity of Ainslie Lake, a large body of fresh water, with the River Margarie for its outlet, in Inverness.

11. *The Eastern, or Sydney Area of Cape Breton.*—This area, as a coal-bearing district, rivals in importance the Pictou area of Nova Scotia proper. It occupies the country around Sydney Harbour, and extends northward across the Little Bras d'Or and Boulardrie Island, and eastward and southward to Mire Bay and the Mire River. Its strata belong essentially to the Middle or Productive Carboniferous series, and consist of the usual sandstones, conglomerates, and shales, with seams of bituminous coal and fire-clay, and occasional bands of

ironstone nodules. They dip, generally, towards the coast, and their coal beds are worked in some instances to a considerable distance beneath the sea. The area thus evidently forms a portion of the western margin of a great sub-marine coal basin, the eastern or north-eastern edge of which outcrops in places on the opposite shore of Newfoundland. A fine section of these strata is exposed on the north-west shore of Sydney Harbour and around Cranberry Head. The beds at this locality dip towards the N E. (or more strictly, N. 60° E.), at an angle of 7°; and they contain a great abundance of sigillariæ with attached roots, and other examples of characteristic coal-plants. Although numerous seams of coal occur within the area, the actual seams of workable thickness do not appear to exceed six or seven in number. These have been brought up, however, at various points by a succession of undulations; and outcrops of the same seam on different properties have thus been regarded in many instances as distinct seams, and special names have been bestowed upon them.* These workable seams vary in thickness from about 4 feet to 10 feet—the average thickness being about 5½ to 6 feet. The average dip is from 5 to 6 degrees, or about 1 in 10 or 12, but the beds flatten greatly, as a rule, in descending. In some places, however, the dip is much higher. The Victoria (Ross) seam, for example, dips at an angle of 38° or 39°; and the McAulay seam, near Cow Bay, dips on one side of a sharp synclinal at an angle of nearly 45°, whilst on the opposite side the slope is only about 7° or 8°. The principal mines are situated more or less immediately along the coast, in a curved line extending from Boulardrie Island, across the Little Bras d'Or and Sydney Harbour, by Lingan and Bridgeport, to beyond Glace Bay and Cow Bay, in the south-east. The coal throughout this area is a bituminous caking coal, containing, as a rule, a very low amount of ash.

12. *The Northern Area of Cape Breton.*—This division includes the more northern portions of the Counties of Inverness and Victoria, forming the great northern peninsula of Cape Breton. Very little is

* The writer made a rapid examination of the Sydney Harbour coal country in 1873, and published commercial reports on the Collins' coal property immediately east of the Little Bras d'Or, and on the Campbell property near Glace Bay He found no indications of faults at these localities, and he is informed by Mr. Hugh Fletcher (one of his old students, now on the staff of the Geological Survey) that late investigations have failed to detect their presence within the coal district proper, the repetition of the seams at different spots being entirely due to a series of folds, as stated in the text above. Mr Fletcher, partly alone, and partly in conjunction with Mr Charles Robb, has mapped and examined the entire coal area of this part of Cape Breton. See the Survey Report for 1875, and that for 1876 now under preparation

known of its geology; but the greater portion, if not the entire surface, of its area appears to be occupied by high ranges of syenitic rocks of Pre-Silurian age, flanked by micaceous and other slates, resembling the altered Palæozoic formations which occur in the southern part of the island, with here and there a few exposures of Lower Carboniferous strata. These latter are seen along the west coast. between Margarie and Cheticamp; and on the eastern coast at Aspy Bay, St. Anne's Bay, and one or two intervening points.

PROVINCE OF PRINCE EDWARD ISLAND.

This fertile island presents a generally level or but slightly undulating surface, with an average altitude of from 100 to 200 feet above the sea. Mountain elevations are altogether unknown within its limits. The coast-line is indented by numerous bays and creeks—some of which penetrate far inland. Its geology is comparatively simple, indicating a single district only. The surface strata consist almost wholly of soft red sandstones, and other Triassic representatives in nearly horizontal or but slightly inclined beds, with here and there an outcrop of underlying Upper Carboniferous (or Permian ?) strata, and some overlying drift and modern deposits.

A very complete Report on the geology of this Province, by Dr. Dawson, (with the co-operation of Dr. Harrington,) was issued by the Geological Survey of Canada in 1870. From this Report—aided by personal observation, the writer having visited the island on two occasions—the brief details which follow are chiefly drawn.

The oldest recognized strata on the island are either Upper Carboniferous representatives, or beds of transition representing part of the Permian Formation. They occur on the south coast at the Gallows or Gallas promontory, east of Hillsborough Bay, as well as on Governor Island, in the centre of the latter inlet; and they range also in a narrow strip, along the greater portion of the north-west coast, from near West Point to the vicinity of North Point. At these localities the strata consist chiefly of brown, red, and grey sandstones, with some reddish shales, and a few concretionary limestones and conglomerates. The beds at Gallas Point form a slight anticlinal, ranging roughly north and south, and extending apparently through Governor Island. These strata, both at Gallas Point and on the north-west shore, contain silicified trunks of a coniferous tree, (*Dadoxylon materiarium*, Dawson,) with several species of calamites, ferns, and other plants belonging essentially to the Upper Division of the Carboniferous series.

These Carboniferous strata, however, are of little significance as regards the geology of the Province generally. The main area of the island, as stated above, is occupied by Triassic representatives. These consist essentially, at the lower part of the series, of concretionary, and more or less magnesian and sandy limestones, with beds of comparatively hard red sandstone and occasional conglomerates; and, at the upper part, of soft red sandstones and clayey marls. The red sandstones form the characteristic strata of the island, but calcareous conglomerates are seen in many of the coast sections on the western shore. Some of the lower beds contain obscure plant-remains and impressions; and portions of the under jaw, with attached teeth, of a Dinosaurian (?) reptile (the *Bathygnathus borealis* of Leidy) were discovered many years ago in the red sandstone of New London, on the northern coast, a short distance east of Cape Tryon. On Hog Island, a small islet lying off the western entrance of Richmond Bay, on this coast, a dyke of dark grey trap or dolerite—the only example of an eruptive rock known within the Province—runs for a short distance along the shore.

The only other rock formations occurring within the Province, consist of Glacial and Post-Glacial deposits, and some modern accumulations. Scattered boulders and deposits of boulder-clay occur more or less generally throughout the island, and are accompanied in places by stratified sands and gravels containing occasional shells of *Tellina Grœnlandica*, so characteristic of Post-Glacial deposits in Quebec and the New England States. The boulders of the south-eastern portion of the island appear to have come chiefly from the syenitic and crystalline ranges of Nova Scotia, whilst those of the north shore have followed the more usual law of distribution, and have come apparently from northern sources, and principally from the gneissoid rocks of Labrador and Newfoundland.

The more recent formations of the Province comprise a series of sandy dunes, or hills and ridges of blown sand, lying mostly along the north-west coast; various beds of peat, as those of Cascumpeque Bay, Lennox Island, Squirrel Creek, &c.; and accumulations of "mussel mud." This latter deposit contains much organic matter, with carbonate and a little phosphate of lime, and is largely used as a mineral manure. It forms beds of variable thickness, exceeding in places ten or twelve feet, in many of the creeks and bays of the island.

ALEXANDER GORDON, THE ANTIQUARY.

A SUPPLEMENTARY NOTICE.

BY DANIEL WILSON, LL D

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In 1872 I communicated to the Canadian Institute some memoranda relative to a famous old Scottish antiquary, Alexander Gordon,* author of the "*Itinerarium Septentrionale*," published in 1726, and recalled anew to modern readers by the prominence assigned to it by Sir Walter Scott in the pages of "The Antiquary." The special claims which the author of the *Itinerarium* presented to notice in a Canadian journal, rested on the fact that in his later years he emigrated to the New World, and closed his life in South Carolina while that was still one of the British colonies. Attracted by the fact that one of the earliest and most diligent labourers in the field of Scottish antiquities had thus spent his later years on this continent, and among scenes so strikingly contrasting with all that had chiefly invited his research so long as he resided in the Old World, I was led to institute inquiries which happily resulted in the recovery of a copy of his will—a curious and highly characteristic document. This I forwarded to my friend, Dr. David Laing, Foreign Secretary to the Society of Antiquaries of Scotland, with a view to its being communicated to that body; and as he has supplemented its production in the Proceedings of that society, with letters and other information concerning Gordon and his works, I have embodied them here, along with some additional notes, in a consecutive narrative, as a supplement to the account already contributed to this journal.

Alexander Gordon was a native of Aberdeen, and a graduate of one or other of the universities which then rivalled each other as seats of learning on the banks of the Dee. But both christian and surname are common in that locality; and it has proved impossible either to trace his family relations, or to pick him out from among

* Alexander Gordon, the Antiquary. Vol. XIV., N. S., p. 9.

the various Alexander Gordons who figure on the rolls of the ancient University of King's College, founded by Bishop Elphinstone, or the later foundation of Marischal College. Dr. Laing thus writes:— "Whether he belonged to any of the Gordon families of note in the neighbouring district has not been ascertained. As, however, he had taken his degree of A.M. at Aberdeen, it was desirable to know both the exact date, and also if the registers might indicate anything as to his parentage. On applying to the Rev. Mr. Fyfe, Registrar of the University, he kindly examined the College registers, and found various persons of the name of Alexander Gordon, between the years 1700 and 1720, without any means of identifying them. Gordon afterwards is said to have travelled abroad, probably as a tutor, and to have spent some years in Italy, France, Germany, &c. His residence in Italy had no doubt its influence in directing his attention to the Antiquities of his native country." He must have been a persevering enthusiast, with considerable energy, and more of that versatility which is better turned to account in a new country than would ordinarily be looked for in one who expended some of the best years of his life, and all his available means, in an attempt to recover the nearly obliterated footprints of the Romans to the north of the Tyne.

Dr. Laing may be right in the surmise that Gordon travelled abroad in the capacity of tutor; but it seems probable that he had originally some little means of his own; and with the frugal habits which enabled him at length to leave a comfortable competency to his children, he found means sufficient to admit of his devoting adequate time to the investigation of the traces of Roman art and civilisation, both on the continent and at home. He must have economised his resources at a later stage; for he is our authority for the fact that he spent three years in exploring, drawing, and measuring the monuments of antiquity described by him in his Itinerary. This must have tended to exhaust his available funds before the publication of that work involved him in pecuniary difficulties, and compelled him to hasten its issue with more regard to his immediate necessities than to his permanent reputation. The volume is dedicated, as previously stated, to His Grace Charles Duke of Queensberry, Dover, &c.; but his efficient patron and ally in the exploration of the traces of the ancient Romans was Sir John Clerk, of Pennycuik, to whom he refers as the Baron, in allusion to his judicial rank as one of the

Barons of the Scottish Exchequer. He formed a large and valuable collection of antiquities, chiefly of the Roman period, and devoted himself with great zeal to their elucidation; but the only other production of his pen, besides his letters communicated to the Society of Antiquaries of London, and his correspondence with Mr. Roger Gale, is his tract, entitled, "Dissertatio de Monumentis quibustem," &c., printed at Edinburgh in 1750, when Alexander Gordon had been settled for years in His Majesty's plantations beyond the Atlantic.

One of Gordon's letters, recovered by Dr. Laing from the Anderson papers in the Advocates' Library, is addressed to the author of "Selectus Diplomatum et Numismatum Scotiæ Thesaurus," and other well-known works. From this letter we learn that he had borrowed Anderson's copy of Sir Robert Sibbald's "Historical Inquiries concerning the Roman Monuments and Antiquities in the north part of Britain called Scotland." Though at that date only published sixteen years before, the elder folio of Roman Antiquities had already become scarce. Gordon had ranged over all the book-stalls in vain search for it, though he now had a promise from "Paton" to procure him a copy. This is, no doubt, Mr. John Paton, a well-known bibliopole of the time, whose tastes were reflected in his son, George Paton, the correspondent of Tennent, Gough, Stukeley, and other antiquaries of his day; and famous among the same elder generation for his collection of choice and rare books. Writing to Mr. Anderson on the 19th of August, 1723—that is about three years before the publication of his own "Itinerarium Septentrionale; or, a Journey thro' most of the Counties of Scotland, and those in the North of England"—Gordon says:

"Since you did me the favour of lending me Mr. Sibald's book, I have been very much instructed and informed by it, have therefore ranged over all the booksellers shoaps in town in search of purchasing it, but to no purpose, save that Paton has promis'd to procure me it this week. However, seeing the Baron and I probably go out of town to-morrow, I have in a manner an indispensable necessity of having that book of Sibald's along with me in my antiquary peregrination, so if I could so far prevail on your goodness to lend me it till I come back from the virtuoso Tuer, which can be no farther than Glasgow, Sterling, and Perth this Summer, I should take it as a demonstration of very condescending goodness in you, seeing I can nott get another at present; and this book is absolutely necessary for my designes, seeing it directs me to 50 or 60 places which I know nothing about, besides am to trace the *Vallum* according to the stages sett doun in his draught. All this considered, and that it may chance to be of publick good, I hope you'l indulge me with this favour which I came to ask of you in person; but I heard you was at the Fowl Briggs; am therefore impatiently waiting your commands this way, or if possitively you will have it returned, I shall; but at any rate should not keep it long from you."

From this we learn that Gordon was to start, in company with Baron Clerk, on the following day, on what he styles an "Antiquary Peregrination," or "Virtuoso Tuer," to the Roman camp at Ardoch, and the remoter footprints of Imperial Rome lying beyond the Tay; as well as to trace the line of the Antonine Wall between the Forth and Clyde, on the details of which, as it existed one hundred and fifty years ago, his own learned folio throws much light.

Sibbald's folio was the *vade mecum* of northern antiquaries, till superseded by that of Gordon; who shows his gratitude for the invaluable aid derived from a predecessor to whose diligent researches he owed the direction to fifty or sixty places, about which, as he acknowledges to Mr. Anderson, he would otherwise have remained in total ignorance, by never wearying in giving expression to his astonishment at his blunders and shortcomings. We have therefore to picture to ourselves Sandie Gordon, mounted, like Don Quixote on his Rosinante, with Sibbald's "Historical Inquiries" stowed away in his huge saddle-bags, for reference, as "a matter of indispensable necessity," in many a learned discussion with the Baron concerning the true country of the Brigantes; the sites of Borcovicus, Alauna, Æsica per lineam Valli, and above all, that of the world-famous battle of Mons Grampius. "If these be in Scotland," he exclaims with bitter irony, at the close of a controversial dissertation on his predecessor's narrative, "Sir Robert must be in the right, and Pancirolus and Cambden in the wrong; which no man, I think, that has any pretence to learning, will now assert." But such was the belligerent fashion of an age which Scott has reproduced for us with such graphic humour.

In this and similar exploratory tours, Gordon made himself master of the details of Roman and other early remains embodied in his dry, but patiently-elaborated folio, which owes the revival of its fame to that memorable event in the world of fancy, when Jonathan Oldbuck undid his brown-paper parcel in the Hawes Fly, or Queensferry Diligence; and, on his fellow-traveller inquiring as to the nature of the volume which formed the object of his study, "he lifted up his eyes with something of a sarcastic glance, as if he supposed the young querist would not relish, or perhaps understand, his answer, and pronounced the book to be Sandy Gordon's *Itinerarium Septentrionale*, a book illustrative of the Roman remains in Scotland."

The experiences of the laborious and learned author were very much of a piece with those of others who, before and since, have undertaken such work. Of fame, of the sort attaching to such labours, he had his share. He carried on a correspondence with Sir John Clerk, and Mr. Roger Gale, a well-known English antiquary, the fruits of whose labours, along with those of his brother Samuel, are preserved in the *Reliquiæ Galeanæ*. The results of this correspondence were communicated from time to time to the Society of Antiquaries of London, whither Gordon had removed on the completion of his work. To such publicity they made no objection; but by and by they manifested some professed alarm at the hint of Gordon's design to issue their letters to the world as a supplement to his own folio. On the 16th of April, 1726, Sir John Clerk writes to Mr. Gale:—"I received this moment the honour of yours of the 9th instant, and at the same time one from Mr. Gordon, wherein he tells me that he had laid aside all thoughts of inserting our letters in his Appendix, and that he was only to take the substance of them in his own way. This piece of news pleases me extremely; and I hope you will keep him to his word."

The most, however, that Gordon could be persuaded to, appears to have been the withholding of his correspondents' names. He printed a folio tractate of "Additions and Corrections, by way of Supplement, to the 'Itinerarium Septentrionale,' containing several dissertations on, and descriptions of, Roman Antiquities discovered in Scotland, since the publishing of the said Itinerary; together with Observations on other Ancient Monuments found in the north of England, never before published;" informing his readers that, since his writing the Itinerary, he had been favoured with the following letters "concerning the Sepulchres, and Funeral Rites, of the Ancients in Britain, from two gentlemen who are the honour of their age and country:" and he adds, as a sort of apology for the use he is thus making of their correspondence: "The subject is so much to my present purpose, and withal, so curious, and their manner of handling is so judicious, that without further apology, I shall present them in their own words." So he accordingly printed a fasciculus of thirty pages, with four additional plates; and, after the fashion of that age of patrons and literary clients—so different from our own,—he dedicated the thirty pages of borrowed learning, not to their author, but, "To the Honourable James Makrae, Esq., late Governor of Fort St. George," whose acquaintance he appears to have made during his sojourn in Italy; and who had continued to manifest a sympathy with his Roman researches after the return of both to Scotland. He thus writes to him:—"The many favours I have received from you, when I was honour'd with your acquaintance abroad, and the continuance of them at home, oblige me to take the first opportunity of declaring to the World how much I am indebted to your friendship," and so he begs him to "accept these Papers, not as any retribution for the many favours receiv'd, but as a sincere acknowledgment of a grateful heart."

But, unfortunately, in his efforts to gratify one patron, Gordon was in the fair way of offending others; and all the more so that he contrived, in printing the letters of Baron Clerk and Mr. Gale, to grieve the eyes and vex the hearts of the two fastidious Antiquaries by some slovenly misprints. But the evil being done, and irremediable, Baron Clerk played the philosopher with an amiability in noticable contrast to the wonted characteristics of the *irritabile genus*; and thus writes to his fellow-sufferer:—

"I cannot now help what is done, but have caused the errata to be printed after the Appendix in as many copies as are to be sold here; I likewise ordered the printer to send them to Mr. Gordon, that they might likewise be inserted in other copies.

"To return to Mr. Gordon, tho' he had done me a great kindness not to put me so much in his records, yet I am obliged to forgive him, for I dare say he had my credit no less in view than his own. As to the errata, I must impute them to my own bad hand and way of writing, with which, I doubt, you are scarcely acquainted as yet. As to the rest of Mr. Gordon's book, it is really a book above my expectation, and might have pleased everybody had he been less precipitate in publishing it. I was not wanting in giving him Horace's advice:

——Nonumque prematur in annum:
Membranis intus positis, delere licebit
Quod non edideris; nescit vox missa reverti.

But, possibly, he has done better if he has acquired by it new and able friends to get him put in a new way of living."

Sir John Clerk thus amiably recalls the fact that while Mr. Gale and himself were amusing an idle hour with antiquarian research as a pleasant pastime, Gordon, with self-sacrificing zeal, had thus far made it the business of his life. The traditions of Pennycuik House recalled the author of the *Itinerarium* as an austere, formal enthusiast, who had won for himself the soubriquet of *Galgacus*, from his abounding zeal on the subject of the famed battle of Mons Grampius and its Caledonian hero. "It was not in vain," he exclaims, "that Galgacus, in his speech to his army, made use of this expression: 'We, the bravest and most noble inhabitants of all Britain, and seated in its very bosom, never so much as once looked on countries of servitude, nor were our eyes at any time polluted with objects of slavery;'" he then adds: "that their situation being at the extreme part of the world, among them only were liberty and fame remaining." And so Gordon goes on to quote and translate the "Nos integri et indomiti," &c., of Tacitus, and to produce anew the Caledonian chief's fictitious rhetoric: "If I be slain in Caledonia, 'twill not be inglorious to have it said that I fell in a country which is the extreme boundary of the earth and nature!"—and all this with a faith in the old Historian's rhetoric equal, at the least, to what we are wont to extend to "Our own correspondent" of the *Times*. His weakness on this point was familiar to Sir John, and he adds: "I cannot omit making some apology for him in relation to what he says of the speech of Galgacus. I once endeavoured to persuade him that it was only a fiction of Tacitus conformable to a liberty among historians, and that there was no reasoning from any thing contained in it to the advantage either of Galgacus or his Caledonians; but Mr. Gordon's high respect for his country hath carried him too far, and made him commit a sort of laudable fault. There are other instances of this infirmity; but his business as an antiquarian will atone for all: the best that could be said for the Caledonians was, that though they had been conquered, yet the Romans could not retain their conquests. I am, I confess, of the opinion of some learned men, that it is a reproach to a nation to have resisted the humanity which the Romans laboured to introduce. As to the rest of Mr. Gordon's book,

Ubi plura nitent—non ego paucis offendar maculis."

Mr. Gale is less amiably inclined. He, it seems, has been *particeps criminis*, having been seduced into favouring and aiding in the publication of the letters, under the belief that it was done with the Baron's approval. After all, perhaps, we may attach too much importance to the coy pair of dilettanti, who did not very bitterly resent the publication of the learned prelections of two such "honours of their age and country," if only the printers and proof readers had presented them to the public eye in more faultless form. The purposed printing of a supplement by Gordon, to his folio, was undoubtedly known to his correspondents, for Mr. Gale, in writing to the Baron about a Roman inscription rescued from the crypt under Hexham Church, in Northumberland, tells him that Gordon designs to publish another inscription, one of Septimius Severus, in his Appendix.

Some of the learned speculations of Gordon's correspondents, which they had no objection then to communicate to the London Antiquarian fraternity, and to the world at large—so far as anybody outside of that learned fellowship troubled himself about such matters,—read oddly enough to us now. Gordon's Itinerary must have been passing through the press when Mr. Gale wrote to Baron Clerk, telling him of one of his letters, that it was received by "our Society with all the applause due to its merit: that is the greatest. I have their commands to desire your acceptance of their thanks for those just observations made by you on the ancient ways of sepulture used by our ancestors, and to beg your leave that they may be inserted into their Archives." But the Society of Antiquaries had not yet begun the publication of their "Archæologia, or Miscellaneous Tracts relating to Antiquity," and indeed did not do so for nearly half a century thereafter; so that, but for Gordon's zeal to supplement his own researches with the speculations of his learned patrons, their illumination of the obscurities of an ancient past would have been to as little purpose as the lighting of the "Perpetual Lamp," which the Baron describes to have been dug up under a cairn in his own neighbourhood. Such lamps, he goes on to say, were lighted and placed by the ancients in their urns; and, if some people are to be believed, "Upon the opening of an ancient sepulchre, light has been perceived in those lamps, which was extinguished on the admission of the air!"

Mr. Gale responds with English experiences in the same line of sepulchral exploration. Lord Pembroke had opened above twenty tumuli in the neighbourhood of Stonehenge, some of them when Dr. Stukeley and himself were present; and so he is able to interchange antiquarian wonders and learned speculation in this pleasant fashion: "Whatever people, whether the old Celts that first came into this island, which seems to me most probable, or the later Britains, erected that stupendous monument of Stonehenge, it certainly was in great veneration, as long as our heathen ancestors possessed the place; for so the many interments here do plainly argue. And what is very remarkable, this sacred spot is crowded with these sepulchral repositories, as far round every way as they could lie in sight of the temple; but as soon as the view is intercepted by the circumjacent rising grounds, you see no more barrows, or funeral circles. Burying the body in the earth was, no doubt, the most ancient way of disposing of it after death; though, that burning it was very old is evident from your undeniable quotations. Olaus Wormius will have burning of the most antique usage among his northern heroes; and tells you, in the first book of his *Mon. Danica*, the very time when burying them with their horse and arms came in fashion, which was at the death of King Dan, who reigned in Denmark when Joshua passed over Jordan; and who can doubt it when he is so exact in his chronology."

Mr. Gale had not the remotest idea of jesting when he thus wrote in commendation of the indubitable accuracy of the old Danish historian, in thus establishing a precise chronology for King Dan and his times. It was in accordance with his ordinary style, which he accompanied with adulatory phrases, and gracious apologies about "trespassing farther upon your patience, which I fear has been sufficiently tried," and the like suave terms: all in the stately phraseology of that eighteenth century. Privately, he thus responds in simpler fashion, concerning the publication of such letters:

"By what Mr. Gordon had said to me, I concluded he had your free leave to publish your letters, otherwise should by no means have parted with them to him, much less have suffered my crude and hasty answers to have attended them into the world, had not the printing of yours indispensably required it. The errors you complain of must be wholly imputed to the stupidity and perverseness of the printers. I corrected the sheets myself with all the care I could; and finding, when the book was finished, most of their faults still left, I persuaded Mr. Gordon to stop the publication of it for a week, whilst those sheets might be once more corrected and reprinted, which he did; but then returning from the press with some of the old errata set right, and new ones added in their room, stop them again he could not, having engaged a second time in the publick prints to deliver them at a certain day to his subscribers, which promise having broke, upon pretence the map was not ready (though the delay in reality was only to reprint the aforementioned sheets), he thought he could by no means excuse another non-performance of his engagements. I offered him to peruse every sheet of the whole book as it came out of the press, for which he seemed very thankful, but never sent me one, except those of the Appendix, containing our letters. I wish it was not his, being persuaded that he was perfectly right in all his notions which occasioned it, though you see as well as myself that he is not clear of mistakes; to which I must add, an impatience of getting the work abroad upon the prospect of getting a little money by it, his circumstances, as I believe, requiring and prompting him to it. I hope also that it has been a recommendation to him to some of our great men here, who, as he tells me, have given him some reason to expect they will do something for him. He may urge in his defence that strong plea of *Res angusta* DOMI for his hasty publication, as he may that other of *Vincit amor* PATRIÆ, where his zeal for the honour of his country has sometimes caused him to enforce his arguments too far."

What author does not know the grief of proofs returning from the printers with new errors added in lieu of the old ones set right. Of fame, as we have said, Gordon had some share in his lifetime, to say nothing of the honours that awaited him in the pages of "The Antiquary." In 1731, as we learn from one of his memoranda: "Some lovers of antiquity in Holland being now printing a Latin edition of my 'Itinerarium Septentrionale,' were desirous to know, at the time they began the said work, if I could transmit to them any additions and corrections for the original in English." If there was nothing else to tempt to such a translation of his learned work, there was his memorable parallel to the Julius Hoff, or Arthur's Oon, of Caligula's Pharus in Holland, which, having these following letters C. C. P. F., is read *Caius Caligula pharum fecit.* He hastened to communicate the joyful tidings to the Baron of Pennycuik. He had printed the corrections, and proposed additions, for the benefit of his old subscribers; but he only partially removed the blemishes of his sensitive patrons; and had in other ways failed in that humble deference which was expected from the literary client of the eighteenth century. The Baron accordingly hailed the prospect of a Latin edition, addressed to the learned cognoscenti, not of Holland only, but of Europe, and thus wrote to Mr. Gale:

"I had the favour of yours of the 11th January, but could not get so much time as to thank you for it, such was the hurry of some affairs in which I am concerned; and on the like occasions you have been so good as to excuse me. I never saw Mr. Gordon's Supplement till within these eight days. He had done well either not to have printed at all, or done it with less precipitation. His dispute with Dr. Hunter (physician at Durham) is amusing, for both what he and the doctor says, about the time of erecting the Basilica, may be true. I was out of all patience when I found him making remarks on some of your observations, which, I believe, were never printed; but, it seems he is one of those that would rather lose their friend than their jest, and a little more learning would make him a compleat modern critic. I have been sorry often to observe such weaknesses; but I was so much obliged to him for the happiness he introduced me to of your acquaintance, that I could overlook many faults in him. I beg it of you not to discountenance him altogether, but continue to give him your good advice, though he may be very little capable of benefiting by it. I have troubled you with the inclosed to him, which I beg you would allow a servant to carry him. I see he has helped off some of his errata in the 'Itinerarium,' but has taken no notice of some ridiculous things he made me say; wherefore I have sent him a few corrections, if there be place for them in his Latin edition."

The original edition of the *Itinerarium Septentrionale* bears on its title—which is more in the fashion of a modern preface,—that it is printed for the Author; and sold by G. Strahan, at the Golden-Ball, in Cornhill; J. Woodham, in Russel Street, Covent Garden; W. and J. Innys, in St. Paul's Church-Yard; and T. Woodward, at the Half-Moon, near Temple-Bar. But, for some reason or other, a change took place; and other copies have a new title, printed with the date

1727, and a different list of booksellers. In all probability, having supplied his original list of subscribers, he parted with the remaining copies; and so, while the 1726 edition bears on its title that it is "printed for the Author," and sold by the above-named booksellers, the later one is said to be printed for F. Gyles, D. Browne, &c. At a later date this was further supplemented by the Appendix and extra plates; and that again, in certain copies, by Sir John Clerk's errata; so that the modern book collector has to look out for the latest issue, unless he is curious in first editions.

From the letter of Sir John Clerk quoted above, it appears that the introduction of Mr. Roger Gale to the Baron of Pennycuik was due to Alexander Gordon; but, with all his submission to the deferential requirements of the age, the diligent and enthusiastic Author of the *Itinerarium Septentrionale* would, it seems, too frequently follow courses that seemed best in his own eyes, and even venture to hold to his own opinions in spite of the suggestions of such learned advisers.

It does not appear that the proposed Latin version of the Itinerary, with Baron Clerk's addenda, and the author's own additions and corrections, ever issued from the Dutch press; and from his English edition—notwithstanding all the fees from subscribers, and gratuities in acknowledgment of special dedications of plates, maps, &c.—it is to be feared that the returns for all his self-sacrificing labours were meagre enough.

The advice which that patrician dilettante, Horace Walpole, gave to the poet Chatterton, when he asked his aid to assist him in procuring some position where he might pursue the bent of his genius, was, to stick to his drudgery, and "when he should have made a fortune, he might unbend himself with the studies consonant to his inclinations." The advice would have suited the Scottish Antiquary as well as the marvellous Bristol boy. He could not dally with the antiquarian Muse—if such there be,—like the laird of Pennycuik, or his English ally, who acknowledges some little force in the poor author's anticipation of the prospects of getting a little money by his work. It is manifest that he had pecuniary difficulties, wranglings with booksellers, and trouble enough with touchy patrons; and, from Mr. Gale's allusion to "that strong plea of *Res angusta domi* for his hasty publication," I infer that he had already married, and had the cares of a household added to his other anxieties.

Dr. Laing has recovered from Nichol's "Literary Anecdotes" the following letter addressed, in 1726, to Joseph Ames, who ultimately became Gordon's successor as Secretary to the Society of Antiquaries of London. Ames had, in all probability, been engaged in canvassing for subscribers to the Itinerary; in which case, if the poor Antiquary had discharged his tailor's bill, and otherwise expended on his behalf £26 10s. out of the expected profits, one can understand his reasonable desire to stay any further demands for such service till he saw what he should have for himself:

"*To Joseph Ames.* Tuesday, 21st June, 1726. SIR,—I received your letter of Monday, in which you desire me to meet you at the Quaker's, which I cannot, by reason of a prior engagement with Mr. Mackay and others; nor do I know well what you mean by insisting on my promises, seeing, I think whatever I promised I have faithfully fulfilled, in a manner sufficient to any services I have had of you, which if you are not content, nor willing of a continuation of friendship, if you have a mind that justice shall decide the matter, let me know, that my attorney may appear, wherever you think proper to let me know, in a friendly manner, and if required, shall have sufficient bail ready, till a judge decide our difference. For my part, I thought by this time, on receipt of your clothes, you had been perfectly satisfied; and that the value of L.26, 10s. is reward for all you have done me. I think you go a very strange way to work in gaining friends and people's esteem, by such unreasonable pretensions, when you know with what difficulty I can get the two ends of my book's expense to meet. I did not expect this at your hand. Had you been easy till I had seen what profit I may have if any, or how my matters stand, I still would have exerted myself on your account, as I have already done, which is all from, Sir, your most humble servant, ALEXANDER GORDON." "P.S.—With the evening tide I go for Richmond to Sir Andrew Fountain, then to Twitnam, with Brigadier Bisset's books, next to Hampton Court, about a particular affair; so when I return I shall be very willing to lay the affair before Mr Colvill and Mr Richardson, your two friends; and I hope thereby exonerate myself and conduct in any affair betwixt you and me."

Sir Andrew Fountain, to whom he refers in this postscript, was, I imagine, the author of "Numismata Anglo-Saxonica et Anglo-Danica breviter illustrata," a learned folio, published at Oxford in 1704.

The date would make him considerably the senior of Gordon: but this accords with other evidence which points to friendly relations between the venerable knight whose numismatic labours supplement Hickes' Thesaurus, and the Romano-Scottish Antiquary. Numismatics were not overlooked by the latter; and his Itinerarium includes a notice, with engravings, of the famous Anglo-Saxon Runic Cross at Ruthwell, in Annandale, which he characteristically describes as "in form like the Ægyptian obelisks at Rome." It is not difficult, therefore, to imagine motives which tempted Gordon to make his way, from time to time, to Richmond; or to conceive of the welcome he received from the old knight, as he produced some choice coin or obscure inscription, over which the two could spend hours of not less keen discussion than those of Sir Arthur Wardour and the Antiquary *par excellence*, either at Knockwinnock Castle, or in the dining room of Monkbarns. In the account of Baupré Bell, another learned numismatist and antiquary, given in the "Literary Anecdotes," Mr. Nichols says, he made a cast of the profile of Dr. Stukeley, prefixed to his "Itinerarium," and an elegant bust of Alexander Gordon, after the original, given by him to Sir Andrew Fountain's niece.

In 1723, as we have seen, Gordon traversed the line of the old Roman wall and military road between the Forth and the Clyde; and so was able "to show how the track, vestiges, and circumstances of this wall of Antoninus Pius, commonly called Graham's Dike, appear on the ground to this day, having taken an actual survey thereof for that purpose, with a mathematical instrument, and measured its track with a Gunter chain the whole way from sea to sea." The fruits of this laborious survey, as he further tells us, he had minutely elaborated in a great map of six large sheets, which he designed very soon "to publish by itself, it being impossible that any book whatsoever should contain it." But this projected publication of the survey of a piece of military engineering which had fallen into disuse for fully thirteen centuries, assumed ere long a much more practical form. Sir John Clerk, writing on the 29th of August, 1726, to the English antiquary to whom he had then been recently introduced by the author of the aforesaid survey, informs him that Mr. Gordon is then expected in Edinburgh, "with his head full of a project, to make a communication between Clyde and Forth by a canal; when I see it is probable he will be less fond of it, for his project has been thought of a good many years ago, but it has been judged the profits would not answer the charge." This may be accepted as an index of the general encouragement which he received on his arrival in Edinburgh. His stay there accordingly was of the briefest. Within a week after he appears to have been in London, and there to have spread out his six large sheets on which his projected canal was traced traversing the old Roman vallum, mile forts, and military way, not only before the incredulous eyes of Mr. Roger Gale and Lord Islay, but before Sir Robert Walpole himself. Mr. Gale replies to his northern correspondent:

"I told Mr Gordon my thoughts of his project to cut through the Northern isthmus, very freely. I could not see what manner of commerce could be so promoted by this new passage, as to pay the immense expence it would require to perfect it; at the same time the public is so poor here, and so many necessary demands upon it, that I am sure it will be impossible to obtain the least sum for such experiments, and I believe your treasury in Scotland is not much richer; he has, however, communicated it to some great men. My Lord Islay treated it, as I hear, with great contempt; and if Sir Robert Walpole gave it a more favourable reception, it proceeded from the recommendation of Secretary Johnson, and from his usual affability and desire to dismiss everybody that applies to him as well pleased as he can." The politic minister of George I., it would seem, flattered the hopes of the enthusiastic projector with commendations of a scheme which was ultimately proved to be not only practicable but useful; but it was not till fourteen years after Gordon's death, and long after he had ceased to trouble himself either with the antiquities or the improvements of his native land, that Parliament gave its sanction to the scheme for cutting a navigable canal between the Forth and the Clyde. Still later the British Government aided the work by contributing the sum of £50,000 from the Scottish estates forfeited in the rebellion of 1745; and at length, in the year 1790, vessels sailed from sea to sea over the track of the old Roman road successively surveyed by Agricola, and by Lollius Urbicus, the proprætor of Antoninus Pius.

How long Gordon laboured in the vain endeavour to persuade the men of his own day to undertake the construction of a navigable passage across the Northern Isthmus, does not appear; but when he found the project was a bootless one, he once more betook himself to his pen, and in 1729, published in folio form, his "lives of Pope Alexander VI. and his son Cæsar Borgia: comprehending the Wars in the Reigns of Charles VIII. and Lewis XII, Kings of France; and the chief Transactions and Revolutions in Italy, from the year 1492 to the year 1506." The volume is illustrated with portraits of Alexander VI and Cæsar Borgia, the former of which Dr. Laing assigns as probably etched by Gordon himself. If so, it exhibits great skill, and the facility of a practised handler of the etching needle. It is a folio plate representing his Holiness seated, in full pontificials, wearing the triple crown, and holding in his right hand the symbolic keys. The drawing is by *Tho^m^ Sadler, Arm. Londini:* the contribution probably of an amateur draftsman, whose name figures as one of the patrons of the volume, among a list of subscribers, including Dukes, Marquesses, Barons, and Judges, Bishops, and Archdeacons, Baronets, Knights, Honourables, and Esquires, headed by Her Most Gracious Majesty, Queen Caroline. The engraver's name is thus obscurely indicated: *Al Sculpt.*, possibly an abbreviation designed to indicate the christian name of Alexander Gordon. The portrait of Cæsar Borgia, with its motto: *Aut Cæsar, aut Nihil*, contrasts with that of the Pope, as a highly finished engraving by T. Vandergucht, from the beautiful half-length painted by Titian. Gordon followed up this result of his Italian studies by publishing his translation of the Marquis, Scipio Maffei's "History of the Ancient Amphitheatres," and in particular that of Verona. The subject might not seem a very popular one for a goodly 8vo volume of upwards of four hundred pages, with twenty-five engravings; but it met with acceptance, and reached a second edition.

Next followed the only known dramatic production of this strange, versatile genius, his "Lupone, or the Inquisitor. A Comedy London, printed for J. Wilford, behind the Chapter-house in St. Paul's Church-yard, 1731." It is dedicated to his Grace Cosmus, Duke of Gordon; and Dr. Laing states that a copy of this Comedy now in his own possession, which was obtained from the Roxburghe collection, has this pencil note, after the Duke's name: "Then (1731) eleven years old. After his father's death in 1728 he was educated in the Protestant religion." This explains the first part of the dedication, which begins "My Lord, the sincere regard for truth, of which your Grace has given the world such early examples, renders you the proper patron of every attempt that tends to the exposing those whose employment is to promote the most pernicious error that ever deluded mankind." The scenes of the Drama are laid in Naples; and Lupone, a Dominican friar, is styled chief Inquisitor. The author does not seem to have aspired to the tempting profits of the stage, though to few men of his day could its rewards have proved more acceptable. He would seem rather to have been inspired by somewhat of the protestant zeal which at a later date animated the notorious Lord George Gordon, a son of this same youthful Duke to whom the author of "Lupone" addressed his approving dedication. It was, indeed, an age of protestant ascendency, in which the lineal claimants to the throne of James II. helped to keep alive the spirit of antagonism which his bigoted folly had evoked. The lives of the Borgias appealed to this prevailing sentiment; and Gordon characteristically writes in the preface: "Some zealous partizans may perhaps give out that this is solely published as a protestant piece of malice, to depreciate that church of which this scandalous Pope whose life I now write was head. But they may please know that it's neither my choice or design to disparage the religion of any church or mortal, but to leave theological controversy to our ecclesiastical champions of profession. I therefore hope, as a lay admirer of truth, without choice or design to arraign any particular system of religion in a wicked professor, and even head thereof, I may be allow'd so far to enjoy the glorious liberty of a country unterrified with Inquisitions, as to acquaint the world with matter of fact, by collecting from Roman Catholick authors the scatter'd life of an infamous Pope; which disagreeable subject I, perhaps, would not have undertaken, were not the contemporary facts in his pontificate the most surprising, and the revolutions which then happen'd the most extraordinary and curious, of any to be match'd in history."

Such is the style in which the author appeals to the popular English sentiment of his day, while deprecating the charge of producing "a protestant piece of malice." As a dramatist, as well as a historian, he derives his inspiration, not from English, but Italian proceedings; and he no doubt hoped for some pecuniary returns from this novel literary venture; for his experiences in the battle of life were such as are only too familiar to the literary enthusiast. Nichols, in his "Literary Anecdotes," reproduces a note, written by John Whiston, a London bookseller, which says of Gordon, "He was but in narrow circumstances. For some time he was in partnership with Mr.

John Wilcox, bookseller in the Strand; but his education, temper, and manners did not suit him for a trade." Whiston appears to have had some prejudice against him, as he says further, "He had some learning, some ingenuity, much pride, much deceit, and very little honesty, as every one who knew him believed. Poverty tempted him to dishonesty; his national character and constitution, to pride and ingenuity; and his dependence on the great, to flattery and deceit." The allusion to his "national character" reminds us of the prejudices which the revolution of a little later date intensified into the passionate antagonism of Smollett's "Briton," and Wilkes' "North Briton," with the pungent bitterness of Churchill's "Famine, a Scottish Pastoral," and others of his satires. No doubt the poor Antiquary found it hard enough to meet all demands, and keep his accounts square with printers, booksellers, traders, and housekeepers. Dr. Laing has recovered a letter, addressed by Gordon, in October, 1739, from his lodging in St. Martin's Lane, to Mr. Nourse, a bookseller at Temple Bar, in which he says: "I shall be obliged to you if you will at your leisure draw out the Credit part of our accompt, what you shew me in your shop last time is the Debtor side of your books I had of you; but I can instruct that you had 24 setts of my Dessertations on the Mummies sent to you, and not 18 as your memory misleads you in thinking, and as such I shall instruct it upon oath if required; besides I cannot possably be owing you a ballance of a guinea, for you may remember after you had your Diogines Laiertius you told me yourself and since, that the ballance due you from me was about 18 or 19 shillings, and I dare say if you ever have stated your number of those Dissertations you received, and sold, right in your books, you will find I owe you no more. I should be sorry to have the same difficulty with you in settling this, as Mr. Mackerther says he has had in his accompts with you. What I have told you is facts I can prove, therefore I am determined I will pay you no more then the ballance we had before settled, and what I realy owe you."

Three years before the date of this letter Gordon had been appointed Secretary to the Society for the Encouragement of Learning; and had succeeded Dr. Stukeley in the Secretaryship of the Society of Antiquaries. He was also indebted to the latter for his introduction to the Egyptian Club, for which also he performed the same duties for a time; and so had his attention diverted to what constituted thereafter his favourite hobby. In 1737 he published "An Essay towards Explaining the Hieroglyphical Figures on the Coffin of the Ancient Mummy belonging to Captain William Lethieullier;" and also another "Essay towards Explaining the Antient Hieroglyphical Figures on the Egyptian Mummy in the Museum of Doctor Mead, Physician in Ordinary to his Majesty." Those, therefore, are doubtless the "Dissertations on the Mummies," about the disposal of which their author had got into hot controversy with Mr. Nourse, and gave him his mind in such blunt fashion.

Alexander Gordon had now, from his secretaryships and other labours, some sure, though moderate, income; and, with a less troubled mind, he turned his old enthusiasm in the direction of his later studies, and undertook the elucidation of the hieroglyphic mystery, and the illustration of "all the Egyptian Mummies in England." To his essay towards an explanation of the hieroglyphics on Dr Mead's Mummy, he adds this information for the benefit of the reader: "The Two preceding Essays being design'd to explain Three of the Twenty-five Copper-plates already deliver'd to Subscribers, an Explanation of the remaining Prints will come forth with all convenient speed; first, what belongs to the other ancient Mummies exhibited in the said Plates; next, what regards the rest of the Monuments on Stone, Wood, Metal, &c. N.B.—When this is finish'd according to the Terms of the Subscription, the Author intends to offer the Public another Work, viz., The History of the Egyptians, from the earliest Accounts given of them, to the Time of Darius, cotemporary with Alexander the Great; which Work is not intended to be publish'd by Subscription, and is now very near ready to put to Press."

Here, as Gordon conceived, was to be his *magnum opus*, which was to bring him wealth and renown; nor did he lose faith even in its pecuniary value to the close of his strangely-chequered career. Perchance it was on the faith of such uncoined wealth that he married, and so made the discovery that the growing responsibilities of a household tended to intrude matter-of-fact cares of the present on a mind preoccupied with buried Pharaohs and the inurned Romans of ancient Caledonia. In the latter researches he had had special reason for referring to his "curious and honoured friend, James Glen, Esq., Provost of Linlithgow:" the same James Glen, of Longcroft, Esq., as I surmise, who figures among the select subscribers for royal copies of the "Itinerarium Septentrionale;" and whose name reappears among those attached to the lives of the Borgias. In 1741, James Glen—son, it may be, or other relative of the old Provost, and laird of Longcroft,—set out for the New World to fill the office of Governor of South Carolina; and in his Excellency's company, probably as his private secretary, there went Alexander Gordon, with a son and daughter. He was already, I presume, a widower. It is, at any rate, apparent from the terms of his will that his wife predeceased him. The step seemed at best a dubious one. The antecedents of the Antiquary did not furnish great promise of fitness for colonial life. The deciphering of Roman altars or of Egyptian mummy inscriptions was in equally little request there. But he was a man of varied acquirements—a good draughtsman, a surveyor, a musician, a portrait painter, and master alike of ancient and modern languages. He had, moreover, a friend in the new Governor; and so we learn from a record in one of the public offices at Charleston that he obtained a transfer of the office of Registrar of the Province; and, as his predecessor Registrar Hamerton's attorney, was appointed to transact all the business and receive the fees of the office.

Here then. after a desultory and wayward career, we find the poor Scholar and Antiquary entering on brighter prospects; and all that we know of his subsequent history shows that he neither lacked the prudence nor judgment requisite to enable him to profit by the opportunities of a young colony. He acquired houses and lands; found leisure to indulge in his early love of art; and, not only painted his friends in oil, but left behind him a portrait of himself, which, it is to be hoped, may yet be identified. For thirteen years he continued to flourish in South Carolina, cherishing his old tastes, and looking forward hopefully for the time when he should be able to give the world at large the benefit of his matured views on the history and mysteries of Ancient Egypt.

So early as 1737, Gordon announced that his History of the Egyptians was nearly ready for the press; and in Bowyer's "Literary Anecdotes," this work is said to have been left by him in MS, under the title of "An Essay towards illustrating the History, Chronolgy, and Mythology of the Ancient Egyptians, from the Earliest Ages on Record, till the Dissolution of their Empire, near the time of Alexander," with the date London, July 6, 1741. This date probably marks the last finishing touch put to his manuscript on the eve of his departure for his new-world home beyond the Atlantic. But we have the best evidence that the prized treatise was not left behind him when its author bade farewell to his native land.

As his prospects brightened in his new home, and comforts unknown till then cheered his hearth, he no doubt brought forth the cherished sheets, and added fresh point to his learned essay; till the time came when, on the 22nd of August, 1754, "being sick and weak of body, but of sound and disposing mind, memory, and understanding," and with the ruling passion strong in death: he proceeded to make and ordain his last will and testament.

It was the recovery of a certified copy of this will which led me to produce the former notice of its author to the members of the Canadian Institute, as a document alike curious as the characteristic memorial of a literary man of mark in the eighteenth century; and interesting as the recovered trace of an old colonist of some note in his day, but of greater interest now from the prominence given to him in one of the most popular of Scott's novels. To his son and daughter he bequeathed his household furniture, plate, houses, landed property, &c., in a mere passing sentence; while the main paragraphs of this testamentary document suffice to show how little change a sojourn of thirteen years amid the strange novelties of the western hemisphere had wrought on the scholarly enthusiast. Having given instructions that his body be committed to the dust "decently, and in a Christian-like manner," he condescends to the disposition of what he is pleased to call "the worldly estate wherewith it has pleased God to bless me with," and thus proceeds: "I give the same and dispose thereof in manner following:—First, It is my express will, and I do hereby order and direct, that my said executors hereinafter mentioned, and the survivors of them, and the executors and administrators of such survivors, shall forthwith and with all convenient speed after my decease, pay off, discharge, and satisfy my funeral charges and all other my just and lawful debts; and after such payment and satisfaction so made and rendered as aforesaid, then I give, devise, and bequeath unto the Honourable Hector Berrenger De Beaufain, Esq., his picture, portraiture, or effigies by me the said testator, painted, drawn, and represented, to have and to hold the same unto the said Hector Berrenger De Beaufain, Esq., his heirs and assignees for ever. *Item*, I give, devise, and bequeath unto the Reverend Mr. Heywood, his picture, portraiture, or effigies, by me the said testator, painted, drawn, and represented as aforesaid, to have and to hold the same unto the said John Heywood, his heirs and assignees for ever. *Item*, I give, devise, and bequeath unto my son Alexander Gordon, my own picture, together with all and singular the paintings, views, and other the representations by me the said testator, painted, drawn, and represented, to have and to hold the same, and each and any of them, unto my said son, his heirs and assignees for ever."

Then, after dealing with his silver watch, gold ring, and his lot of land in Ansonborough, with all the houses erected on it, in about as many words; he next disposes of "all and singular other my pictures hereinbefore not particularly given;" and so, relieved of the trouble of such secondary matters, he comes to the grand prize on which his own fame, the fortunes of his heirs, and the enlightenment of the world at large, are to depend, and thus proceeds:

"*Item*, it is my express will and desire, and I do hereby order and direct, that my said son shall, as conveniently as may be, cause to be printed and published my book now remaining in manuscript, and tituled 'A Critical Essay towards the illustrating the History and Chronology of the Egyptians and other most Ancient Nations, from the earliest ages on record till the times of Alexander the Great,' &c., &c. *Item*, I give, devise, and bequeath unto my said son two-thirds parts, the whole in three equal parts to be divided, of all and every such sum and sums of money that shall arise and accrue from the printing and publication of the said book, to have and to hold the same unto my said son, his heirs and assignees for ever. *Item*, I give, devise, and bequeath unto my said daughter, Frances Charlotte Gordon, the remaining third part or share of all and singular such sum and sums of money so arising and accruing from the printing and publishing of the said book, to have and to hold the same unto my said daughter, her heirs and assignees."

Happily for his heirs, this precious bequest was accompanied with more easily realisable property. We will hope that both Alexander and Frances Charlotte Gordon estimated with all filial reverence the invaluable Critical Essay; but it is to be feared that, with the death of the author, its only probable reader within the bounds of the Province, or indeed of the whole Colonial settlements of North America, had passed away. The circumstances and tastes of a young Colony were not encouraging, whatever may have been the zeal which animated the inheritors of this unique bequest. The convenient time for printing and publishing never did arrive; and so Alexander Gordon, junior, never received his two-thirds, nor Frances Charlotte her one-third part, of all and singular the sums of money which the sanguine Antiquary persuaded himself were to accrue from the sale of his grand solution of the Egyptian mystery.

To survivors belonging to a century which has shared in the labours and elucidations of Dr. Thomas Young, Champollion, and many later Egyptologists, by whom the Rosetta Stone, and subsequent discoveries of inscribed tablets and papyri, have been turned to such good account, the unpublished "Critical Essay" of the author of the Itinerarium Septentrionale would be of little enough value now. But it is otherwise with his own portrait. As a work of art, its merit is possibly not to be ranked very high; and, now that his heirs and assignees have all passed away, if it still exists, it is probably consigned to some lumber room, or deserted attic, from whence—if it could but be ferreted out,—the lucky discoverer might rescue it almost for the trouble of taking it away; and yet, to not a few it would be a prize of rare worth. Doubtless it bears its own means of identification: the author's folios, perchance, duly labelled with the titles of his literary fame; or—in evidence of the tastes of a later era,—an Egyptian mummy, or other symbol of those mystic studies which beguiled him from his first love. By some such feature the old canvas may yet be identified, and so introduce to us the veritable effigies and handiwork of Alexander Gordon, the quondam Roman Antiquary, and Registrar of the Province of Carolina in those good old times when George II. was King. Since we have been fortunate enough to recover his will, with its characteristic bequests, after its destruction had been assumed as unquestionably involved in General Sherman's sack of Columbus, the capital of the old State, and the burning of all the records of elder generations treasured there, we may still indulge the hope that some lucky chance will yet restore to the State of South Carolina the portrait of its old Registrar, around whom a fresh halo of glory has gathered since the times when he transacted, unheeded, the routine duties of his office, as a citizen of Charleston; and, in accordance with his own directions, was there committed to the dust, "decently, and in a Christian-like manner."

LEAVES THEY HAVE TOUCHED;

BEING A REVIEW OF SOME HISTORICAL AUTOGRAPHS.

BY HENRY SCADDING, D D

ADDENDA.

As addenda to the series entitled "Leaves they have touched," I desire to transcribe and put on record here, several autograph MS. relics which have come into my hands since the papers thus entitled were read to the Canadian Institute. I should have preferred to have introduced them in their proper places.

I. (1.) The following letter from Lord Dorchester to Sir George Yonge, transcribed from the original, dated at Quebec, 22nd June, 1790, belongs to the Canadian series. Lord Dorchester is more generally known among us as Sir Guy Carleton, the companion of Wolfe at the taking of Quebec, and the defender of Quebec, at the time of Arnold and Montgomery's attack in 1775. Sir George Yonge was "Secretary at War" in 1790. He is the personage from whom our YONGE STREET has its name—a communication opened, in the first instance, with a view to military operations, no less than commercial. A particle of warmth may perhaps be detected in Lord Dorchester's letter. He had applied for a commission in the Guards for his son, Guy Carleton, but a delay of four years was beginning to try his patience. He possibly felt that his services deserved more prompt attention.

"Sir," Lord Dorchester proceeds, "As I apprehend that many importunities have retarded the success of my application, about four years since, for an Ensigncy in the Guards for my eldest son Guy; and, fearing lest the same reasons may still continue, while he is advancing considerably beyond the age judged necessary for entering into the military profession, I am to request you will take a proper opportunity of laying my petition before the King, that He would be graciously pleased (till such time as it may suit His Majesty's convenience and good pleasure to honour him with a commission in His Guards) to give him a Cornetcy in any of His Regiments in

Great Britain. I am, Sir, with regard, your most obedient and most humble servant, DORCHESTER." Guy probably never obtained the Cornetcy. He died unmarried in 1793, aged just 20. Nor did his next brother Thomas, who died in the following year, at exactly the same age. But Christopher, the third son, born in 1775, was a Lieutenant-Colonel in the army, and was father of Arthur Henry, the second Baron Dorchester, who died unmarried in 1826, when the barony descended to his cousin Guy, born in 1811. Lord Dorchester, the writer of the letter just given, died November 10, 1805.

(2.) I next transcribe a document possessing a two-fold interest as bearing the autographs of GEORGE IV. and LORD PALMERSTON. It is to be placed in the Canadian series, inasmuch as it consists of a royal warrant, authorizing magistrates at "York, Upper Canada," (*hodie* TORONTO), to enlist men for service in the regular army of Great Britain. I suppose at the present date such a warrant would be locally held to infringe on the principle of responsible government. Its date is 1828. It runs as follows: "GEORGE R.—It being expedient that the provisions contained in the 117th clause of the Act, passed in the 7th and 8th years of Our reign, for the punishment of mutiny and desertion be duly carried into effect, We do hereby authorize and appoint you to enlist and attest, in our Colony at York, Upper Canada, any soldiers or others, desirous of enlisting, or re-enlisting into Our service, and to administer such oaths as are directed and required to be administered in that behalf, by Justices of the Peace in Our United Kingdom, in relation to the enlisting and re-enlisting of soldiers; and every person so enlisted or re-enlisted by you, shall be deemed and taken to be so enlisted or re-enlisted under the provision of any Act in force in relation to the enlisting of soldiers, and for the punishment of mutiny and desertion, in like manner, in every respect, and as fully and effectually, to all intents and purposes, as if such oath had been administered and such attestation had been made, and such enlisting and re-enlisting had taken place before a Justice of Peace of the United Kingdom. Given at Our Court at Windsor, this third day of September, in the eighth year of Our reign. By His Majesty's Command, PALMERSTON. To the Justices of the Peace, and other Civil Magistrates for the time being, at York, Upper Canada."

The name of Palmerston, when Foreign Secretary, especially during the period 1835–41, was regarded with a good deal of awe on the continent of Europe. Mr. Ashley quotes a German couplet to the effect that—

> "If the devil have a son,
> Then be sure it's Palmerston"

And Borrow, in the tenth chapter of his "Bible in Spain," describes in an amusing manner the reverence shown on a certain occasion in that country to the autograph signature of the English Minister. "Señor Nacional," said Borrow to the civic guard on entering the gate of the town of Jaraicejo, "You must know that I am an English gentleman, travelling in this country for my pleasure. I bear a passport which, on inspecting, you will find to be perfectly regular; it was given me by the great Lord Palmerston, Minister of England, whom you, of course, have heard of here; at the bottom you will see his own handwriting, look at it and rejoice—perhaps you will never have another opportunity. As I put unbounded confidence in the honour of every gentleman," Borrow continued, "I leave the passport in your hands, whilst I repair to the posada to refresh myself." The national guard, on bringing back the document, makes many inquiries about Palmerston, whom he takes to be a great military personage; he asks whether he was likely to assume personally the command of the British Legion in Spain, to which Borrow replies, "No; but he has sent over to head the fighting men, a friend of his, who is thought to be nearly as much versed in military matters as himself." After having his curiosity satisfied on this and some other points, the guard asks again to see the signature of the "Caballero Balmerston." "I showed him the signature," Borrow says, "which he looked upon with a profound reverence, uncovering his head for a moment: we then embraced and parted."

II. (1.) To the group in the British series, containing relics of Mrs. Piozzi, Garrick, and Dr. Parr, I now subjoin what was long with me a desideratum, a fragment in the handwriting of Dr. Samuel Johnson. It consists of a brief request to Mr. Cadell to have two pairs of two of the Doctor's early political pamphlets half bound and sent to him speedily. These were brochures, briefly spoken of here as the "False Alarm" and the "Falkland Islands," written to order for the ministry of the day, and supporting, unhappily, the weaker side of the several questions involved. Thus the message transcribed from the original runs: "Mr. Johnson begs the favour of Mr. Cadell that he will send to his Binder two *False Alarms*, and two

Falkland Islands, one of each to be bound together in half-binding. Let it be done as soon as it can."

In a conversation between Boswell and Johnson, given in chapter v. of the "Life," these pamphlets are spoken of together in immediate association. "We talked," Boswell says, "of his two political pamphlets, the 'False Alarm,' and 'Thoughts concerning Falkland's Islands.'" JOHNSON: "Well, Sir, which of them did you think the best?" BOSWELL: "I liked the second best." JOHNSON: "Why, Sir, I liked the first best; and Beattie liked the first best. Sir, there is a subtlety of disquisition in the first that is worth all the fire of the second." BOSWELL. "Pray, Sir, is it true that Lord North paid you a visit, and that you got two hundred a year in addition to your pension?" JOHNSON: "No, Sir. Except what I had from the bookseller, I did not get a farthing by them. And between you and me, I believe Lord North is no friend to me." BOSWELL: "How so, Sir." JOHNSON: "Why, Sir, you cannot account for the fancies of men."

Mrs. Piozzi, in her Reminiscences of Johnson, remarks of the "False Alarm:" "This, his first and favourite pamphlet, was written at our house between eight o'clock on Wednesday night and twelve o'clock on Thursday night. We read it to Mr. Thrale, when he came home very late from the House of Commons."

The "False Alarm" was connected with the repeated expulsion of Wilkes from the House, it seeming to be implied by that action of the majority, that one expulsion was equivalent to total exclusion. The rejoinder which appeared to the "False Alarm" was supposed to be from the pen of Wilkes himself. "The Thoughts concerning Falkland's Island" had reference to a threatened war with Spain, arising out of the occupation by England of the island or islands named, off the south coast of Patagonia. (2.) Accompanying my relic of Johnson is a transcription of a letter of Johnson's in the handwriting of Malone, the editor of several successive issues of Boswell's Life of Johnson. (3.) My Johnsonian memorial circle is rounded off by a copy of Hamilton, Balfour and Neill's beautiful edition (Edinburg, 1758) of Terence, which has the autograph of Wilkes inscribed on its title-page.

(4.) A note in the handwriting of Sir Walter Scott, while yet "Walter Scott, Esq., Advocate." It is a frank permission sent to a musical composer to set some of his poetry to music, and to dedicate a certain piece to him. He speaks of himself as "a professor of the art of poetry," and he thinks it would be churlish in him to withhold such favours from an amateur of the sister art of music The letter is dated from Ashestiel, in Stirlingshire, almost as famous as Abbotsford, as the residence of Scott from 1804 to 1812, where he wrote his "Lady of the Lake," the "Lord of the Isles," and many of the compositions now included in his miscellaneous works. "Sir,—I am favoured with your letter, and make you most heartily welcome to set and publish (so far as I am concerned) any part of the poetry I have written. I am very sensible of your delicacy and politeness in making the application, which I have made it a general rule never to refuse, as I should hold it very churlish of a professor of the art of poetry to withhold any contribution in his power from an amateur of music. Not knowing exactly how to address you, I begged Mr. John Ballantyne to find some way of sending you a note, requesting my name might be put down for three copies of your music. Wishing you all the success your liberality merits, I am, sir, your obedient servant, WALTER SCOTT." Dated from "Ashestiel, 2nd September," with this postscript added: "I need not add, I will consider myself honoured by your intention of inscribing the music to me of the Hymn, &c." Addressed on the outer cover, "G. F. Graham, Esq., care of Mr. Hamilton, Music Seller, North Bridge." The Hymn was doubtless that of the "Hebrew Maid," beginning—

"When Israel, of the Lord beloved,
Out from the land of bondage came."

George Farquhar Graham was the author of an Essay on Musical Composition, Edin., 1838; Songs of Scotland, 1858; and Articles—Music, Organ, &c., in eighth edition of Encyclopædia Britannica, besides other books on general literature.

Ashestiel was situated at a considerable distance from a place of worship, and it was Scott's practice, Lockhart tell us, chap. xvii., on Sundays to read the church service, and then "he usually walked with his whole family, dogs included, to some favourite spot at a considerable distance from the house—most frequently the ruined tower of Elibank—and there dined with them in the open air on a basket of cold provisions, mixing his wine with the water of the brook, beside which they all were grouped around him on the turf; and here," it is added, "or at home, if the weather kept them from their ramble, his Sunday talk was just such a series of biblical lessons as that which we have preserved for the permanent use of rising generations, in his Tales of a Grandfather on the early history of Scotland."

III. To the European or Continental MS. relics described in subdivision III. of "Leaves they have Touched," I now add a document bearing the autograph signature of the poet Goethe, in his capacity as one of the Commissioners appointed for a special purpose at Weimar in 1790. It is a paper of some length, relating to a deduction to be made in moneys due to the public treasury from the estate of one defunct. It appears to be a quaint specimen of official red-tapeism, and it reads as follows, as kindly translated for me by Mr. Vander Smissen: "The Princely Amt und Unter Steuer Directorium (Board of Assessors) will see from the annexed copy of Document in what manner the heirs-at-law of the late District Commissioner, Aulic Councillor Lenz of Nurnberg have offered a compromise of 30 p. c. as a final settlement of the Ilmenau assessment claim against the Lenz estate, amounting to 590 R. 4 k. The aforesaid offer having been accepted on behalf of the Commissioners in a reply transmitted this day to the Councillor of Legation at Nürnberg aforesaid, and it being still required that the calculation in this matter should be made up as soon as possible, Therefore the Princely Amt und Unter Steuer Directorium is hereby directed by the Commissioners to supply what is required in this case, and thus to finally settle the matter in question, and to write off the balance to Profit and Loss account. We herewith also return to you the Assessment documents sent in with your Report of 15th April a. c., as enclosure sub +. Given at Weimar, the 29th June, 1790. The Commissioners appointed for the Inspection of the Assessment Department of Ilmenau of the Principality of Saxony, J. W. v. Goethe, C. G. Voigt."

IV. My fourth subdivision embraced MS. relics of eminent Oxford and Cambridge men. These I now supplement by the following, transcribed from the originals; all of them, however, from the hands of Cambridge men. (1.) A note of the present Astronomer Royal, George Biddell Airy, formerly Plumian Professor of Astronomy at Cambridge, to Mr. G. V. Fowler, who has been communicating with him on some new method of correcting the compass on board of iron ships: "Sir," writes the Astronomer Royal from the "Royal Observatory, Greenwich, London, S.E., May 18th, 1864," "If you will have the kindness to send me any details which you think fit, on your proposed method of correcting the compasses of iron ships, I shall be glad to consider them, and as opportunity serves, will report to you on them. I presume that I am not to understand literally, your expression, 'needles can be and are *insulated* from the local influence of iron ships and ships' iron'? I am, sir, your obedient servant, G. B. Airy." (2.) Two notes from the hand of Sir John F. W. Herschel, author of the well-known "Discourse on Natural Philosophy," and formerly Fellow of St. John's College. Both of them are characteristic. One is addressed to some gentleman who has asked him to join an expedition to a cavern at Maidstone, where the remains of hyenas are found. His occupations and engagements oblige him to decline. In like manner he was not able on Friday last to attend a meeting of the Geological Society; and that evening he was to be by appointment with Mr. Sande at the Observatory of Camden Hill, where he expects they will make a night of it. The other is addressed to Professor Faraday in 1827. It contains a scheme for a series of scientific experiments to be made by him, and reported on periodically. In this note, the Observatory at Slough is mentioned, from which Herschel desires to be as little absent as possible, so long as the state of the moon permits him to continue his observations. (*a*) "2nd June, 1827.—Dear Sir: I am sorry I can't go on the very interesting expedition to the Hyeniferous Cavern at Maidstone. I am no less sorry I could not attend at the Geological Society on Friday; and to-night am going to make the second observation at the Observatory at Camden Hill, according to promise. Mr. Sande made the first last night, which decided a point. I suppose we shall make a night of it. Yours truly, J. F. W. Herschel." (*b*) "Devonshire Street, Tuesday, November 6th, 1827. Dear Sir: I received yesterday, too late to allow me an opportunity of seeing you before your leaving town, your note dated the 3rd. I am glad to hear the furnace and other preparations are in a state of forwardness, and when you return, hope the expedition will commence. I directed Mr. Hudson to forward to you the report of the third experiment in the Glass-house; that and the committee books will put you in possession of all that has been done, (together with your own recollection of what has passed under your own eyes.) On Saturday, the 10th, my astronomical pursuits call me to Slough, whence I am to be desirous to be as little absent as possible, so long as the state of the moon permits me to continue my observations. I will gladly, however, meet you and Mr. Dollond any morning, provided you arrange your times early enough to admit of my return to Slough before dusk, and will give me, if possible, sufficient notice, and the choice of two days. With regard to the train of experiments you may think it necessary to engage in, Mr. Dollond, I am sure, as well as myself, feel every disposition to defer to your superior chemical knowledge, and wish to be as little a clog on your researches as possible. The essential point consists in preserving a very accurate detail of our proceedings, and making (as we are bound to do) a full report of them; and perhaps it might be as well to meet periodically (in our capacity of a sub-committee) at stated, or at least preconcerted days, in order to preserve a strict formality in all we do. What say you to the following sketch: 1. Mr. Dollond, Chairman; Mr. Faraday, Journalist and Treasurer; Mr. Herschel, Secretary,—of the sub-committee for the following year. 2. Sub-committee to hold regular meetings on the (Tuesday?) next immediately adjacent to, or on the day of every full moon (at o'clock), except during the months of in the summer vacation, and intermediate meetings when necessary. 3. A regular journal to be kept of all the experiments made and of all the alterations made in the apparatus, by the Journalist. 4. A book to be kept in which any one may enter any suggestion of an experiment to be considered by the sub-committee. 5. The Treasurer to keep an account of all expenses. 6. The business of the sub-committee at meetings to be arranged as follows: (1.) Minutes of last meeting. (2.) Reconsideration thereof and confirmation. (3.) Journal of the last meeting to be read. (4.) Journal to be ordered to be entered on the Minutes (or regarded as part of them, to avoid trouble of copying—though perhaps a duplicate may be desirable in prudence). (5.) Treasurer's account to be audited for the past month. (6.) Results of experiments to be discussed. (7.) Suggestions to be read, and plans of future experiments to be considered after. The sub-committee to make three reports—one at Christmas, one after Easter, and one annual, at the Council, after the meeting of the Society in November. If you approve this plan, and it also meets Mr. Dollond's approbation, the sooner we act on it the better. Yours truly, J. F. W. HERSCHEL." (3.) In the fourth subdivision of "Leaves they have Touched," I gave some account of the Rev. Charles Simeon, Senior Fellow of King's College, Cambridge, in 1835, with an autograph relic. I now subjoin another of the same memorable person. It is a letter addressed by him in 1819 to Mr. Charles Grant, at a later period Colonial Minister, well-known to Canadians as Lord Glenelg. In it he speaks of the new College in Bengal, *i.e.*, Bishop's College, Calcutta, and he says that if a Head for it is wanted, he has in his pocket one that would exactly suit—Mr. James Scholefield, his assistant in Trinity Church, Cambridge; he is sure that he would prove a second Dealtry, *i.e.*, equal to the Thomas Dealtry, whom he (Mr. Simeon) had been instrumental in sending out to be Bishop of Madras. Mr. Scholefield became afterwards Regius Professor of Greek in the University, and never went out to India. Mr. Simeon's letter reads as follows: "K. C. Camb., Aug. 20th, 1819.—My Dear Sir: The new College in Bengal is of great moment, and the Bishop's letter about it is a good letter. If you have the means of recommending a Head, I have a Dealtry in my pocket for you—a man every way qualified by piety, diligence, and the highest attainments, quite *laden* with University honours, and not obnoxious on account of his Religion either. It is no other than my Assistant, Mr. Scholefield. I have sent them a Martyn and a Thomason, and I will now give them precisely what you will understand, *in all its bearings*, a Dealtry. Are you likely to want more than one Chaplain? Most affectionately yours, C. SIMEON." Addressed outside to "Charles Grant, Esq., India House, London."

I close this appendix by briefly describing two manuscript copies of the Four Gospels, of an early date, which I class among my "Leaves they have Touched," because, although they are neither of them to be identified as the production or former property of any personage of note, the imagination can legitimately conceive that they have each of them come under the eye and been turned over by the hand of many an eminent man, during the four hundred and six hundred years of their respective existences. Both are manuscripts on vellum. (1.) The first is a manuscript of the Fourteenth Century, of the Four Gospels in Latin. Out of reverence, doubtless, some former possessor has had it bound in costly olive-coloured morocco, whereby its margins have been somewhat curtailed—the edges having been cut for the purpose of being gilt. I should have preferred seeing it in its original cover of oak board, limp parchment, or whatever else it may have been. It is written in double columns in the usual black letter. There is no distinction of chapter and verse; but sections or paragraphs are numerous, and each begins with a conspicuous rubricated letter. The first letter of each Gospel is of extra size and length. Space is economized and labour saved to the greatest possible extent by abbreviations throughout, as in the early printed black letter books, which closely imitated the manuscripts. Slight marks over the words, which I do not attempt to reproduce, are made to denote contractions. Jesus is ihc, Deus is ds, est is e, generatio is gnacio, etc. The Latin is that of the Vulgate, but the orthography is mediæval and non-classic. A superfluous *h* is prefixed to some words. Thus we have habiit mœrens, he went away sorrowful, for abiit mœrens; while, on the other hand, a customary *h* is removed, making habuit to be abuit, &c. Mihi is michi. Habundanti for abundanti recalls Abbot Wheathampstead's frequent allusion to his own name at St. Albans—Valles habundabunt frumento. Dies hulcionis for dies ultionis, day of vengeance, has a curious look. An *h* appears unexpectedly in the middle of a word, as in introhibunt for introibunt, reminding one of the "abhominable" of Shakspeare's Holofernes. For admirabantur I observe ammirabantur. Prefixed to each Gospel is a short account of the author. Some marginal notes appear in a later hand, written in minute and neat characters. These consist of slight corrections and omissions. For convenience, another hand has noted the chapters; and a recent hand has numbered the folios on the right hand side (ccxi.) In the tenth chapter of St. Mark we have an example of homoioteleuton—as it is called—a common error or source of error in manuscripts. The monkish scribe has given us "da nobis ut unus ad dexteram tuam, et alius ad sinistram tuam sedeamus in gloriâ tuâ. Jesus autem ad eis: calicem quidem quem ego bibo, bibetis," &c. The corrector has here properly written in the margin, to be inserted between *eis* and *calicem*, the following words, which were omitted: "Nescitis quid petatis: potestis bibere calicem quem ego bibo, aut baptismo quo ego baptizor, baptizari: et illi dixerunt ei Possumus: Jesus autem ait eis." The last "Jesus autem ait eis" caught the eye of the copyist, instead of the preceding identical expression, and caused the omission. In like careless fashion in St. Matthew, ch. 13, where the text runs: "alia autem ceciderunt in petrosa, ubi non habebant terram multam, et continuo exorta sunt, quia non habebant altitudinem terræ, sole autem orto æstuaverunt; et quia non habebant radicem, aruerunt," the copyist has left out, and the corrector has marked for insertion the words, "quia non habebant altitudinem terræ; sole autem orto æstuerunt et"—the second "quia non habebant" having led the eye astray. Copying slowly and mechanically day after day, the scribe doubtless became listless now and then. As to the age of the volume, Messrs. Ellis and Green, the well-known English and Foreign booksellers, of 33 King Street, Covent Garden, experts in respect of such matters, state that, "in ninety-nine cases out of a hundred, the date of a MS. can be judged with certainty from the character of the handwriting, the formation of certain letters, the use of contractions, and various other points familiar to any one who sees many such specimens. From such data we have no hesitation in repeating that the MS. in question [*i.e.*, The Quatuor Evangelia now before us] was beyond doubt written before 1400." "Repeating" refers to the statement made by Messrs. Ellis and Green in their advertisement of this MS. in the *Saturday Review*. Supposing, then, its writing to have taken place about midway in the fourteenth century, it is within the bounds of possibility that this identical copy of the Four Gospels may have been used by Wycliffe while engaged in his translation of the Scriptures, or that its leaves may have been those from which Robert Langlande transcribed the Latin texts, which appear every here and there in the Vision and Creed of Piers Ploughman. On the first folio are memoranda of Libraries to which this MS. has in its days belonged, or been presented. One of them was that of a monastery of St. Andrew, but the name of the place where, I have not been able satisfactorily to decipher.

(2.) I next describe an ancient MS. copy of the Four Gospels in Greek. It is a small thick quarto, five by six inches. The covers are of wood, perhaps cedar or cypress, very thick but light. A thin leather is stretched over the wood. A number of holes pierce both substances; once the receptacles of pins or rivets which, at the four corners, fastened to the cover metal bosses, holding, it may be, each a precious stone; whilst in the middle of each cover there has evidently been an ornamental figure; that on the first, appears, from traces left, to have been a crucifix. The volume was originally fastened, not by clasps, but, by strings of which there are remains inside: on the edge of the left hand cover there are metal pins to which the strings were looped or tied. The wood of the right-hand cover is somewhat decayed towards the top. The leaves of the MS.

are a fine vellum. Small bits of leather glued on so as to project a little, facilitate the finding of the beginning of each Gospel, and one or two other places often wanted, as I suppose. Each book has at its commencement a well-executed illumination, here and there, however, now slightly abraded. That at the beginning of St. Matthew is a broad frame of arabesques in purple, vermilion, and gold, surrounding the title: at each corner a miniature head, all of them more or less damaged. That at the beginning of St. Mark is a similar border round the title, in good preservation, but without miniatures. At the beginning of St. Luke, it is not a frame for the title, but a large compartment above it, fitted with arabesques. And St. John's Gospel is distinguished by a rich frame-work of arabesques surrounding an oval in which is a solitary head, probably intended for that of Christ. The titles themselves are: *τὸ κατὰ ματθαῖον ἅγιον εὐαγγέλιον: τὸ κατὰ μάρκον ἅγιον καὶ σεπτὸν εὐαγγέλιον: τὸ κατὰ λουκᾶν ἅγιον εὐαγγέλιον: τὸ κατὰ ἰωάννην ἅγιον εὐαγγέλιον.* (The rather unusual word *σεπτὸν* applied to St. Mark's Gospel means august, venerable: its initial sigma is given as a C, an antique form of sigma, appearing also in other places throughout the MS.) The initial letter of St. Matthew is a large quaintly-formed beta in purple and gold: that which begins St. Mark is a large alpha in the same style. St. Luke's is an epsilon, in which the middle limb is an arm and hand, the two fore-fingers extended; and St John's is also an illuminated epsilon, but of a different and quite arbitrary design. Each of the titles of the four books was once bright with gold; and certain small capitals, conspicuous in every page, were all originally gilded. The handwriting of the text throughout is very beautiful; minute and even and distinct, with the accents, breathings, and marks of contraction very clear. Proper names are not distinguished by capitals. The abbreviations and conjoined letters are numerous. *Θεός* appears as *θσ*: *Ἰησοῦς* as *ισ*: *Χριστός* as *χσ*, each looking strangely insignificant. *Ἄνθρωπος* is *ἄνοσ*. The final sigma is *σ*, not *ς*. The omega is like an 8 laid sideways. The *ν* looks like a mutilated *μ*. The iotas of the dative are not subscribed, but placed at the end of the word. The small conspicuous capitals, above mentioned, were probably for purposes of ready reference, like the numerals attached to our modern "verses." They form the beginning of certain lines in every page, but are not placed at regular intervals. Sometimes the conspicuous capital is the first letter, not of a word, but of a syllable belonging to a word in the preceding line.

The Gospels of St. Mark, St. Luke, and St John are each preceded by a table of κεφάλαια or subjects, written by the original hand, and numbered in the Greek way; and the numerals, with the κεφάλαια added, are repeated afterwards at the top of the pages of the Gospels. From the minuteness of the Greek, and the many contractions, it is not easy quickly to identify a particular passage, when it is desired to compare one with a printed copy of the Greek text. These κεφάλαια are then found to be of considerable use. The table of κεφάλαια for St. Matthew has been unfortunately lost or worn out; but the beginning of the Gospel itself was thus probably preserved intact. The ink of the original scribe has retained its colour throughout very fairly. On the margins are symbols and numerical abbreviations, for ecclesiastical purposes, corresponding with tables at the end; many of these are in a later hand and carelessly written; as also are memoranda of contents written at the top and bottom of several of the pages. The ink of these additions has become very faint.

The MS. before us appears to belong to what the critics style the Constantinopolitan recension. Thus it has in Mark V. at v. 1, ἦλθον for ἦλθεν; at v. 2, ἐξελθόντι αὐτῷ, not ἐξελθόντος αὐτοῦ, and ἀπήντησεν, not ὑπήντεσεν; in v. 5, ὄρεσι καὶ ἐν τοῖς μνήμασι, not μνήμασι καὶ ἐν τοῖς ὄρεσι, &c. It has the twenty-first chapter of St. John, and the sixteenth of St. Mark from v. 9 onwards; but originally it had not the first part of the eighth chapter of St. John. The passage is added, in another hand, in the margin. The whole of the space usually vacant at the top of the page is filled with this; also the right-hand margin and a portion of the bottom of the page. In the narrative of the cure of the impotent man in St. John we have another example of homoioteleuton. Verse twelve of the received text is left out, but by accident. It is copied by another hand in the margin, as an omission, four dots in the text indicating the place where it is to be inserted. The passage ends with the word περιπατεῖ; and it will be observed that v. 11 ended with the same word: hence the copyist's error. At the end of St. John is a πίναξ ἀκριβής, an "accurate table," showing apparently, in a technical and most abbreviated way, the beginnings and endings of the Gospels for the Sundays throughout the year in the Greek Church. Then follows a Μηνολόγιον or ecclesiastical Calendar naming the saint or saintly event commemorated each day of the month throughout the year, with the proper περικοπαὶ or lessons indicated by conventional abbreviations to which correspond similar signs on the margin, and at the top and bottom of the pages in the preceding MS. The Calendar begins with Sep. 1, and the personage named for commemoration on that day is Saint Simeon Stylites. Both in the πίναξ and the μηνολόγιον the initial letters of numerous words seem to have been written in red ink which has now become very faint.

London experts assure us that the copy of the Four Gospels before us was written prior to 1200. We might easily conceive it to have been written a century earlier, so closely does it correspond in character with *fac-simile* specimens which I have seen of MSS in the British Museum, said to be of the eleventh century. Not knowing its history, it is impossible to say with any definiteness whose hands may have turned over its pages. It is a chronological possibility that those of Thomas à Beckett may have done so. Or, a few years later, it may have been brought home from the Holy Land, bright and fresh, by some bibliophile pilgrim in the retinue of Hubert Fitz-Walter, Bishop of Salisbury, companion of Richard Cœur de Lion in the Third Crusade. More probably, however, some more recent English traveller, some tourist to Mount Athos—some Curzon, bent on exploring the neglected treasures of the twenty-one monasteries of the Holy Mountain—purchased it of a needy Abbot there, and brought it to England with other literary spoil. In 1833, Mr. Curzon (afterwards Lord de la Zouche) found numerous ancient MS. copies of the Gospels in the monasteries of Egypt, Syria, and the Ægean, and brought many of them with him to England. And since his visit, other travellers have gone over the same ground, and made similar forays. The latest discoverer of eminence in fields of this kind is Professor Tischendorf, of Leipsic, who first in 1844 lighted on a part, and in 1857 recovered the whole, of a MS. containing the Old Testament in Greek, and the entire New Testament, all written, it is confidently held, in the early half of the fourth century. The scene of Tischendorf's fortunate find was the Convent of St. Catherine on Mount Sinai. The MS. thus rescued is now known as the Codex Sinaiticus, and is in the possession of the Emperor of Russia, who has had copies of it made in *fac-simile*, and in ordinary Greek type. In 1833, such relics of bygone centuries were not universally appreciated among the monasteries of the East. This is Curzon's description of a sight which met his eye in the dilapidated library of Pantocratoras on Mount Athos: "By the dim light which streamed through the opening of an iron door in the wall of the ruined tower, I saw above a hundred ancient manuscripts lying among the rubbish which had fallen from the upper floor, which was ruinous, and had in great part given way. Some of these manuscripts," the writer says, "seemed quite entire—fine large folios; but the monks said they were unapproachable, for that floor also on which they lay was unsafe, the beams below being rotten from the wet and rain which came in through the roof. Here was a trap ready set and baited for a bibliographical antiquary. I peeped at the old manuscripts, looked particularly at one or two that were lying in the middle of the floor, and could hardly resist the temptation. I advanced cautiously along the boards, keeping close to the wall, whilst every now and then a dull cracking noise warned me of my danger, but I tried each board by stamping upon it with my foot before I ventured my weight upon it. At last, when I dared go no farther, I made them bring me a long stick, with which I fished two or three fine manuscripts, and poked them along towards the door. When I had safely landed them, I examined them more at my ease, but found that the rain had washed the outer leaves quite clean; the pages were stuck tight together into a solid mass, and when I attempted to open them they broke short off in square bits like a biscuit. One fine volume, a large folio in double columns, of most venerable antiquity, particularly grieved me. I do not know how many more manuscripts there might be under the piles of rubbish. Perhaps some of them might still be legible, but without assistance and time I could not clean out the ruins that had fallen from above, and I was unable to save even a scrap from this general tomb of a whole race of books." In other quarters Mr. Curzon was much more successful.

Although, as an authority, the manuscript which I have described adds nothing to the critical apparatus of the New Testament, I have ventured to have stamped upon the morocco case in which I have placed it, the words CODEX TORONTONENSIS, because, as I suppose, there is no other example of an early manuscript copy of the Four Gospels in the original Greek, in Toronto.

(3.) Lastly, for the sake of including a genuine specimen of a portion of the Scriptures in Hebrew, as well as in Latin and Greek, I add and describe now a roll of the Book of Esther, beautifully and boldly written, without points, on five sheets of asses' skin, beautifully prepared, so as to present a white enamelled surface. Its length is $9\frac{1}{2}$ feet, and its breadth $11\frac{1}{4}$ inches. Its matter is arranged, not exactly in columns, but, in eighteen large pages or "doors" as they were called from their shape. One end of the MS. is lined with green silk and provided with ribbons of the same colour, but the central wooden cylinder, with the projecting umbilicus or boss at either end, is wanting. It is a document of some antiquity, and has doubtless been unrolled by the hands of eminent rabbis, and often read by them in synagogues on the Continent of Europe, in the ears of attentive assemblages of old and young. It may be added that the Book of Esther is sometimes called the Megillah or ROLL *par excellence*. It was sometimes prepared in this separate form, for special use at the Feast of Purim, when it is annually read through.

SYNOPSIS OF THE FLORA OF THE VALLEY OF THE ST. LAWRENCE AND GREAT LAKES,

WITH DESCRIPTIONS OF THE RARER PLANTS.

BY JOHN MACOUN, M A, *Botanist to the Geological Survey.*

AND

JOHN GIBSON, B A, F G S, F B S E.

(*Continued from page 66*)

SISYMBRIUM, L. Hedge Mustard.

S. officinale, Scopoli. Officinal Hedge Mustard.

Naturalized from Europe. Waste places, roadsides, and in the vicinity of barn-yards. Common at Belleville and Owen Sound (Macoun). Waste places everywhere, London, Ont. (Saunders). Common near Prescott (Billings). Vicinity of Montreal (Brunet). Roadsides, Hamilton, Ont. (Logie). Malden, Ont. (Maclagan). Waste places, Bayfield, County Huron, Ont. (Gibson).

S. Sophia, L. Flaxweed.

Introduced from Europe. Waste places Borders of fences near Quebec (Brunet). Montreal (Maclagan, Mrs. Percival). East Street, Prescott (Billings).

S. canescens, Nutt. Sickle-pod. Tansy Mustard.

Indigenous. Dry, rocky ground. Montreal, St Helen's Island (Maclagan). Little Current, Georgian Bay (Macoun). Whisky Island, Lake Huron (Dr. Bell). North shore of Lake Superior (Agassiz). Saskatchewan plains (Bourgeau). Fort Edmonton, on the Saskatchewan; Mosquito Prairie, near Fort St. John, Peace River; Telegraph Trail, Upper British Columbia (Macoun). Arctic America (Hooker).

BRASSICA, Tourn. True Mustard.

B. sinapistrum, Boissier. Wild Mustard.

Introduced from Europe Waste places, roadsides, and cultivated fields. West to Lake Superior (Macoun).

B. alba, Boissier. White Mustard.

Introduced from Europe. In cultivated grounds. New Brunswick (Dr. Fowler). Vicinity of Quebec (Brunet).

B nigra, Boissier. Black Mustard.

Introduced from Europe. In cultivated grounds, around barns and manure heaps. Around old barns in the Counties of Prince Edward and Hastings (Macoun). Gardens and waste places, Quebec (Brunet). New Brunswick (Dr. Fowler). Prescott (Provancher).

DRABA, L. Whitlow Grass.

D. alpina, L. Alpine Whitlow Grass.

Indigenous. Dwarf, 2′—4′ high; rather rigid; scapes naked, mostly somewhat hirsute; leaves spatulate-obovate or spatulate-lanceolate, nearly veinless, more or less pilose, with branching hairs; petals yellow, more than twice the length of the calyx; silicles glabrous (in our specimens) or pubescent, somewhat corymbed, oblong-elliptical; styles very short

Rocky coast of Labrador (Brunet). Shore of Sturgeon Lake, Dawson route (Macoun). Rocky Mountains, lat. 48° N. (Bourgeau). Melville Island, Arctic Sea coast, Kotzebue's Sound (Torr. & Gray). July.

D. Canadensis, Brunet. Canada Whitlow Grass.

Indigenous. "Legerement pubescente à poils étoilés; tige fenilée, ordinairement simple; feuilles radicales aigues, lancéolées, atténuées à la base, génèralement entières quelquefois munies au sommet de deux dents latérales; feuilles caulinaires oblongues et dentées; fleurs blanches; en grappe simple; petales échancrés au sommet plus longs que le calice; silicules ovales-elliptiques, longues de 4 à 5 douzièmes de pouce, rarement contournées; pédicelles inférieurs deux fois plus long que la silicule, pédicelles supérieurs plus courts."—Catalogue des Plantes Canadiennes, par L'Abbé Ovide Brunet, Quebec, 1865. Crevices of rocks, St. Joachim, Cap Tourmente, Quebec.

D. arabisans, Michx. Arabis-like Whitlow Grass.

Indigenous Ledges of rock, river banks, and lake shores. North shore of Lake Superior (Agassiz and Pitcher). Rocky Mountains (Bourgeau). July.

D. incana, L. Var. contorta, Ehrh.

Indigenous. Coast of Labrador, on rocks (Brunet). Islands of the St. Lawrence (Torr. & Gray). Unalaska and Arctic America (Hooker). Cariboo, Labrador (Butler). Vicinity of Montreal (Provancher).

D. nemorosa, L.

Indigenous. Rocks and sandy grounds. On sands at the mouth of the Michipicotin River, July 26, 1869. This is undoubtedly the same Draba found by Agassiz at the same place some twenty-five years ago. Reported from Port Huron, and will therefore in all probability be found on the sandy plains of Sarnia, on the Canada side. This is probably the D. muralis reported from the vicinity of Montreal by Hooker, Fl. Bor.-Am. I. p. 56. Upper British Columbia and Peace River (Macoun).

D. Caroliniana, Walt. Var. umbellata, Torr. & Gray.

Indigenous. Dry calcareous soils. Ox Point and vicinity of Belleville, Hastings Co; abundant at Ferry House, opposite Belleville; Grape Island, at the head of the Bay of Quinté, Ont. (Macoun). Amherstburg, Ont. (Maclagan).

D. verna, L. Whitlow-grass.

Probably introduced. Fields and hillsides in the vicinity of Quebec (Brunet). Cap Tourmente (Provancher).

COCHLEARIA, Tourn. Scurvy Grass.

C. officinalis, L. Officinal Scurvy Grass.

Indigenous Rocks Southern coast of Labrador (Brunet). Arctic America (Hooker). Silicles globose-ovate, half as long as the pedicels; radical leaves petioled, cordate, cauline ones ovate, toothed or angled.

C. tridactylites, DC.

Indigenous. Rocks. Ledges of rock. Labrador and Cape Charles (Brunet). Labrador (Herb. Banks) Silicles globose-ovate; cauline leaves with a single tooth on each side, as if 3-lobed.

Alyssum calycinum.

Brock's Monument, Ontario (Judge Clinton).

VESICARIA, Lam. Bladder Pod.

V. arctica, Richardson. Northern Bladder Pod.

Indigenous. Rocks. Canescent, with a stellate pubescence; stem 5′—8′ high, simple or somewhat branched above; radical leaves spatulate, crowded, entire, or with a single notch on each side, obtuse; cauline ones few, linear; style slender, about half the length of the globose silicle; silicles glabrous, or minutely pubescent Seeds 4—6 in each cell, roundish, without a margin. Island of Anticosti (Mr. Shephard, Torr & Gray). Plains of North Saskatchewan River (Bourgeau) West of the Assiniboine River (Macoun). In the latter locality was found the variety (*a*) of Torrey & Gray, "silicles minutely pubescent."

CAMELINA, Krautz. False Flax.

C sativa, Krautz. False Flax.

Introduced from Europe. In cultivated fields. In a field at Lotbinière (Brunet). New Brunswick (Dr Fowler) Vicinity of Prescott (Billings) Fields in the vicinity of Belleville; fields near Collingwood and Owen Sound, Ont. (Macoun). Cayuga, Ont (Maclagan). Paris, Ont. (Buchan).

CAPSELLA, Vent. Shepherd's Purse.

C. Bursa-pastoris, Moench. Shepherd's Purse.

Introduced and naturalized from Europe. Waste place. Everywhere abundant from the mouth of St. Lawrence, through Quebec and Ontario, westward to the Pacific Ocean. Through the summer.

THLASPI, Tourn. Penny Cress.

T arvense, L. Field Penny Cress, or Mithridate Mustard.

Naturalized from Europe. Waste places and cultivated fields. Anticosti Island, Salmon River, vicinity of Quebec (Brunet). Nicolet and Montreal (Maclagan). Rivière du Loup (Dr. Thomas). Streets of Prescott and Toronto (Macoun) Plains of the Saskatchewan (Bourgeau). Between Fort Garry and Winipeg (Macoun). June, July.

T. alpestre, L.

Probably introduced. Vicinity of Quebec (Provancher).

LEPIDIUM, L. Pepperwort. Peppergrass.

L. Virginicum, L. Virginian Peppergrass.

Introduced from the South. Roadsides, railroads, and waste places. Roadsides, Cape Soute, Quebec (Brunet). New Brunswick (Dr. Fowler). Roadsides and fields near Belleville, Ont. (Macoun). Vicinity of London, Ont. (Saunders). Roadsides, Hamilton (Logie). Huron County, Ont (Gibson). Mississagui River, Lake Huron (Prof. Bell). Owen Sound, Whisky Island, and Little Current (Dr. John Bell). We are doubtful whether this species was found on Lake Huron by the last two observers, as Prof. Macoun in the same locality detected only the L intermedium, which, being the northern form, is certainly the indigenous one; *vide* Gray, 5th edition. Citadel Hill, Montreal (Dr. Holmes). June to September.

L. intermedium, Gray. Peppergrass.

Indigenous. In fields and dry places. North of the Counties Hastings and Northumberland, Ont.; Picton, Prince Edward County, Ont.; Little Current, Georgian Bay; Fort Edmonton on the Saskatchewan; Fort Assinaboine on the Athabasca; Little Slave Lake; Dunvegan, Peace River (Macoun). Saskatchewan Plains (Bourgeau).

L. ruderale, L.

Indigenous and introduced. Roadsides and waste places. Roadsides, Hamilton, Ont., introduced (J. M. Buchan) West of the Little Saskatchewan, indigenous (Macoun). British America to the Pacific (Torr. & Gray).

L. campestre, L. Field Peppergrass.

Naturalized from Europe. Cultivated grounds and old fields. Niagara Falls (Macoun). Vicinity of Hamilton, Ont (J M. Buchan).

CAKILE, Tourn. Sea-Rocket.

C. Americana, Nutt. American Sea Rocket.

Indigenous. Gravelly beaches of the sea and Great Lakes Kamouraska and Anticosti (Brunet) New Brunswick (Dr Fowler) Trois Pistoles (Maclagan). Sea shore, Rivière du Loup (Dr Thomas) Wellington beach, Lake Ontario; Prince Edward County (Macoun). Hamilton (Buchan). County Huron, on Lake Huron (Gibson) Cockburn Island and McLeod's Harbour (Dr. Bell) North shore of Lake Superior (Agassiz) West coast of Newfoundland (Dr. Bell).

RAPHANUS, L. Wild Radish.

R. Raphanistrum, L. Wild Radish. Jointed Charlock.

Introduced from Europe. Waste places. New Brunswick (Dr. Fowler). Barrie, Lake Simcoe, Ont. (Buchan). June to August.

CAPPARIDACEÆ.

POLANISIA, Raf. Polanisia.

P. graveolens, Raf. Heavy-scented Polanisia.

Indigenous. Gravelly beaches of lake shores. Border of Lake Ontario, Kingston, Ontario (Brunet). Burlington beach, common (Logie). Montreal, Lake Ontario, and Malden, Ont (Maclagan). St Helen's Island, Montreal (Dr. Holmes). June to August.

VIOLACEÆ.

VIOLA, L. Violet Heart's-ease.

V. lanceolata, L. Lance-leaved Violet.

Indigenous. Marshes, wet meadows, and shores of streams New Brunswick (Dr. Fowler) Muskoka Lake, Ont (F. Seymour). Sault Ste Marie, Lake Superior, in rear of the village, July 9, 1869 (Macoun) May to July.

V. primulæfolia, L. Primrose-leaved Violet.

Indigenous. Damp soil and wet meadows. Rivière du Loup, not common (Dr. Thomas). May to July.

V. blanda, Willd. Sweet White Violet.

Indigenous. Wet woods, low grounds, and along streams. New Brunswick (Mathews). Isle aux Noix, Montreal; Kingston and Amherstburg, Ont. (Maclagan). Rich woods generally on limestone, Rivière du Loup (D'Urban). Prescott (Billings). Owen Sound; woods at Thunder Bay (Macoun). McLeod's Harbour and Cockburn Island (Dr. John Bell). Hamilton (Logie). London (Saunders). County Huron, Ont. (Gibson). Plains of the Saskatchewan (Bourgeau). Fort Edmonton; Fort Assiniboine on the Athabasca; Little Slave Lake (Macoun) Labrador (Butler). Upper British Columbia and Rocky Mountains, lat. 56° N (Macoun).

V. renifolia, Gray. Kidney-leaved Violet.

Indigenous. Dry cedar swamps and rich woods. In cedar swamps, Castleton Village, Northumberland Co., Ont., May 24, 1860. Cedar swamps east of Belleville, 1861; low, rich woods, Brighton, Northumberland Co., Ont., 1865 (Macoun). This species is evidently common throughout Canada, but has hitherto been taken for a pubescent form of V. blanda. Fort St. James, Upper British Columbia, through the Rocky Mountains to St John's, on Peace River, lat 56° N.; woods at Methy Portage, lat. 56° N. (Macoun).

V. palustris, L. Marsh Violet.

Indigenous. Marshes. One mile west of Prince Arthur's Landing, Dawson route, Lake Superior, July 22, 1872 (Macoun). West coast of Newfoundland (Dr. Bell). From Vancouver Island throughout British Columbia to lat. 56° N.; Lake Athabasca and Methy Portage (Macoun).

V. Selkirkii, Pursh, Goldie, 1822. Great Spurred Violet.

Indigenous. Damp shady soil. Gate Lake, Wentworth Township, Quebec (D'Urban) Rivière du Loup (Thomas). Dartmouth River, Gaspé Peninsula; McLeod's Harbour, Lake Huron (Dr. Bell). Lake Superior (Robbins). Island of Montreal (Dr. Holmes). Walkerton and Owen Sound (Buchan).

V. cucullata, Aiton. Common Blue Violet.

Indigenous. Wet meadows and woods. Common throughout Ontario, Quebec, and the Maritime Provinces. Plains of the Saskatchewan River (Bourgeau). Little Slave Lake (Macoun). Arctic America (Torrey & Gray). West coast of Newfoundland (Dr. Bell).

V. cucullata, Ait. Var. cordata, Gray.

Indigenous. Dry, rocky hillsides. Dry hillsides covered with poplars (P. tremuloides), near Belleville (Macoun). Cemetery and open fields, near English's woods, London, Ont., not very common, labelled *V. villosa* (Saunders).

V. cucullata, Ait. Var. palmata, Gray.

Indigenous. Swamps and low grounds. Amherstburg, Ont. (Maclagan).

V. sagittata, Ait. Arrow-leaved Violet.

Indigenous. Dry, sandy and gravelly fields, woods, copses, and pastures, rare. Vicinity of Belleville, Ont; Rice Lake plains, Ont.; near Toronto (Macoun) Galt, Ont (Miss Crooks) Jones' Falls, Rideau Canal; Amherstburg, Ontario (Maclagan); Nun's Island, Berthier, Quebec (Dr. Holmes). Lorette. Stanfold (Provancher) May.

V. canina, L Var. sylvestris, Regel. Dog Violet.

Indigenous. Borders of brooks, and damp shady woods. Common throughout Ontario, Quebec, and the Maritime Provinces. Saskatchewan Plains (Bourgeau). Edmonton on the Saskatchewan; Fort Assinaboine on the Athabasca; Little Slave Lake; Dunvegan on Peace River (Macoun). Labrador and British America, lat. 59° N. (Torr. & Gray). May.

V. rostrata, Pursh. Long-spurred Violet.

Indigenous. Rocky woods, and shaded hillsides. Smith's Falls, Kingston, Ont, and Chippewa, Ont. (Maclagan). Hastings and Northumberland Counties, rare (Macoun). Rare at Prescott, Ont (Billings). Woods, Hamilton (Logie). Vicinity of London, common (Saunders). Owen Sound? (Dr. Bell) This species seems to be confined to Ontario. May.

V. striata, Ait. Pale Violet.

Indigenous. Rich open woods and low grounds. Common at London, Ont. (Saunders). Common near Hamilton, Ont. (Logie). Island of Montreal (Herb McGill College). May to September.

V. Canadensis, L. Canada Violet.

Indigenous. Rich woods. Common from Newfoundland to Lake Superior. Grand Islands, Lake Huron (Prof. Bell). St. Joseph's Island, Lake Huron (Dr. Bell). Saskatchewan plains (Bourgeau). Fort Edmonton; Fort Assinaboine, on the Athabasca; Dunvegan, Peace River (Macoun). Hudson's Bay (Torr. & Gray). Woods, Upper British Columbia to lat. 56° N. (Macoun). May to August.

V. pubescens, Aiton. Downy Yellow Violet.

Indigenous. Rich woods. Common throughout Ontario and Quebec. Gore Bay and Vermont Harbour, Lake Huron (Dr. John Bell). Saskatchewan Plains (Bourgeau). May, June.

V. tricolor, L. Pansy. Heart's Ease.

Naturalized from Europe. Waste places. New Brunswick (Dr. Fowler), Spontaneous in some gardens, Belleville, Ont. (Macoun). The var. arvensis. DC. is reported from Lake Huron by Provancher. May to August.

CISTACEÆ.

HELIANTHEMUM, Tourn. Rock Rose.

H. Canadense, Michx. Frost-weed.

Indigenous. Dry, sandy, or gravelly soil. East of Belleville; very abundant on Rice Lake plains; St James' Cemetery, Toronto; Point aux Pins, Lake Superior (Macoun). English's woods, common, London (Saunders). Galt, Ont., by Miss Crooks (Logie). Sandwich, Ont. (Maclagan). Sandy plains of the Rivière aux Sables, Co. Lambton, Ont (Gibson). North shore of Lake Superior (Agassiz). Plains of the Saskatchewan (Bourgeau). Fort Francis, Dawson route (Macoun). June to August.

HUDSONIA, L. Hudsonia.

H. tomentosa, Nutt. Downy Hudsonia.

Indigenous. Sandy shores of the Great Lakes and St Lawrence. Anticosti, St Laurent, Quebec (Brunet). New Brunswick (Dr Fowler) Montreal Island, Point aux Pins, and sandy islands of Lake Superior (Macoun). Lake Champlain to Slave Lake (Torr. & Gray). 15-mile Point, Rainy Lake, and Lake of the Woods (Macoun).

LECHEA, L. Pinweed.

L. Major, Michx. Greater Pinweed.

Indigenous. Dry woods and sterile soil. Rare at London, Ont. (Saunders). In dry woods, Canada (Torr. & Gray).

L. thymifolia, Pursh.

On sands on the sea coast. Kent Co, New Brunswick (Dr. Fowler).

L. minor, Lamarck. Lesser Pinweed.

Indigenous. Dry sandy fields and open woods. West of Brockville, Ont. (Billings). Three Rivers, Quebec, and Sandwich, Ont. (Maclagan). Rice Lake Plains; Heely Falls, County Northumberland; rare in the vicinity of Belleville, Ont., sandy woods, Gull Lake, County Addington; St. Nora's Lake, 84 miles north of Lindsay, Ont.; St. James' Cemetery, Toronto, (Macoun). Not common, London (Saunders). Vicinity of Hamilton (Buchan). Rivière aux Sables, Co. Lambton, Ont (Gibson). Sturgeon Lake, Dawson Route (Macoun).

DROSERACEÆ.

DROSERA, L. Sundew.

D. rotundifolia, L. Round-leaved Sundew.

Indigenous. Sphagnum swamps and wet bogs. Cedar swamps, Quebec (Brunet). Bogs, Rivière du Loup (Dr. Thomas). Labrador (Butler). New Brunswick (Mathews). Near Prescott Junction (Billings). Partridge Lake, Hooper's Lake, Counties Hastings and Northumberland; Owen Sound; Fishing Islands, Lake Huron; north-east coast of Lake Superior (Macoun). Westminster Pond, London, Ont. (Saunders). Vicinity of Paris and Ancaster, Ont. (Logie). Lake Burwell, County Lambton (Gibson). Cockburn Island, Lake Huron (Dr. Bell). Nicolet and Montreal (Maclagan). Plains of the Saskatchewan (Bourgeau). West coast of Newfoundland (Dr. Bell).

D. longifolia, L. Spatulate-leaved Sundew.

Indigenous. Sphagnous swamps, borders of lakes and ponds. New Brunswick (Dr. Fowler). Cedar swamps, Batiscan, Quebec (Brunet) Indian Village, on the River Rouge, also at Lake of the Two Mountains (D'Urban). Bogs and swamps, North Hastings, Ont ; peat bog, Kennebec, County Addington ; shore of Lake Huron, at Oliphant (Macoun). Westminster Pond, London (Saunders). North shore of Lake Superior (Agassiz).

D. linearis, Goldie. Linear-leaved Sundew. Slender Sundew.

Indigenous. Marshes. Lake Simcoe, Ont. (Goldie) Chicken Bay, and at Oliphant, Lake Huron (Macoun). McLeod's Harbour and Cockburn Island (Dr. Bell). Lake Superior (Provancher).

HYPERICACEÆ.

Hypericum, L. St. John's-wort.

H pyramidatum, Ait. Great St. John's-wort.

Indigenous. River bottoms and low lands. River Lachine, Montreal (Brunet). Roadsides near Madoc, Hastings County ; Rice Lake plains (Macoun). Vicinity of London, not common (Saunders). Fullarton, Ont. (J. M. Buchan). Bayfield River, County Huron, Ont. (Gibson). Plains of the Saskatchewan (Bourgeau).

H Kalmianum, L. Kalm's St. John's-wort.

Indigenous. Wet rocks and low grounds Falls of Niagara (Douglas). Shores of Lake Isaac, Bruce Peninsula, Lake Huron; Red and Chicken Bays, Lake Huron ; and Oliphant, Lake Huron (Macoun). Shores of Whisky, Mississagui, and Cockburn Islands, Lake Huron (Dr. Bell). Hamilton (Logie) Huron Co., Lake Huron (Gibson).

H. ellipticum, Hooker. Elliptical-leaved St. John's-wort.

Indigenous. Low grounds and shady banks of streams and lakes. New Brunswick (J. G. Mathews). Pastures and meadows, Quebec (Brunet) Kingston and Chippawa, Ont (Maclagan). Counties of Hastings and Northumberland ; Gull River, Victoria County ; shore of Lake Huron, at Oliphant; Pie Island, Thunder Bay, and Sault Ste. Marie (Macoun). Goulais Point, Lake Superior (R. Bell). Hamilton ? (Logie). Rare at London (Saunders).

H. perforatum, L. Common St. John's-wort.

Introduced from Europe. Roadsides, fields and pastures. New Brunswick (Mathews). Pastures and meadows, Quebec (Brunet). Kingston and Chippewa, Ont. (Maclagan). Northumberland and Hastings Counties, Toronto, and Owen Sound (Macoun) Prescott, common (Billings) Common at London (Saunders). Hamilton (Logie). Counties Lambton and Huron (Gibson).

H. corymbosum, Muhl. Corymbed Hypericum.

Indigenous. Low, rich grounds. Near Quebec, and Island of Orleans (Brunet). Nicolet and Belœil ; Niagara, Thorold, and Malden (Maclagan). Scarce in Northumberland County ; Red Bay, Lake Huron, abundant, and at Oliphant and Fishing Islands, Lake Huron (Macoun) Prescott (Billings). London (Saunders). Hamilton (Logie). Co. Huron, Ont. (Gibson). Island of Montreal (Herb. McGill College).

H. mutilum, L. Diminutive-flowered Mutilum.

Indigenous. Low grounds and river banks. New Brunswick (Dr. Fowler). In Quebec (Brunet). Prescott, Ont. (Billings). Bruce Peninsula, Lake Huron, and north shore of Lake Superior (Macoun) Common at London (Saunders) Western Canada (Maclagan). Sault Ste. Marie (Prof. Bell). Hamilton (Buchan). Mississagui, and St. Joseph's Islands, Lake Huron (Dr. Bell). Island of Montreal (Herb. McGill College).

H. Sarothra, Michx.

Indigenous. Sandy fields and roadsides. Canada (Torrey & Gray; Provancher).

H. Canadense, L. Canada St. John's-wort.

Indigenous. Wet ground and sandy soil. New Brunswick, Kent Co. (Dr. Fowler). Quebec (Brunet). Near Prescott (Billings). Wet, sandy fields, Belleville; head of the Bay of Quinté; Fishing Islands, Lake Huron (Macoun) Sandwich, Ont. (Maclagan). Mississagui River, Lake Huron (Dr. Bell). Loon Portage, Dawson route (Macoun). Newfoundland (Torrey & Gray).

H. Canadense, L. Var. major, Gray.

Indigenous. Head of Bay of Quinté, Ont. Lake Superior (Robbins).

ELODES, Adans. Marsh St. John's-wort.

E Virginica, Nutt. Marsh St. John's-wort.

Indigenous. Swamps and marshes. New Brunswick (Mathews). Quebec, Charlesburg, &c. (Brunet). Three Rivers, Montreal; Kingston, Chippawa, and Malden (Maclagan). Common in Central and Western Canada. Kaministiquia River, Lake Superior; Red Bay and Oliphant, Lake Huron (Macoun). Islands of Lake Huron (Dr. Bell).

CARYOPHYLLACEÆ.

SAPONARIA, L. Soapwort.

S. officinalis, L. Bouncing Bet.

Naturalized from Europe. Waste places. Abundant through Hastings, Northumberland, and Prince Edward Counties (Macoun). Vicinity of London (Saunders). Hamilton (Logie). Owen Sound (Macoun).

VACCARIA, Medik. Cow-herb.

V. vulgaris, Medik. Common Cow-herb.

Introduced. Scarcely naturalized. Cultivated fields and gardens at Belleville and Owen Sound. Fort Francis, Dawson route (Macoun).

SILENE, L. Catchfly.

S. inflata, Smith. Bladder Campions.

Introduced. Vicinity of Belleville, very scarce. Quebec (Mrs. Percival). Vicinity of Prescott, rare (Billings). Hamilton City (Logie). Loretto, Montreal, and Tamiscouta (Dr. Maclagan). Rivière du Loup, common (Dr. Thomas). Kent Co., New Brunswick (Dr. Fowler).

S. antirrhina, L. Snap-dragon Catchfly.

Indigenous. Dry, rocky or gravelly soil and sandy plains. Extends from the Atlantic to the Pacific, and from Florida, on the south, to North-eastern Ontario, on the north. Prescott, rare (Billings). Galt (Miss Crooks). Hamilton (Buchan). Huron County, Ont. (Gibson). Kingston Mills, Niagara, and Malden, Ont. (Dr. Maclagan). Central Canada, abundant; Thunder Bay and Kaministiquia River; Sturgeon Lake, Dawson route; Fort Edmonton and North Saskatchewan; Vancouver Island (Macoun). Saskatchewan plains (Bourgeau). Mississaqui Island, Lake Huron (Dr. Bell).

S. noctiflora, L. Night-flowering Catchfly.

Introduced from Europe. Cultivated grounds and waste places. Abundant in Ontario, Indian Village, Arundel (D'Urban). Kent County, New Brunswick (Dr. Fowler). Canoe Route, Dawson Road (Macoun). Bruce Mines, Lake Huron (Dr. Bell).

S. acaulis, L. Moss Campion.

Indigenous. Rocky places. Labrador coast (Brunet). Rocky Mountains, lat. 53° N. (Bourgeau). Cariboo Mountains (Macoun). Arctic America to the Pacific (Dr. James).

S. Armeria, L. Lobel's Catchfly. Garden Catchfly.

Introduced from Europe. Escaped from gardens. Kent Co., New Brunswick (Dr. Fowler) Spontaneous in a few gardens in Central Canada.

S. Virginica, L. Fire Pink. Catchfly.

Indigenous. Open woods. In Canada is apparently confined to the southwestern portion of Ontario. Upper Canada (Hooker). Islands at Detroit River (Maclagan).

LYCHNIS, Tourn. Lychnis. Cockle.

L. Githago, Lam. Corn Cockle.

Introduced from Europe. Cultivated land. Throughout the wheat-bearing region of Canada. Abundant at Fort Francis, Fort Garry, Fort Edmonton, Dunvegan on Peace River, and Vancouver Island.

L. vespertina, Smith. Evening Lychnis.

Introduced from Europe. Dry grassy fields. Township of Stanley, County of Huron, Ont. (Prof. Gibson).

ARENARIA, L. Sandwort.

A. serpyllifolia, L. Thyme-leaved Sandwort.

Introduced, though at times apparently indigenous. Labrador (Brunet). Kent County, New Brunswick (Dr. Fowler). Sandy places by the sea, Rivèire du Loup (Dr. Thomas). Woods and fields near Ottawa (Billings). London (Saunders). Hamilton (Buchan). Huron County, Ontario (Gibson). Owen Sound (Macoun). Central Canada.

A. stricta, Michx.

Indigenous. Rocky, gravelly, and sandy soil. Near London, Ont. (Saunders). Huron County (Gibson). North shore of Lake Superior (Agassiz).

Common in Central Canada (Macoun). McLeod's Harbour, Cockburn Island, Lake Huron (Dr. Bell). Saskatchewan plains (Bourgeau). Red Bay, Bruce Peninsula, Lake Huron; Pic River, north-east shore of Lake Superior; Lake of the Woods; Dunvegan, Peace River (Macoun). North to Arctic America (Hooker).

A. stricta, Michx. Var. juniperina.

Macoun and Gibson.

Arenaria groendandica.

Hillsides, Baie des Rochers, Labrador (Butler).

A. lateriflora, L. Broad-leaved Sandwort.

Indigenous. Gravelly shores and damp, shady places. Labrador and Restigouche (Brunet). Kent County, New Brunswick (Dr. Fowler). Nicolet, Kingston, Chippewa (Maclagan). Rivière du Loup (Dr. Thomas). Central Canada (Macoun). Eastern shore of Lake Huron (Gibson). From N. lat. 40° to the Arctic Circle (Torr. & Gray). Saskatchewan valley (Bourgeau). Dunvegan, Peace River (Macoun). Montreal Island (Herb. McGill College). West coast of Newfoundland (Dr. Bell).

A. peploides, L. Sea-side Sandwort.

Indigenous. Sands of the sea-shore. Coast of Labrador (Brunet). Kent Co., New Brunswick (Dr. Fowler). Sea-shore, Rivière du Loup (Dr. Thomas). Atlantic coast, from N. lat 40° to Labrador and the Arctic Circle (Torr. & Gray). West coast of Newfoundland (Dr. Bell).

A. verna, L. Var. hirta, Fenzl.

Indigenous. Carspitose, 2′—3′ high, minutely hirsute; leaves subulate, 3-nerved, erect, obtuse or acutish; cyme erect, few or many flowered; sepals ovate, acute, strongly 3-nerved, mostly exceeding the petals. Kotzebue's Sound (Beechey). Greenland and Behring Straits (S. Watson). Cape Charles, Labrador (Brunet). Amoor Bay, Labrador (Butler.)

STELLARIA, L. Chickweed.

S. media, Smith. Chickweed.

Introduced from Europe. Everywhere in damp, rich soils and old gardens. Little Slave Lake and Dunvegan. Peace River (Macoun). N. W. America, (Torr. & Gray). West coast of Newfoundland (Dr. Bell).

S. longifolia, Muhl. Long-leaved Chickweed.

Indigenous. Grassy placés. Kent County, New Brunswick (Dr. Fowler). Prescott Junction and Ottawa (Billings). Vicinity of Hamilton (Logie). Chippewa and Malden, Ont. (Maclagan). Vicinity of London (Saunders). Near the Bayfield and Maitland Rivers, Ont. (Gibson). Common in Central Canada, Sault Ste. Marie, Rainy River, Little Slave Lake, Fort Assinaboine, on the Athabasca; Dunvegan, on Peace River (Macoun). From Virginia to Sub-Arctic America, and westward to Sitka and Oregon (Torr. & Gray). Saskatchewan plains (Bourgeau). St. Joseph's Island, Lake Huron (Dr. Bell). Lachine woods, Montreal (Herb. McGill College).

S. longipes, Goldie. Long-stalked Chickweed.

Indigenous. Rocky grounds. Vicinity of Quebec (Brunet). Restigouche County, New Brunswick (Dr. Fowler). Rocky ground, vicinity of Belleville, Ont.; north shore of Lake Superior; Victoria Missions, Saskatchewan River; Fort Assinaboine, Athabasca River; Little Slave Lake; Dunvegan, Peace River; Fort St. James, British Columbia; Cariboo Mountains; Vancouver's Island (Macoun). From Maine to Wisconsin, thence northward through Canada to the Arctic Sea, and westward to the Pacific coast; but in no locality seems to be very common. Labrador coast (Butler).

S. uliginosa, Murr. Swamp Chickweed.

Indigenous. Swamps and springs. Moosepath, New Brunswick (Mathews). Kent County, New Brunswick (Dr. Fowler). Rocky Mountains (Hooker). Unalaska (Chamisso).

S. crassifolia, Ehrh.

Indigenous. Marshy flats. Labrador, south coast (Butler).

S. gracilis, Richardson.

Indigenous. Perennial, growing in tufts. Stems glabrous, weak and branching, about eight inches high. Leaves lanceolate, spreading, succulent, upper ones slightly ciliate-margined. Peduncle solitary, axillary or terminal, one-flowered. Pedicel generally over an inch long, spreading. Petals two-parted, slightly longer than the scarious-margined, glabrous, acute sepals. In general appearance this species resembles wide-leaved varieties of S. borealis, but its mode of inflorescence is quite different in detail. Hudson's Bay, Cumberland House (Richardson). Pie Island, Thunder Bay, growing in tufts close to the water. July 15th, 1869.

S. borealis, Bigelow. Northern Starwort.

Indigenous. Cool bogs and swamps. New Hampshire and New York to Arctic America, thence west and south through Oregon and California to the Pacific coast (S. Watson, in King's Report). Kent County, New Brunswick (Dr. Fowler). Anticosti and River Saguenay (Brunet). Bevin's Lake, Montcalm, River Rouge (D'Urban). Mt. Johnson, Quebec (Dr. Maclagan). Lake Burwell, County Lambton, Ont. (Gibson). Saskatchewan plains (Bourgeau). St. Joseph's Island, Lake Huron (Dr. Bell). Arctic America (Hooker). Cold Swamps, Hastings County; Thunder Bay, Lake Superior; marshes at the mouth of the Kaministiquia; Little Slave Lake; Dunvegan, Peace River; Cariboo Mountains, and a form from Vancouver's Island (J. Macoun). June.

S. humifusa, Rottbœll.

Indigenous. Greenland to the Arctic Sea, and west to Sitka (Torr. & Gray). York County, New Brunswick (Dr. Fowler). Kamouraska (Dr. Maclagan). Greenland, Arctic Sea, and Sitka (Bougard).

CERASTIUM, L. Mouse-ear Chickweed.

C. vulgatum, L. Mouse-ear Chickweed.

Introduced. Waste places from Florida to Eastern Canada. Vicinity of Quebec (Brunet). Common among grass at Hamilton's Farm, River Rouge (D'Urban). Rivière du Loup (Dr. Thomas). In gardens at Kingston and at Fort William, Thunder Bay, Lake Superior. Lately reported from vicinity of Hamilton by J. M. Buchan, Esq.

C. viscosum, L. Larger Mouse-ear Chickweed.

This species is certainly indigenous in Ontario, being found in many cases at great distances from cultivated grounds. Gray seems to think it is indigenous to the Northern United States, and gives fields and copses as its habitats; whilst Chapman, in his Flora of the Southern States, cites only fields. It seems probable, therefore, that both in Canada and in the United States we have two forms, the one introduced, the other indigenous. Everywhere common at Prescott (Billings). Vicinity of Quebec (Brunet). Kent County, New Brunswick (Dr. Fowler). City of Hamilton (Logie). Near Goderich (J. Gibson). Kingston and Amherstburg (Dr. Maclagan). Common in Central Canada, Toronto, Owen Sound (J. Macoun). Bruce Mines, Lake Huron (Dr. Bell). Plains of the Saskatchewan (Bourgeau). West coast of Newfoundland (Dr. Bell). May to July.

C. nutans, Raf. Nodding Mouse-ear Chickweed.

Indigenous. Low moist grounds from Hudson's Bay to Louisiana, and west to Vancouver and Oregon. In Canada it seems to have been generally overlooked; very abundant in the vicinity of Belleville on wet limestone shingle; Prince Arthur's Landing; Big Lake, near Edmonton, Little Slave Lake and Vancouver Island (J. Macoun).

C. oblongifolium, Torr.

Indigenous. On rocky banks and hills. It seems to be confined, in its geographical range, to a comparatively small area. In the United States it is circumscribed by New York, Virginia, and Illinois; whilst in Canada it has only been reported from the vicinity of Amherstburg by Dr. Maclagan, and lately by J. M. Buchan, Esq., from the vicinity of Hamilton. April to June.

C. arvense, L. Field Chickweed.

Indigenous. On rocky banks, hills, and pastures, from Canada to Georgia and west to the Pacific; Rivière du Loup and Gaspé (Brunet). Mary Island, Islands in Detroit River (Dr. Maclagan). Vicinity of Hamilton (Buchan). Labrador (Butler). Kent Co., New Brunswick (Dr. Fowler). Rocky banks of the Moira, Trent, and Gull Rivers; sandy fields, Toronto; Point Aux Pins, entrance to Lake Superior; Dawson Route, Lake of the Woods; Plains west of Fort Garry; Edmonton, Saskatchewan River; Little Slave Lake, Dunvegan, Peace River; Fort St. James, New Caledonia, and Vancouver Island (J. Macoun). Plains of the Saskatchewan (Bourgeau).

C. alpinum, L. Alpine Chickweed.

Indigenous. "Perennial; silky, hirsute. Stems 4—6 inches high, few-flowered; leaves elliptical-ovate; peduncles more or less elongated; petals bifid at the point, twice the length of the scariously margined and hairy sepals" (Torrey & Gray). Capsule nearly twice as long as the calyx. In North America it extends from Greenland to the islands of Sitka and New Archangel on the west, and southward, on the authority of Brunet, as far as the coast of Labrador. Rocky Mountains (Bourgeau). Kotzebue's Sound and Unalaska (Beechey). Forteau Bay, Labrador (Butler).

SAGINA, L. Pearlwort.

L. procumbens, L. Procumbent Pearlwort.

Indigenous. Springy places and damp rocks. Kent County, New Brunswick (Dr. Fowler). West coast of Newfoundland (Dr. Bell).

S. nodosa, Fenzl.

Indigenous, Wet sandy soil and crevices of wet rocks. Upper Canada to the Arctic Sea and North-west coast. Coast of Maine, New Hampshire, also

Lake Superior and northward (Gray). North shore of Lake Superior (Agassiz). Island of St. Ignace ; Agate Island ; Michipicotin Island and along the North-east coast of Lake Superior (J. Macoun).

SPERGULARIA, Pers. Sand-Spurrey.

S. rubra, Presl. Var. campestris, Gray. Red Sandwort.

Indigenous. Sandy or generally dry soil, along the coast from New England to Virginia. Seldom Maritime (Gray). Halifax, Nova Scotia (Dr. Fowler). Hamilton, Ont. (Buchan).

S. Salina, Presl. Salt Sandwort.

Indigenous. Brackish lands, &c., along the coast from New England to Virginia and southward (Gray). St. John's, New Brunswick (C. F. Mathews). Kent County, New Brunswick (Dr. Fowler). Rivière du Loup ; Labrador (Brunet).

S. media, Presl.

Indigenous. Salt marshes and sands. On the coast and in salt marshes and sands from Florida to Newfoundland. In Central British America from Lake Winipeg to Bear Lake, and in the United States from Washington Territory to California. Found at a salt spring in Parley's Park, Wahsatch Mountains, Utah (S. Watson, in King's Expedition). Kent County, New Brunswick (Dr. Fowler).

SPERGULA, L. Spurrey.

S. arvensis, L. Corn Spurrey.

Introduced. Sandy fields from Maine to Florida. Fields and pastures, St. Joachim (Brunet). Kent County, New Brunswick (Dr. Fowler). St. John, Quebec (Maclagan). A most troublesome weed in New Brunswick (Fowler).

SCLERANTHUS, L. Knawel.

S. annuus, L. Annual Knawel.

Introduced from Europe. Waste places. Dry fields, New England and Middle States (A. Wood). Three Rivers, Quebec (Dr. Maclagan).

MOLLUGO, L. Indian Chickweed.

M. verticillata, L. Carpet-weed.

An immigrant from further south. Dry places throughout North America (Torr. & Gray). Borders of rivers near Montreal (Brunet). Island of Montreal (Holmes Herb., McGill College). Malden, Ont. (Dr. Maclagan).

PORTULACACEÆ.

PORTULACA, Tourn. Purslane.

P. oleracea, L. Common Purslane.

Introduced from Europe. Cultivated and waste grounds. Common in Central Canada (Macoun). Common in Western Ontario (Logie, Saunders, Maclagan, Gibson). Vicinity of Quebec (Brunet). Island of Montreal (Holmes Herb., McGill College). Near Fort Francis, Dawson Route (Macoun).

CLAYTONIA, L. Spring-beauty.

C. Virginica, L. Virginian Spring-beauty.

Indigenous. Moist, open woods. Frequent in Central Canada (Macoun). Abundant in Western Ontario (Logie, Saunders, Gibson). Kingston, Chippawa, St. Catharines, and Malden (Maclagan).

C. Caroliniana, Michx.

Indigenous. Rich woods. Common in Central Canada (Macoun). Prescott (Billings). . Isle of Orleans; St. Anselme; Gaspé (Brunet). Abundant, River Rouge, Quebec, (D'Urban). New Brunswick (G. F. Mathews). Montreal, Three Rivers, Isle aux Noix, Kingston, Chippawa, Malden (Maclagan). Rivière du Loup (Dr. Thomas). Walkerton, and Owen Sound, Ont (Buchan). New Brunswick, west to the Rocky Mountains (Hooker). West coast of Newfoundland (Dr. Bell).

MALVACEÆ.

MALVA, L. Mallow.

M. rotundifolia, L. Common Mallow.

Introduced from Europe. Waysides and cultivated grounds. Common in Central Canada (Macoun). Vicinity of London, Ont. (Saunders). Prescott (Billings). Gate of St. Louis, Quebec (Brunet). Vicinity of Hamilton (Logie). New Brunswick (Dr. Fowler). Kingston, Chippawa, Malden (Maclagan). Rivière du Loup (Dr. Thomas). Owen Sound, Ont. (Macoun). County Huron, Ont. (Gibson). Montreal Island (Dr. Holmes).

M. sylvestris, L. High Mallow.

Introduced. In gardens and waysides. Common in Central Canada (Macoun). Prescott, rare (Billings). New Brunswick (Dr. Fowler). Near Fort Francis, Dawson Route.

M. crispa, L. Curled Mallow.

Introduced. Sparingly escaped from old gardens. Gardens and waste places at Belleville, and Seymour (Macoun). New Brunswick (Dr. Fowler.)

M. moschata, L. Musk Mallow.

Introduced. Roadsides, escaped from gardens. Roadside on Rice Lake plains, and at Owen Sound, Ontario (Macoun). Island in Detroit River (Maclagan). Hamilton (Buchan).

ABUTILON, Tourn. Indian Mallow.

A. Avicennæ, Gaertn. Velvet-leaf.

Introduced. Waste places and potato fields. Frequent in Central Canada (Macoun). Vicinity of Dundas, Ont. (Logie).

HIBISCUS, L. Rose-Mallow.

H. Moschentos, L. Swamp Rose-Mallow.

Indigenous. Brackish marshes along the coast and along rivers. An Island in Detroit River (Maclagan).

H. trionum, L. Bladder Ketmia. Flower-of-an-hour.

Introduced from Europe. Escaped from gardens. Spontaneous in a few gardens at Belleville, Ont (Macoun). Malden, Ont. (Maclagan).

TILIACEÆ.

TILIA, L. Linden. Basswood.

T. Americana, L. Basswood.

Indigenous. Rich, moist woods. Common in Central Canada, and Owen Sound (Macoun). Common in Western Ontario (Logie, Saunders, Gibson) Prescott (Billings). Quebec (Brunet). River Rouge (D'Urban). New Brunswick (Dr. Fowler). St. Joseph's Island and Cockburn Island, Lake Huron (Dr. Bell). South side of Lake Superior (Prof. Bell). Lake of the Woods (Macoun). Saskatchewan plains (Bourgeau). Canada, lat. 52° (Hooker). The T Americana, var. pubescens, reported from Quebec and Lake St Clair by Douglas, is doubtless a more or less pubescent form of the above.

LINACEÆ.

LINUM, L. Flax.

L. Virginianum, L. Virginian Flax.

Indigenous. Dry woods. Vicinity of Hamilton (Judge Logie). Hills in Upper Canada (Torrey & Gray).

L. striatum, Walt.

Indigenous. Wet or boggy grounds. Shores of Lake Huron ; Red Bay, Bruce Peninsula ; Fishing Islands and Oliphant, Lake Huron (Macoun).

L. sulcatum, Riddell.

Indigenous. Dry soils. Rice Lake Plains and near Castleton, County Northumberland ; Oak Hills, Hastings County, Ont. (Macoun).

L. usitatissimum, L. Common Flax.

Introduced from Europe. Cultivated ground and along the railway track. Common throughout Canada, especially along the railroad.

L. perenne, L. Perennial Flax.

Indigenous. Dry, gravelly soil. Perennial; glabrous; stems 1°—3°, branching above ; branches virgate; leaves alternate, linear, acute, scattered; flowers supra-axillary and terminal, rather large ; peduncles becoming elongated and nodding in fruit ; sepals oval, with membranous margins, a little shorter than the globose capsule ; petals free, somewhat retuse, blue 3—4 times the length of the calyx ; styles five, capsules five-celled. Flowers throughout the summer. Indigenous at Marmora Lake, Peterborough County, Ont. (Macoun). Canada (Mrs. Percival, *vide* Hooker). Saskatchewan plains ; Peace River Valley ; west of the Rocky Mountains, Telegraph Trail (Macoun). To the Arctic Sea (Hooker).

(*To be continued.*)

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BRAIN-WEIGHT AND SIZE IN RELATION TO RELATIVE CAPACITY OF RACES.

BY DANIEL WILSON, LL.D., F.R.S.E.

Read before the American Association for the Advancement of Science, at Buffalo, N.Y. 25th August, 1876.

Consistently with the recognition of the brain as the organ of intellectual activity, it seems not unnatural to assume for man, as the rational animal, a very distinctive cerebral development. One of the most distinguished of living naturalists, Professor Owen, has even made this organ the basis of a system of classification, by means of which he separates man into a sub-class distinct from all other mammalia. But while a comparison between man and the anthropoid apes, as the animals most nearly approximating to him in physical structure, lends confirmation to the idea not only that a well developed brain is essential to natural activity, but that there is a close relation between the development of the brain and the manifestation of intellectual power: the distinctive features in the human brain, as compared with those of the anthropomorpha, prove to be greatly less than had been assumed under imperfect knowledge. The substantial difference is in volume. "No one, I presume," says Darwin, "doubts that the large size of the brain in man, relatively to his body, in comparison to that of the gorilla or orang, is closely connected with his higher mental powers;" * and it might not unfairly be reasoned from analogy, that the same test distinguishes the intellectual

* "The Descent of Man," Part I., chap. iv.

man from the stolid, and the civilised man from the savage. A careful study of the subject, however, shows some remarkable deviations from such a scale of progression. In this Mr. Darwin would recognize an analogy to greatly more ample proofs of inequality between the organic source of power and the manifestations of mental energy; as, for example, in the ant, with its cerebral ganglia not so large as the quarter of a small pin's head, displaying instincts and apparent affections of wonderful intensity and compass. Viewed in this aspect, "the brain of an ant is one of the most marvellous atoms of matter in the world, perhaps more marvellous than the brain of man." Here, however, we look on elements of contrast rather than analogy; and seek in vain in this direction for any appreciable test of the soundness of the popular belief in the size of the brain as a measure of intellectual power. It is otherwise when we turn to the anthropomorpha. There, alike in the scientific and in the popular creed, very special and exceptional affinities to man are admitted; and the more careful study of their anatomical structure tends to increase the recognized points of analogy.

Mr. Lockhart Clarke, in a contribution to Dr. Maudsley's work on the Physiology and Pathology of Mind, gives a minute description of the concentric layers of nervous substance which combine to form the convolutions of the human brain, and of the forms and disposition of the various nerve-cells of which its vesicular structure consists. Comparing the human brain with those of other animals, he says: "Between the cells of the convolutions in man and those of the ape tribe I could not perceive any difference whatever; but they certainly differ in some respects from those of the larger mammalia—from those, for instance, of the ox, sheep, or cat."* Apart from the difference in volume (55 to 115 cub. in.), the only distinctive features, according to Professor Huxley, between the brain of the anthropomorpha and that of man, are "the filling up of the occipito-temporal fissure; the greater complexity and less symmetry of the other sulci and gyri; the less excavation of the orbital face of the frontal lobe; and the larger size of the cerebral hemispheres, as compared with the cerebellum and the cerebral nerves."

The brain of the orang is the one which seems most nearly to approximate to that of man. In volume it is about twenty-six or twenty-seven cubic inches; or about half the minimum size of a

* "Insanity and its Treatment," by G. F. Blandford, M.D., p. 10.

normal human brain. The frontal height is greater than in that of other anthropomorpha; the frontal lobe is in all respects larger as compared with the occipital lobe; and certain folds of brain-substance, styled "bridging convulsions," which in the human brain are interposed between the parietal and occipital lobes, also occur, though greatly reduced, in the brain of the orang; while they appear to be wholly wanting in the chimpanzee, the gibbon, and other apes which superficially present a greater resemblance to man. Referring to the convolutions of the central cerebral lobe, Huschke says: "With their formation in the ape, the brain enters the last stage of development until it arrives at its perfection in man;" and the higher class of brains may be arranged between the extremes of poorly and richly convoluted examples.

But it must not be overlooked that, apart from structural differences, relative, and not absolute mass and weight of brain has to be considered, otherwise the elephant and the whale would take the foremost place. "The brain of the porpoise," Professor Huxley remarks,* "is quite wonderful for its mass, and for the development of the cerebral convolutions;" but it is the centre of a nervous system of corresponding capacity, while as compared with the size of the animal, the brain is not relatively large. Vogt states the weight of the human body to be to the brain, on an average, as 36 to 1; whereas in the most intelligent animals the difference is rarely less than 100 to 1.

Assuming the existence of some uniform relation between the size of the brain and the development of the intellectual faculties, along with whatever is recognized as most closely analogous to them in the lower animals, it might be anticipated that we should find not only a graduated development of brain in the anthropomorpha as they approximate in resemblance to man; but, still more, that the progressive stages from the lowest savage condition to that of the most civilized nations should be traceable in a comparative size and weight of brain. Dr. Carl Vogt, after discussing certain minor and doubtful exceptions, thus proceeds: "We find that there is an almost regular series in the cranial capacity of such nations and races as, since historic times, have taken no part in civilization. Australians, Hottentots, and Polynesians, nations in the lowest state of barbarism, commence the series; and no one can deny that the place they

* "Mr. Darwin's Critics: Critiques and Addresses."

occupy in relation to cranial capacity and cerebral weight corresponds with the degree of their intellectual capacity and civilization."* But the position thus confidently assigned to the Polynesians receives no confirmation from the evidence supplied by the measurements of Dr. J. B. Davis, in his *Thesaurus Craniorum;* and a careful study of the subject reveals other remarkable deviations from such a scale of progression, not only in individuals but in races. To these exceptional deviations, with their bearing on the comparative capacity of races, the following remarks are chiefly directed. The largest and heaviest brains do indeed appear, for the most part, to pertain to the nations highest in civilization, and to the most intelligent of their number. But this cannot be asserted as a uniform law, either in relation to races or individuals. The more carefully the requisite evidence is accumulated, the less does it appear that the volume of brain, or the cubic contents of the skull, supply any uniform gauge of intellectual capacity. In the researches which have thus far been instituted into the characteristics of the human brain among the lowest races, the development is in many respects remarkable; and, as was to be expected, no organic differences between diverse races of men have been traced.

Professor C. Luigi Calori has published the results of a careful examination of the brain of a Negro of Guinea. It presented the marked excess of length over breadth so characteristic of the Negro cranium; but in other respects it corresponded generally to the fully developed European brain. The distribution of the white and gray substances was the same; the cerebral convolutions were collected into an equal number of lobes; and the only special difference was that the convolutions were a little less frequently folded, and the separating sulci somewhat less marked than in the average European brain. But even in this respect the complication was great. The actual weight of the brain, according to Professor Calori, was 1,260 grammes, equivalent to 44·4 cubic inches. The complexity of convolution, and consequent extension of superficies of the encephalon, appears to be an essential element in the development of the brain as the organ of highest mental capacity; and to the cerebrum, apparently, the true functions of intellectual activity pertain. Professor Wagner undertook the measurement of the convex surface of the frontal lobe in a series of brains. The heaviest, as a rule, had also the greatest

* Vogt, "Lectures on Man." Lect. III

development of surface. But the two elements were not in uniform ratio. Some of the lighter brains presented a much greater degree of convolution and consequent extent of convex superficies than others which ranked above them in weight. It is thus apparent that in estimating the comparative characteristics of brains, various elements are necessary for an exhaustive comparison. Besides the functional differences of the cerebrum, cerebellum, and pons varolii, they have different specific gravities, so that brains of equal weight may differ widely in quality. Dr. Peacock, taking distilled water as 1000, gives the values of the subdivisions of the brain thus: cerebrum, 1034; cerebellum, 1041; pons varolii, 1040. Again, Dr. Sankey states the mean specific gravity of the gray matter of the brain in either sex as 1·0346, and of the white matter as 1·0412. The variations from these results, as given by Bastian, Thurnam, and others, are trifling. But it is significant to note that recent researches shew that where greater specific gravity of brain occurs in the insane, it appears to be limited to the gray matter.* Professor Goodsir maintained that symmetry of brain has more to do with the higher faculties than bulk or form. It is, at any rate, apparent that two brains of equal weight may differ widely in quality.

Nevertheless, the popular estimate embodied in such expressions as "a good head," "a long-headed fellow," and "a poor head," like many other popular inductions, has truth for its basis. Up to a certain stage the growth of the brain determines the capacity of the skull. Then it seems as though more complex convolutions accompanied the packing of the elaborated cerebral mass within the fixed limits of its osseous chamber.

A comparison of races, based on minute investigation of an adequate number of brains of fair typical examples, may be expected to yield important results; but in the absence of such direct evidence, the chief data available for this purpose are derived from measurements of the internal capacity of their skulls. Among English observers who have devoted themselves to this class of observations, the foremost place is due to Dr. J. Barnard Davis, who, in 1867, summed up the results of his extensive researches in a contribution to the Royal Society, entitled, "Contributions towards determining the weight of the brain in different races of man."† Inferior as such

* "Journal of Mental Science," Vol XII., p 23.

† "Philosophical Transactions," Vol. CLVIII., p. 505.

evidence must necessarily be, if compared with the examination of the brain itself, nevertheless the number of skulls of the different races gauged unquestionably furnishes some highly valuable data for ethnical comparison. The evidence, moreover, is obtained from a source in some respects less variable than the encephalon; and will always constitute a corrective element in estimating results based on direct examinations of the brain. Dr. Davis, indeed, claims "that the examination of a large series of skulls in ascertaining their capacities and deducing from those capacities the average volume of the brain, affords in some respects more available data for determining this relative volume for any particular race than the weighing of the brain itself." The defect is, that its most important results are necessarily based on the assumption of a uniform density of brain; whereas some notable ethnical differences, hereafter referred to, may prove to be due to the fact that certain races derive their special characteristics from a prevailing diversity in this very respect.

But the extensive observations of Dr. Davis, as of Dr. Morton, have a special value from the fact that each furnishes results based on a uniform system of observation; for the diverse methods and materials employed by different observers in gauging the human skull have greatly detracted from their practical value. In a communication by the late Professor Jeffreys Wyman to the Boston Natural History Society,* he presented the results of a series of measurements of the internal capacity of the same skull with pease, beans, rice, flax-seed, shot, and coarse and fine sand. From repeated experiments he arrived at the conclusion that the apparent capacity varied according to the different substances used, so that the same skull measured respectively, with pease 1193 centimetres, with shot 1201·8, with rice 1220·2, and with fine sand 1313 centimetres. Professor Wyman was led to the conclusion that, for exactness, small shot, as employed latterly by Dr. Morton, is preferable to sand, were it not for its weight, which, in the case of old and fragile skulls, is apt to be destructive to them. With a view to avoid the latter evil, Dr. J. B. Davis has used fine Calais sand of 1·425 specific gravity. The diversity in apparent volume, consequent on the employment of different substances in gauging the internal capacity of the skull, necessarily detracts from the value of comparative results of Morton, Davis, and others. But the elaborate measurements of their great collections

* "Proceedings of the Boston Natural History Society," Vol XL.

of human crania furnish reliable series of data, each uniform in system, and sufficiently minute to satisfy many requirements of comparative craniometry.

Without assuming an invariable correspondence in cubical capacity and brain-weight, there is a sufficient approximation in the cubical capacity of the skull and the average weight of the encephalon to render the deductions derived from gauging the capacities of skulls of different races an important addition to this department of comparative ethnology. For minute cerebral comparisons, however, it is apparent that much more is required; and the special functions assigned to the various organs within the cranium have to be kept in view. Of these the medulla oblongata, in direct contact with the spinal cord, is now recognized as the centre of the vital actions in breathing and swallowing; and is believed also to be the direct source of the muscular action employed in speech. Next to it are the sensory ganglia, arranged in pairs along the base of the brain. To the cerebellum, which the phrenologist sets apart as the source of the emotions and passions embraced in his terminology of amativeness, philoprogenitiveness, &c., physiologists now assign the function of conveying to the mind the conditions of tension and relaxation of the muscles, and so controlling their voluntary action. But above all those is the cerebrum, or brain-proper, consisting of two large lobes of nervous substance, which in man are so large that, when viewed vertically, they cover and conceal the cerebellum. To this organ is specially assigned emotion, volition, and ratiocination. It is the assumed seat of the mind; and, in a truer sense than the skull,

"The dome of thought, the palace of the soul;"

if indeed it be not, to one class of reasoners, the mind itself. Certain it is that no acute disease can affect it without a corresponding disorder of the functions of mind; and with this organ much below the average size, intellectual weakness may always be predicated. But at the same time, it is significant to note that the human brain, stinted in its full proportions, and reduced to a seeming equality with the anthropomorpha, exhibits no corresponding capacities or instincts in lieu of the higher mental qualities. Microcephaly is the invariable index, not of mere limited intelligence and mental capacity, but of actual mental imbecility. If the augmentation of the brain of the anthropomorpha from 55 to 115 cubic inches be all that is requisite for the transformation of the irrational ape into the reasoning man, it would seem to be in no degree illogical to look for the accompaniment of the inversion of the process by an approximation, in some instances, to certain capacities and functions of the ape. But there are no indications of this. In some examples of microcephaly, the so-called animal propensities do indeed manifest themselves to excess; but there is no reproduction of the animal nature, instincts, or capacities, analogous to the scale of cerebral development of the orang or chimpanzee. A microcephalous idiot, who died at the age of twenty-two, in St. Bartholomew's Hospital, London, had a brain weighing only 13·125 oz., or 372 grammes. In describing this case, Professor Owen remarks: "Here nature may be said to have performed for us the experiment of arresting the development of the brain almost exactly at the size which it attains in the chimpanzee, and where the intellectual faculties were scarcely more developed. Yet no anatomist would hesitate in at once referring the cranium to the human species." And so is it with the encephalon. The brain of the chimpanzee is a healthy, well-developed organ, adequate to the amplest requirements of the animal; whereas the microcephalous human brain is inadequate for any efficient, continuous cerebral activity: not merely limited in its range of powers. Much, however, may yet be learned from a careful attention to the imperfect manifestations of activity in certain directions, in cases of microcephalic idiocy, and noting the predominant tendency in each case, with a view to subsequent examination of the brain. By this means it may be found possible to refer certain forms of mental activity to special variations in the structure of the organ, or to distinct members of the encephalon.

Dr. Laennec recently exhibited to the Anthropological Society of Paris a microcephalous idiot of the male sex, aged fourteen years. "This child is entirely unconscious of his own actions, and his intellectual operations are very few in number, and very rudimentary. His language consists of two syllables, *oui* and *la*, and he takes an evident pleasure in pronouncing them. He takes no heed in what direction he walks. He would step off a precipice, or into a fire." Attention was specially directed to the idiot's hands: "The thumbs are atrophied, and cannot be opposed to the other fingers. The palms of the hands have the transverse creases, but not the diagonal,—the result of the atrophy of the thumbs. Hence the hand resembles that of the chimpanzee. The dentition too is defective. Though fourteen years of age, the child has only twelve teeth." Here it is curious to note the analogies in physical structure to the lower anthropomorph in other organs besides the brain, for it only renders more striking the absence of any corresponding aptitudes.

Dr. J. Barnard Davis, in his interesting monograph on "Synostotic Crania among Aboriginal Races of Man," produces some remarkable illustrations of the effect of premature ossification of the sutures of the skull in arresting the full development of the brain, and so rendering it unequal to the due performance of its functions. "I have," he says, "the cranium of a convict who was executed on Norfolk Island, which I owe to the kindness of Admiral H. M. Denham. This man was executed there when that beautiful isle was appropriated to the reception of the most dangerous and irreclaimable convicts from the other penal settlements. It is a microcephalic skull, rather dolichocephalic, of a man apparently about forty years of age. It exhibits a perfect ossification of the sagittal and of the greater portion of the lambdoidal sutures. The coronal suture is partially obliterated at the sides in the temporal regions, and can only be distinguished by faint traces in all its middle parts. In this case there has not been any compensatory development of moment in other directions. The calvarium is not abridged in its length, which is 7·1 inches, equal to 179 millimetres; probably it is a little elongated. It is, however, very narrow, being only 4·8 inches, or 122 m.m. at its widest part, between the temporal bones. So that the result is a very small, dwarfed, almost cylindrical calvarium. The internal capacity is only 59 ounces of sand,* which is equal to 71·4 cubic inches, or 1169 cubic centimetres." Here is a skull considerably below the lowest mean of the crania of any race in Morton's enlarged tables, or in the more comprehensive ones furnished in Dr. Davis's "Thesaurus Craniorum." Another skull nearly approximating to it is that of a Cole, one of the savage tribes of Nagpore, in Central India, who are said to go entirely naked. It is described in the supplement to the "Thesaurus Craniorum" as that of "Chara," a Cole farmer, aged fifty,

* The internal capacity of 59 oz. is given here from the "Thesaurus Craniorum," p. 40, in correction of that of 50 oz stated in the memoir in "Transactions of the Dutch Society of Sciences," Haarlem, p. 21, which may be presumed to be a misprint Dr. Davis adds, in the "Thesaurus Craniorum," "An early closure of the sutures has occasioned a stunted growth of the brain, especially of its convolutions, and thus prevented the development of those structures and faculties which might have given a different direction to his lower propensities;" and he justly adds his conviction that this was a case rather for timely treatment as a dangerous idiot, than for punishment as a criminal.

and its internal capacity is stated as 59·5 oz. av., equivalent to 71·7 cub. inches. The Coles appear to be small of stature. The heights of three of them, whose skulls are in the same collection, were respectively 5 ft. 5 in., 5 ft. 2 in., and 5 ft., and the average internal capacity of five male skulls is only 66·6. The small stature in this and others of the native races of Central India, has to be taken into account in estimating the relative size of the brain. But the Cole skulls are remarkable for their small size, being smaller even than the ordinary Hindoos of Bengal. Yet one of them, "Cootlo," whose skull is among those included in the above mean, commanded a band of insurgents in the Porahant rebellion of 1858, and made himself a terror to the district.

The microcephalism of races, as well as of individuals, of small stature, must not be confounded with the true microcephaly of a dwarfed or imperfectly developed brain, which is invariably accompanied with mental imbecility. The Mincopies of the Andaman Islands are spoken of by Professor Owen as "perhaps the most primitive, or lowest in the scale of civilization, of the human race."* Mr. G. E. Dobson, in describing his first visit to one of their "homes," says: "Although none of the tribe exceeded 64 inches in height, so that on first seeing them we thought the shed contained none but boys and girls, I was especially struck by the remarkable contrast between the size of the males and females."† Dr. J. B. Davis has given, in the supplement to "Thesaurus Craniorum," the dimensions of a male Mincopie skeleton in his collection. The age he assumes to have been about thirty-five. The internal capacity of the skull is 62 oz. (Calais sand), equivalent to 75·5 cubic inches, and the entire height of the skeleton is 58·7 inches. It belongs, says Dr. Davis, to a pigmy race, is small in all its dimensions, and is particularly small in the dimensions of the pelvis. Of their skulls, moreover, he adds, "it is somewhat difficult to determine the sex with confidence. They are all small (but this is a character of the race), they are delicate in development, and they have that fullness of the occipital region, and smallness of the mastoid processes, which are marks of feminism."

Mr. Alfred R. Wallace connects the Mincopies with the Negritos and Semangs of the Malay peninsula, a dark woolly-haired race,

* "Report of British Association," 1861.
† "Journal Anthrop. Inst.," Vol. IV, p. 464.

dwarfs in stature. Dr. Davis says of the six Mincopie skulls in his collection, four male and two female, as well as of others which he has seen: "They are all remarkably and strikingly alike, not merely in size but in form also. They are all small, round, brachycephalic crania of beautiful form." Moreover, though classed as "lowest in the scale of civilization," the Mincopies betray no deficiency of intellect. The admirable photographs which illustrate Mr. Dobson's narrative show in the majority of them good frontal development. The brain is not, indeed, relatively small. Their canoes are made of the trunk of a tree, hollowed out; and Mr. Dobson remarks: "The construction of their peculiar arrows and fish spears with movable heads exhibits much ingenuity, and the use of no small reasoning power in adapting means to an end."

We are indeed too apt to apply our own artificial standards as the sole test of intellectual vigour; whereas it is probable that in the amount of acquired knowledge and acuteness of reasoning many savage races surpass the majority of the illiterate peasantry in the most civilized countries of Europe. Mr. Wallace, in viewing the subject in one special light, remarks: "The brain of the lowest savages, and, as far as we yet know, of the prehistoric races, is little inferior in size to that of the higher types of man, and is immensely superior to that of the higher animals; while it is universally admitted that quantity of brain is one of the most important, and probably the most essential of the elements which determine mental power. Yet the mental requirements of savages, and the faculties actually exercised by them are very little above those of animals. The higher feelings of pure morality and refined emotion, and the power of abstract reasoning and ideal conception, are useless to them; are rarely, if ever, manifested; and have no important relations to their habits, wants, desires, and well-being. They possess a mental organ beyond their needs."*

Here, however, it may be well to guard against the confusion of two very distinct elements. The higher feelings of pure morality and refined emotion are not manifestations of intellectual vigour in the same sense as is the power of abstract reasoning and ideal conception. It is not rare to find an English or Scottish peasant with little intellectual culture or capacity for abstract reasoning, but with an acutely instinctive moral sense. On the other hand, among the criminal

* "Limits of Natural Selection, as Applied to Man."

class, it is by no means rare to find examples of wonderfully vigorous intellectual power applied to the planning and accomplishing of schemes which involve as much foresight and skill as many a triumph of diplomacy; but which at the same time seem to be nearly incompatible with any moral sense. Moreover, it is needless to say that intellectual vigour and high moral principle are by no means invariable concomitants in any class of society; nor can they be traced to a common source. Mr. Wallace recognizes that "a superior intelligence has guided the development of man in a definite direction, and for a special purpose;" and such guidance involves much more than the mere evolution of a higher animal organization. But, appreciating as he does the difficulties involved in any acceptance of a theory of evolution which assumes man to be the mere latest outgrowth of a development from lower forms of animal life, Mr. Wallace points out that "natural selection could only have endowed savage man with a brain a little superior to that of an ape, whereas he actually possesses one very little inferior to that of a philosopher."

Yet neither Mr. Wallace, nor Professor Huxley when controverting this argument, withholds a due recognition of the activity of the intellect of the savage. No one indeed can have much intercourse with savage races wholly dependent on their own resources, without recognizing that, within a certain range, their faculties are kept in constant activity. The savage hunter has not merely an intimate familiarity with all the capabilities and resources of many regions traversed by him in pursuit of his game; his geographical information includes much useful knowledge of the topography of ranges of country which he has never visited. I found, on one occasion, when exploring the Nepigon River, on Lake Superior, that my Chippewa guides, though fully five hundred miles from their own country, and visiting the region for the first time, were nevertheless on the look-out for a metamorphic rock underlying the sienite which abounds there; and they made their way by well-recognized land-marks to this favourite "pipe-stone rock." While moreover the Indian, like other savages, is devoid of much of what we style "useful knowledge," but which would be very useless to him, he is fully informed on many subjects embraced within the range of the natural sciences; and has a very practical knowledge of meteorology, zoology, botany, and much else which constitutes useful knowledge to him. He is familiar with the habits of animals, and the medicinal virtues of many plants; will find his way through the forest by noting the special side of the trunks on which certain lichens grow; and follow the tracks of his game, or discover the nests of birds, by indications which would escape the most observant naturalist. The Australian savage, stimulated apparently to an unwonted ingenuity by the privations of an arid climate, is the inventor of two wonderfully ingenious implements, the *wommera* or throwing stick, and the *bomerang*, which, when employed by the native expert, accomplish feats entirely beyond any efforts of European skill. Moreover, as Professor Huxley remarks, he "can make excellent baskets and nets, and neatly fitted and beautifully balanced spears; he learns to use these so as to be able to transfix a quartern loaf at sixty yards; and very often, as in the case of the American Indians, the language of a savage exhibits complexities which a well-trained European finds it difficult to master." Again he goes on to say: "Consider that every time a savage tracks his game he employs a minuteness of observation, and an accuracy of inductive and deductive reasoning which, applied to other matters, would assure some reputation to a man of science, and I think we need ask no further why he possesses such a fair supply of brains. In complexity and difficulty, I should say that the intellectual labour of a good hunter or warrior considerably exceeds that of an ordinary Englishman." Hence Professor Huxley is not prepared to admit that the American or Australian savage possesses in his brain a mental organ which he fails to turn to full account. But without entering on the questions of evolution and natural selection in all their comprehensive bearings, it is still apparent that the brain of the savage is an instrument of great capacity, employed within narrow limits.

In estimating the comparative size of the brain, it is seen to be necessary to discriminate between individuals or races of small stature and cases of true microcephaly. On the other hand, it is not to be overlooked that examples of idiocy are not rare where the head is of a fair average size, and where the mental imbecility is regarded as congenital. But in this as in other researches of the physiologist, he is limited in his observations mainly to the chance opportunities which offer for study; and not unfrequently the prejudices of affection arrest the hand of the student, and prevent a *post mortem* examination in cases where science has much to hope for from freedom of investigation. Hence the data thus far accumulated in evidence of the actual structure, size and weight of the human brain fall far short of what is requisite for a solution of many questions in reference to the relations between cerebration and mental activity. From time to time men of science have sought by example, as well as by precept, to lessen such impediments to scientific research. Dr. Dalton left instructions for a *post mortem* examination, in order to test the peculiarity of his vision, which he had assumed to be due to a colouring of the vitreous humour; Jeremy Bentham bequeathed his body to his friend Dr. Southwood Smith, for the purposes of anatomical science; and the Will of Harriet Martineau, who died during the present year, contains this provision: "It is my desire, from an interest in the progress of scientific investigation, that my skull should be given to Henry George Atkinson, of Upper Gloucester Place, London, and also my brain, if my death should take place within such distance of his then present abode as to enable him to have it for purposes of scientific investigation." The Will is dated March 10th, 1864; but by a codicil, dated October 5, 1871, this direction is revoked, with the explanation which follows in these words: "I wish to leave it on record that this alteration in my testamentary directions is not caused by any change of opinion as to the importance of scientific observation on such subjects, but is made in consequence merely of a change of circumstances in my individual case." The natural repugnance of surviving relatives to any mutilation of the body must always tend to throw impediments in the way of such researches; though it may be anticipated that, with the increasing diffusion of knowledge, such obstacles to its pursuit will be diminished. Thus far, however, notwithstanding the persevering labours of Welcker, Bergmann, Parchappe, Broca, Boyd, Skae, Owen, Thurnam, and other physiologists, their observations have been necessarily limited almost exclusively to certain exceptional sources of evidence, embracing to a large extent only the pauper and the insane classes; and in the case of the latter especially, the functional disorder or chronic disease of the organ under consideration renders it peculiarly desirable that such results should be brought, as far as possible, into comparison with a corresponding number of observations on healthy brains of a class fairly representing the social and intellectual status of a civilized community.

The average brain-weight of the human adult, as determined by a numerous series of observations, ranges for man from 40 oz. to 52½ oz., and for woman from 35 oz. to 47½ oz. But some indications among ancient crania tend to suggest a doubt as to whether this difference in cerebral capacity was a uniformly marked sexual distinction among early races; due allowance being made for difference in stature. Dr. Thurnam made the race of the British Long Barrows a special subject of study; and Dr. Rolleston has followed up his researches with valuable results. Amongst other points, he notes that the males appeared to have averaged 5 feet 6 inches, and the females 4 feet 10 inches in height. But while the difference of stature between the male and the female exceeds what is observable in most modern races, the variation in the size and internal capacity of their skulls appears to be less than among civilized races. The like characteristics are noticeable in the larger race of Europe's palæotechnic era. Nothing is more striking in the discovery of those ancient remains of European man than the remarkable development of the skulls, and the good brain capacity of the race of the palæotechnic dawn, where man is proved, by his works of art and all the traces of his hearth and home, to have been still a rude hunter and cave-dweller. Whatever other changes, therefore, may have affected the brain as the organ of human thought and reasoning, it does not thus far appear that the average mass of brain has increased since the advent of European man. Important exceptions have indeed been noted. Professor Broca's observations on the cerebral capacity of the Parisian population at different periods, based on nearly 400 skulls derived from vaults and cemeteries of various dates from the 11th or 12th to the 19th century, appear to him to show a progressive cerebral development in that remarkable centre of European civilization.* But though the assumption is not inconsistent with other results of civilization, and is the necessary corollary of the postulate that intellectual activity tends to permanent development of brain; the fact that the crania presented a still greater diversity in type than in size reminds us of the intermixture of races on the banks of the Seine, and the consequent necessity for much more extended observations before so important a deduction can be received as an established truth.

Taking the average brain-weight of the human adult as already stated, all male brains falling much below 40 oz. or 1130 grammes,

* "Bull. de la Soc. d'Anthropologie de Paris." 1861, ii., p. 501; 1862, iii., p. 102.

and female brains below 35 oz. or 990 grammes, may be classed as *microcephalous;* and all above the maxima of the medium male and female brain, viz., 52½ oz. or 1480 grammes, and 47½ oz. or 1345 grammes, may be ranked as *megalocephalous,* or great brains.

Professor Welcker, who devoted special attention to the whole subject under review, assumes another and simpler test, when he says that skulls of more than 540 to 550 millemetres, or 21·26 to 21·65 inches in circumference—the weight of brain belonging to which is 1490 to 1560 grammes (52·5—55 oz. avoir.),—are to be regarded as exceptionally large. But while an excess of horizontal circumference may be accepted as indicating good cerebral capacity, it must not be overlooked that the adoption of it as the key to any definite or even approximate brain-weight ignores the important elements of variation involved in the difference between acrocephalic and platycephalic head-forms. The volume of brain in Scott, and probably in Shakespeare, appears to have depended more on its elevation than its horizontal expansion. The same was also the case with Byron. The intermastoid arch, measured across the vertex of the skull from the tip of one mastoid process to the other, furnishes an accurate gauge of this development. Of thirteen selected male English skulls in Dr. Davis's collection, the mean of this measurement is 15·1; and of thirty-nine male and female English skulls, it is only 14·4. Of the whole number of eighty-one English skulls described in the "Thesaurus Craniorum," three exceptionally large ones are—No. 123, that of an ancient British chief, of fully 6 ft. 2 in. in stature, from the Grimsthorpe Barrow, Yorkshire; No. 905, a calvarium of great magnitude, very brachycephalic, and with the elevation across the middle of the parietals apparently exaggerated by compression in infancy, from Hythe, Kent; and No. 1029, another male skull, remarkable alike for its size and weight, and with a peculiarity of conformation ascribed by Dr. Davis to synostosis of the coronal suture. The intermastoid arch in those exceptionally large skulls measures respectively 16·0, 16·2 and 16·9; whereas the same measurement derived from the cast of Scott's head taken after death, yields the extraordinary dimensions of 19 inches.* This last measurement is over the hairy scalp. But after making ample allowance for this, the vertical measurement of the skull and consequently of the brain is remarkable.

* I am indebted to Dr. J. A. Smith F.S.A., Scot., for this and other measurements of casts of The Bruce, Burns, Scott, &c., not accessible to me.

Full value has been assigned at all periods to the well-developed forehead. It is characteristic of man. The physiognomist and the phrenologist have each given significance to it in their respective systems; and it has received no less prominent recognition from the poets. A fully developed forehead is assumed as distinctive of the male skull. But Juliet, in "The Two Gentlemen of Verona," when depreciating her rival, exclaims, "Ay, but her forehead's low;" and the jealous Queen of Egypt, in "Antony and Cleopatra," is told of Octavia that "her forehead is as low as she would wish it." "The fair large front" of Milton's perfect man is the external index of an ample cerebrum: the organ to which the seat of consciousness, intelligence, and will is assigned. It is therefore consistent with this that a low, retreating forehead is popularly assumed to be the characteristic index of the savage, and of the unintellectual among civilized races. But the cerebral characteristics of both ancient and modern civilized races have still to be studied in detail; and the influence of race and sex on the form of the head and the mass and weight of the brain, involves some curious questions in relation to the oldest illustrations of the physical characteristics of man, and to the effect of civilization on the relative development of the sexes.

Early observations led Dr. Pruner-Bey and other ethnologists of France to recognize in certain ancient Gaulish skulls of a brachycephalic type the evidences of a primitive race, assumed to represent the inhabitants of France and of Central Europe during its reindeer period, and which appeared to be assigned with reasonable probability to a Mongol origin. But in the Cro-Magnon cavern, and in other caves more recently explored, the remains of a race of men have been brought to light markedly dolichocephalic, and no less striking in cranial capacity. Dr. Broca speaks of these ancient cave-dwellers of the valley of the Vezère as characterized by "sure signs of a powerful cerebral organization. The skulls are large. Their diameters, their curves, their capacity, attain, and even surpass, our medium skulls of the present day. The forehead is wide, by no means receding, but describing a fine curve. The amplitude of the frontal tuberosities denotes a large development of the anterior cerebral lobes, which are the seat of the most noble intellectual faculties." Alongside of the remains of this ancient race, and in the underlying deposits, lay those of the mammoth, cave-lion and bear, fossil horse, and reindeer. In neighbouring caves of the same valley, and especially in that of La Madelaine, numerous specimens of primitive art have been found: tools and weapons of flint, carved lances and harpoons of bone; and ingenious engravings and carvings of the mammoth, reindeer, and of man himself, on pieces of horn and ivory tablets. The evidences of primitive skill and intellectual vigour are remarkable. Dr. Broca, after a review of their ingenious arts, says: "They had advanced to the very threshold of civilization;" and Dr. Pruner-Bey thus comments on their characteristics: "If we consider that its three individuals had a cranial capacity much superior to the average at the present day; that one of them was a female, and that female crania are generally below the average of male crania in size; and that nevertheless the cranial capacity of the Cro-Magnon woman surpasses the average capacity of *male* skulls of to-day, we are led to regard the great size of the brain as one of the more remarkable characters of the Cro-Magnon race. This cerebral volume seems to me even to exceed that with which at the present day a stature equal to that of our cave-folks would be associated: whilst the skulls from the Belgium caves are small, not only absolutely, but even relatively in the rather small stature of the inhabitants of those caves."*

The remarkable cranial capacity of the skulls thus seemingly pertaining to the most primitive of European races—the troglodytes of the mammoth and reindeer periods of Central Europe,—is the more significant from its bearing on the evidence of progressive cerebral development adduced by Dr. Broca from skulls recovered from ancient and modern cemeteries of Paris. It appears indeed to conflict with any theory of a progressive development from the Troglodyte of the post-glacial age to the civilized Frenchman of modern times. Mr. W. Boyd Dawkins has accordingly been at some pains in his "Cave Hunting," to show that the conclusions formed by previous observers as to the epoch of their burial are not supported by the facts of the case; and he sums up his review of the whole evidence by expressing a conviction that he "should feel inclined to assign the interments to the neolithic age, in which cave-burial was so common. The facts," he adds, "do not warrant the human skeletons being taken as proving the physique of the palæolithic hunters of the Dordogne, or as a basis for an inquiry into the ethnology of the palæolithic races." Mr. Boyd Dawkins also pronounces the same doubts in reference to the equally characteristic

* "Reliquiæ Aquitanicæ."

male skeleton found in a cave at Mentone, and to others obtained in the Lombrive and other caves. Nor was this caution without reason, for the remains of man differ from other animal remains found in such series of deposits as mark a succession of periods, in so far as they pertain to the only animal habitually given to the practice of interment; so that human skeletons found under such circumstances may have been artificially intruded long subsequent to the accumulation of the breccia in which they lay. Happily, however, any doubts as to the contemporaneity of the human remains with the other cave-relics has since been removed by the discovery of skeletons, similar in type, in other caverns in the same valley—and especially in that of Laugerie Basse,—in positions which seem to leave no room for questioning their being of the same age as the works of art found along with them.

Other examples of the ancient man of Europe show him in like manner endowed with a cerebral development far in advance of the rudest races of modern times. The skull found by Dr. Schmerling in the Engis Cave, near Liége, along with remains of six or seven human skeletons, was embedded in the same matrix with bones of the fossil elephant, rhinoceros, hyæna, and other extinct quadrupeds. It is a fairly proportioned, well developed dolichocephalic skull; and, like others of the seemingly most ancient human skulls yet found, has signally disappointed the expectations of those who count upon invariably finding a lower type the older the formation in which it occurs. "Assuredly," says Professor Huxley, "there is no mark of degradation about any part of its structure. It is, in fact, a fair average human skull, which might have belonged to a philosopher, or might have contained the thoughtless brain of a savage." Even the famous Neanderthal skull, of doubtful geological antiquity, but pronounced to be "the most brutal of all human skulls," acquires its exceptional character chiefly from the abnormal development of the superciliary region.

It is a universally accepted fact that the size of the male head and the weight of the brain are greater than those of the female. The average weight of the male brain is found to exceed that of the female by about ten per cent.; or, as it is stated by Professor Welcker, the brain-weight of man is to that of woman as 100 : 90. But the difference of stature between the two sexes has to be taken into account. The average, based on various series of observations to determine the mean stature for man and for woman, shows the latter to be about eight per cent. less than the former; or, as Dr. Thurnam has stated it more precisely:

RATIO OF STATURE AND BRAIN-WEIGHT IN THE TWO SEXES.

	MALE.		FEMALE.
Stature....................	100·	......	92·
Weight of Brain............	100·	......	90·3

Here again, however, it becomes important to take into consideration other elements of difference besides weight; for, as Tennyson insists, "Woman is not undevelopt man, but diverse." The results of Wagner's observations on the superficial measurements of the convolutions of the brain point to the conclusion that in the female the lesser brain-weight may be compensated by a larger superficies. Ranked in the order of their relative weights in grammes, six average brains of men and women were found to stand thus:

1	Male	(*a*)	1340
2	"	(*b*)	1330
3	"	(*c*)	1273
4	Female	(*d*)	1254
5	"	(*e*)	1223
6	"	(*f*)	1185

But the same brains, when tested by the degrees of convolution of the frontal lobe, measured in squares of sixteen square millimetres, irrespective of the question of relative size, ranked as follows, advancing the female (*d*) from the fourth to the first place, and reducing the male (*c*) from the third to the sixth place:

1	Female	(*d*)	2498
2	Male	(*a*)	2451
3	Male	(*b*)	2309
4	Female	(*f*)	2300
5	Female	(*e*)	2272
6	Male	(*c*)	2117

But, as already indicated, some modern disclosures tend to raise the question whether the difference between the sexes, in so far as relative volume of brain is concerned, has not been increased as a result of civilization. The disparity in size between the Cro-Magnon male and female skeletons is quite as great as that of modern times, but the capacity of the female skull is relatively good.

Other observations, such as those of Professor Rolleston "On the People of the Long Barrow Period," seem to indicate a nearer approximation in actual cranial capacity of the two sexes in prehistoric times than among modern civilized races. On the assumption that intellectual activity tends to permanent development of brain, it is consistent with the conditions of savage life that it should bring the mental energies of both sexes into nearly equal play. They have equally to encounter the struggle for existence, and have their faculties stimulated in a corresponding degree. As nations rise above the purely savage condition of the hunter stage, this relative co-operation of the sexes is subjected to great variations. The laws of Solon with reference to the right of sale of a daughter or sister, and the penalties for the violation of a free woman, show the position of the weaker sex among the Greeks at that early stage to have been a degrading one. But the change was great at a later stage; and much of our higher civilization is traceable to the early establishment of the European woman's rights, which Christianity subsequently tended to enlarge. The position of woman among the ancient Britons appears to have been one of perfect equality with man. Among the Arabians and other Mohammedan nations, including the modern Turks, the opposite is the case; and the whole tendency of the creed of the Koran, and the social life among Mohammedan nations, must be towards the intellectual atrophy of woman. Hence it is consistent with the diverse conditions of life that, in so far as cerebral development is the result of mental activity, a much closer approximation is to be looked for in the mass and weight of brain in the two sexes among savage races, than among nations where woman systematically occupies a condition of servile degradation, or of passive inertness.

Some interesting results of the actual brain-weights of Negroes and other typical representatives of inferior savage races have been published, including examples of both sexes; and although the observations are as yet too few for the deduction of any absolute or very comprehensive conclusions, they furnish a valuable contribution towards this department of ethnical comparison. In 1865, Dr. Peacock published the results of observations on the brains of four Negroes and two Negresses; and to those he subsequently added a seventh example.* Other examples are included in the following table. But I have excluded some extremes of variation, such as the two given by Mascagni, one of which weighed 1458 grammes, or

* "Mem. Anthropol. Soc. Lond.," Vol. I., p. 65.

51·5 oz. av., and the other only 738 grammes, or 26·1 oz. av. In addition to each actual brain-weights, Morton, Tiedemann, Davis, Wyman, and others, have gauged the skulls of Negroes, American Indians, Mincopies, Tasmanians, Australians, and other savage races, as well as those of many civilized and semi-civilized nations, and thereby contributed valuable data towards determining their relative cranial capacity. In his "Crania Ægyptiaca," Dr. Morton, when discussing the traces of a Negro element in the ancient Egyptian population, says: "I have in my possession seventy-nine crania of Negroes born in Africa, for which I am indebted to Drs. Goheen and McDowell, lately attached to the medical department of the colony of Liberia, in western Africa; and especially to Don Jose Rodriguez Cisneros, M.D., of Havana, in the island of Cuba. Of the whole number, fifty-eight are adult, or sixteen years of age and upwards, and give eighty-five cubic inches for the average size of the brain. The largest head measures ninety-nine cubic inches; the smallest but sixty-five. The latter, which is that of a middle-aged woman, is the smallest adult head that has hitherto come under my notice."*

TABLE I.

NEGRO BRAIN-WEIGHT.

	Race.	Authority.	Weight.
M	African, Mozambique	Peacock	43·80
M	"	"	45·80
M	" Buenos Ayres	"	44·00
M	" Congo	"	46·25
M	"	"	42·80
M	"	Sœmmering	45·40
M	"	Tiedemann	35·20
M	" Congo	C. Luigi Calori	44·40
M	"	Barkow	50·80
M	"	"	45·90
M	"	"	38·90
M	"	Sir A. Cooper	49·00
F	Hottentot Venus	Marshall	31·00
F	Bushwoman	"	30·75
F	"	"	31·50
F	"	"	31·00
F	"	Flower & Murie	38·00
F	African	Peacock	46·00
F	"	"	41·00

* "Crania Ægyptiaca," p. 21.

The influence of race on the volume, weight, disposition, and relative proportions of the different subdivisions of the human brain, and so of brain on the character of races, has thus far been very partially tested. But the diversities of race head-forms—brachycephalic, dolichocephalic, platycephalic, acrocephalic, &c.—are now well recognized, though their relation to cerebral development still requires much research for its elucidation. The ancient Roman forehead, as illustrated by classic busts, and confirmed by genuine Roman skulls, was low but broad, and the whole head was platycephalic. The Greek had a high forehead, and the works of the Greek sculptors show that this was regarded as typical. But contemporary with the classic races were the Macrocephali of the Euxine and the Caspian Seas, who, like many modern tribes of the New World, purposely aimed at depressing a naturally receding forehead, and thereby exaggerated the typical forehead characteristic of certain ancient barbaric races.

In the case of hybrids the interchange of physical and mental characteristics of the parents, including modifications of head-form, is a familiar fact. The English head-form appears to be an insular product of intermingled Briton, Teuton and Scandinavian elements, which has no continental analogue; and its sub-divisions, or sub-types, vary with the ethnical intermixture. The Scottish head appears to exceed the English in length, while the latter is higher. Where the Celtic element most predominates, the longer form of head is found; but even in the most Teutonic districts the difference between the prevailing head-form and that of the continental German is so marked that the latter finds it difficult to obtain an English-made hat which will fit his head.* Here the diversities of head-form are accompanied with no less marked differences of individual and national character.

Professor Welcker determined the average capacity of the German male skull as 1450 cubic centimetres, equivalent to 88 cubic inches, and representing an average brain-weight of 49 oz. Dr. Davis, by a similar process, assigns to the Germans, male and female, the larger mean brain-weight of 50·28 oz.; but by combining the means of both sexes, as derived from his own tables and those of Huschke and Wagner, we obtain a mean weight of German brain of 1314 grms., or 46·37 oz. The results of an extensive series of observations by

* *Vide* "Physical Characteristics of the Ancient and Modern Celt." *Canadian Journal*, Vol. VII., p. 369.

Dr. Broca, on the male French skull, yield a mean capacity of 1502 cubic centimetres, or 91 cubic in., representing an average brain-weight of 50·6 oz. Morton, taking his average from five English skulls, gives the great internal capacity of 96 cubic in.; while Dr. J. B. Davis arrives at a capacity of only 90·9 cubic in., from the examination of thirty-two skulls, male and female; and for the Scottish and Irish, each of 91·2 cubic in., from an examination of thirty-five skulls. But unfortunately the Davis collection, so rich in other respects, derived its chief English specimens from a phrenological collection; and, along with a few large skulls, contains "many small and poor English examples."* The average weight of the English brain may therefore, as Dr. Davis admits, be assumed to be higher than the mean determined by him. "Still a comparison with actually tested weights of brains shows that there cannot be any material error." The average brain-weight of twenty-one Englishmen, as given by him, is 50·28 oz., that of thirteen women is 43·13; and of the combined series, 47·50. The results determined by the same process in relation to the other nationalities of Europe are exhibited in detail in Dr. Davis's tables, printed in the "Philosophical Transactions."

Such averages are, at best, only approximations to true results; and when obtained, as in Morton's English race, from a very few examples, or in Dr. Davis's, from exceptional skulls, collected under peculiar circumstances or for a special purpose, they must be tested by other observations. According to Dr. Morton, for example, the mean internal capacity of the English head is 96 cubic in., while that of the Anglo-American is only 90 cubic in. Such a conclusion, if established as the result of comparison of a sufficiently large number of well authenticated skulls, would be of great importance in its bearing on the influence of change of climate, diet, habits, &c., as elements affecting varieties of the human race. But determined as it was in the Morton collection, from five English and seven Anglo-American specimens, it can be regarded as no more than a mere chance result. Ranged nearly in the order of mean internal capacity of skull, the following are the results arrived at, mainly by gauging the skulls in various collections available for such comparisons of different races of mankind. In presenting them here, I avail myself of Dr. Thurnam's researches, augmenting them with other data sub-

* "Thesaurus Craniorum;" App., p. 347.

sequently published, including results deduced from Dr. J. B. Davis's minute reports of his own extensive collections, and taking Tiedemann's capacity of 92·3 for the European skull as 100.

TABLE II.

RATIO OF CUBICAL CAPACITY OF SKULLS OF DIFFERENT RACES.

Race.	Authority.	Capacity.
European	Tiedemann	100·
Asiatic	Davis	94·3
African	"	93·
American	Tiedemann	95·
"	Davis	94·7
"	Morton	87·
Oceanic	Davis	96·9
Chinese	Davis	99·8
Mongol	Morton	94·
"	Tiedemann	93·
Hindoo	Davis	89·4
Malay	Tiedemann	89·
American Indian	Morton	91·
Esquimaux	Davis	98·8
Mexican	Morton	88·5
Peruvian	Wyman	81·2
"	Morton	81·2
Negro	Tiedemann	91·
"	Peacock	88·
Hottentot	Morton	86·
Javan	Davis	94·8
Tasmanian	"	88·
Australian	Morton	88·
"	Davis	87·9

The tables of Dr. Morton and Dr. Davis furnish materials for drawing comparisons between diverse nations of the great European family; but though they are of value as contributions to the required means for ethnical comparison, they fall far short of determining the average cranial capacity of the different nationalities. Whilst, for example, the tabular data in the "Thesaurus Craniorum" show a mean internal capacity of 94 cub. in. for the combined Teutonic family, the Finns yield the higher mean capacity of 96·3 cub. in. Again, Dr. Thurnam found that the results of the weighing of fifty-nine brains of patients at the Friends' Retreat near York, mostly persons of the middle class of society, yielded weights considerably above those which he subsequently obtained from testing those of pauper patients in Wilts and Somerset. But this has to be estimated along with the undoubted ethnical differences which separate the population of Yorkshire from that of Somerset and Wiltshire. An interesting paper in the West Riding Asylum Reports gives the results of the determination of 716 brain-weights, rather more than half being males. The average is 48·149 oz. for the male, and 43·872 for the female brain; whereas the average weights of 267 male brains of a similar class of patients in the Wilts' County Asylum, as given by Dr. Thurnam, is 46·2 oz., and of 213 female brains, 41·0 oz. The results of the observations carried on by Dr. Boyd at St. Marylebone yield, from 680 male English brains, a mean weight of 47·1 oz., and from 744 female brains a mean weight of 42·3 oz.; whereas Dr. Peacock determined, from 183 cases in the Edinburgh Infirmary, the weight of the male Scottish brain to average 49·7, and that of the female brain to average 44·3 oz. Here the results are determined by so numerous a series that they might be accepted as altogether reliable, were it not that in the former case they are based to a large extent on a purely pauper class; whereas the patients of the Royal Infirmary of Edinburgh include respectable mechanics and others from many parts of Scotland, among whom education is common. It is not to be doubted, indeed, that a considerable difference in the form and size of the head, and no doubt also in brain-weight, is to be looked for amongst English, Scotch, Irish, German and French men and women, according to the county or province of which they are natives, and the class of society to which they belong.

The comparative ratio of the cubical capacity of the skull, or the average brain-weight, in so far as either is indicative of ethnical differences among members of the European family of nations, has thus to be determined by numerous examples; or dealt with in detail in reference to the different nationalities. Even in single provinces or counties, social position, and probably education, must be taken into account; so that a series of observations on hospital and pauper patients may be expected to fall below the general average; and fallacious comparisons between European peoples may be based on data, correct enough *per se*, but unjust when placed alongside of a different class of results. The great mass of evidence in reference to brain-weight has thus far been mainly derived, in the case of the sane, from one rank of life. A comparison of the results with those derived from the insane of various classes of society shows less discrepancy than might have been anticipated. But there are certain cases of hydrocephalous and other abnormally enlarged brains which have to be rigorously excluded from any estimate of the size or weight of the brain, either as a race-test or as an index of comparative mental power.

Were it possible to select from among the great intellects of all ages an adequate series of representative men, and ascertain their brain-weights, or even the cubical capacity of their skulls, one important step would be gained towards the determination of the relation between size of brain and power of intellect. But we have little other data than such hints as the busts of Æschylus, Pericles, Socrates, Plato, Aristotle, and other leaders of thought may supply. Malcolm Canmore—Malcolm of the great head, as his name implied,—stands forth with marked individuality from out the shadowy roll of names which figure in early Scottish history. Charlemagne, we should fancy, merited a similar designation. But the portraits of his modern imperial successor, Charles V., show no such loftiness of forehead. Judging from the portraits and busts of Chaucer, Shakespeare, Milton, Cromwell, Napoleon, and Scott, their brains must have considerably exceeded the ordinary size. In the report of the *post mortem* examination of Scott, the physicians state that "the brain was not large." But this, no doubt, means relatively to the internal capacity of the skull in its then diseased condition. The intermastoid arch, as already noted, shows a remarkably exceptional magnitude of 19 inches, whereas the average of fifty-eight ancient and modern European skulls, as given in the "Thesaurus Craniorum," is only 14·60. The portraits of Wordsworth and Byron show an ample forehead; and the popular recognition of the "fair large front" of Milton's typical man as the index of superior intellect is an induction universally accepted. But, on the other hand, examples of intellectual greatness undoubtedly occur with the brain little, if at all, in excess of the average size. On the discovery of Dante's remains at Ravenna in 1865, the skull was pronounced to be ample, and exquisite in form. But its actual cubical capacity and estimated brain-weight fall considerably below those of the heaviest ascertained brain-weights of distinguished men. Again, looking at the casts of the skulls of Robert the Bruce and the poet Burns, the first impression is the comparatively small size of head, and the moderate frontal development in each. Mr. Robert Liston, the eminent surgeon, remarked of the former: "The division of the cranium behind the meatus auditorius is large in proportion to that situated before it. The skull is also remarkably wide and capacious in that part, whereas the forehead is rather depressed." * Other characteristics so markedly indicate the elements of physical rather than intellectual vigour, that Mr. Liston expressly pointed out the analogy to "the heads of carnivorous animals." The Bruce was indeed pre-eminently distinguished for courage and deeds of personal prowess; but it was no less by statesmanlike qualities, calm, resolute perseverance, and wise prudence, that he achieved the independence of his country.

Mr. George Combe, the phrenologist, to whom the original cast of Burns' skull was first submitted, thus states the case in reference to the frontal development of the poet: "An unskilful observer looking at the forehead, might suppose it to be moderate in size; but when the dimensions of the anterior lobe, in both length and breadth, are attended to, the intellectual organs will be recognised to have been large. The anterior lobe projects so much that it gives an appearance of narrowness to the forehead which is not real."† The actual dimensions of the skull are, longitudinal diameter, 8 inches; parietal diameter, 5.95; and horizontal circumference, 22·25.

In the year 1865 the bones of Italy's greatest poet, Dante, were submitted to a minute examination under the direction of commissioners appointed by the Italian Government to verify the discovery; and careful measurements were taken of the skull. Dr. H. C. Barlow, describing it from personal observation, says: "The head was finely formed, and the cranium showed, by its ample and exquisite form, that it had held the brain of no ordinary man. It was the most intellectually developed head that I ever remember to have seen. The occipital region was prominently marked, but the frontal was also amply and broadly expanded, and the anterior part of the frontal bone had a vertical direction in relation to the bones of the face." (*Athenæum*, September 9, 1865). But however intellectually developed and exquisite in form the poet's skull may have appeared, the actual measurements fall short of the amplitude here assigned to it. The dimensions were as follows:—Internal capacity, determined by filling the calvarium with grains of rice, 3·1321 lb. avoird., or a

* "Archæologia Scotica," Vol. II., p. 450.

† "Phrenological Development of Robert Burns," by George Combe, p. 7.

little over 50 oz.; circumference, 52 cent. 5 mill.; occipito-frontal diameter, 31 cent. 7 mill.; transverse diameter, taken between the ears, 31 cent. 8 mill.; height, 14 cent. If the internal capacity is accepted without any correction, it would yield 57 oz., but if allowance be made, as in the actual weighing of the brain, for the abstraction of the dura mater and fluids, of say 8 per cent., this would reduce it to about 52·5, or nearly the same weight as that of the mathematician, Gauss. Professor Welcker deducts from 11·6 to 14 per cent., according to the size of the skull; Dr. J. B. Davis recommends a uniform deduction of 10 per cent. If we apply the latter rule, it will reduce the estimated weight of Dante's brain to 51·3 oz.*

Another interesting example of the skull of an Italian poet is that of Ugo Foscolo, a cast of which was taken on the transfer of his remains to the Church of Santa Croce at Florence. Though only fifty years old at the time of his death, the skull was marked by "the entire ossification of the coronal, sagittal, and lambdoidal sutures, and that atrophy of the outer table, manifested by a depression on each side in the posterior half of each parietal, leaving an elevated ridge in the middle, in the position of the sagittal, which is but rarely observed except in extremely advanced age."† Sir Henry Holland, who knew the poet intimately, describes him as resembling in temperament the painter Fuseli, "passionately eccentric in social life." Full of genius and original thought, as the writings of Foscolo show him to have been, he "was fiery and impulsive, almost to the verge of madness." ‡ He died in England in obscurity and neglect; but a regenerated Italy recalled the memory of her lost poet, and transferred his remains to Santa Croce's consecrated soil. The estimated size of his brain is given as 1426 cub. cent., equivalent to 87 cub. in. internal capacity, which corresponds to a weight of brain

* The use of different standards of weights and measures, and of diverse materials for determining the capacity of the skull in different countries, greatly complicates the researches of the craniologist. Some pains have been taken here to bring the various weights and measurements to a common standard. In attempting to do so in reference to the weight of brain of Italy's great poet, the following process was adopted: It was ascertained by experiment that 912·5 grs. of rice, well shaken down, occupied the space of 1000 grs. of water. Hence 3·1321 lbs. rice=3·4324 water. Multiplying this by 1·04, the s.g. of brain, the result is the capacity of the skull, viz., 3·5697 lbs., or 57 oz., as given above. In this and other investigations embodied in the present paper, I have been indebted to the valuable co-operation of my friend and colleague, Prof. H. H. Croft.

† Dr. J. B. Davis, Supp. "Thesaurus Craniorum," p. 7.

‡ Sir H. Holland's "Recollections of Past Life," p. 254.

of 48·44 oz. The longitudinal diameter is 6·90; the parietal diameter 5·70; the intermastoid arch 15·0; and the horizontal circumference 520 m.m., or 20·5 in. The brain capacity of the poet was thus little more than the European mean deduced by Morton from the miscellaneous examples in his collection.

Dr. J. C. Gustav Lucae, in his "Zur Organischen Formenlehre," furnishes views and measurements of two other skulls of men of known intellectual capacity. One of these is Johan Jacob Wilhelm Heinse, the author of "Ardinghello," a work of high character in the elements of æsthetic criticism, though as a romance fit to rank with "Don Juan" in subjective significance and morality. He wrote another romance entitled "Hildegard;" in addition to numerous articles and translations of Petronius, Tasso, &c., which won for him the high commendation of Goethe, and the more guarded admiration of Wieland. His skull, as figured by Dr. Lucae, shows the frontal suture still open at the age of 53, at which he died. The internal capacity of the skull is stated as 41·4 oz., equivalent to 1173 grms., In this, as in other examples hereafter referred to, Dr. Lucae has gauged the capacity of the skull with peas, and gives the weight in "unzen." In the results deduced from them here the *unzen* are assumed to be Prussian ounces, the lb. of 12 oz. equal to 350·78348 grms. Professor Croft has made a series of experiments for me with a view to correct the error necessarily resulting from the fact that peas do not entirely fill the cavity. The results show that 82·5 grms. of ordinary sized peas occupy the space of 100 grms. of water. Deducting 10 per cent. for membranes and fluids, the estimated brain-weight of Heinse is 1379 grms. or 48·7 oz. av. The dimensions of the skull are given thus:

	HEIGHT.	LENGTH.	BREADTH.
Fore part........................	4·9	4.0	4·10
Middle part......................	4·10	3·11	5·3
Hind part........................	3·9	3·6	4·1

The other example produced by Dr. Lucae is that of Dr. Christian Heinrich Bünger, Professor of Anatomy in the University of

Marburg. In this skull the frontal suture is still more strongly defined at the age of 60 than in that of Heinse. The internal capacity of the skull is stated as 42·8 oz., equivalent to 1213 grms., which, dealt with as above stated, yields 1410 grms. or 49·8 oz. av. Other dimensions of the skull are given as follows:

	Height.	Length.	Breadth.
Fore part	4·8	4·1	4·20
Middle part	4·9	4·1	5·0
Hind part	3·7	3.10	4·1

Professor Welcker assigns a standard, which was accepted by Dr. Thurnam, thus: "Skulls of more than 540 to 550 millemetres in horizontal circumference (the weight of brain belonging to which is 1490 to 1560 grms., or 52·5–55 oz. avoirdupois), are to be regarded as exceptionally large. The designation of *kephalones*, proposed by Virchow, might commence from this point. Men with great mental endowments fall, for the most part, under the definition of kephalony. If we consider the relations of capacity, 1800 grms. (63·5 oz.) appears to be the greatest attainable weight of brain within a skull not pathologically enlarged." But the brain of Cuvier—the heaviest healthy brain yet recorded,—exceeded this. Its weight is stated by Wagner as 1861 grammes, or 65·8 oz.; but this M. Broca corrects to 1829·96 grammes. Even thus reduced it exceeds the limits assigned by Professor Welcker to the normal healthy brain. But a curious commentary upon this is furnished by the fact that the modern English skull which Dr. J. B. Davis selects as presenting the most striking analogy to the Neanderthal skull—"the most ape-like skull which Professor Huxley had ever beheld,"—though marked not only by the prominence of the superciliary ridges, but by great depression of the frontal region, appears to have a cubical capacity equivalent to that of Dr. Abercrombie, whose brain is only surpassed by that of Cuvier among the ascertained brain-weights of distinguished men.* Its capacity is 94 oz. of sand, or 113 cubic inches,

* "Memoirs of Anthrop. Soc., Lond.," Vol. I., p. 289. "Thesaurus Craniorum," p. 49.

equivalent—after making the requisite deduction for membranes and fluids,—to a brain-weight of 63 oz.

I have attempted in the following table to reduce to some common standard such imperfect glimpses as are recoverable of the cranial capacity of some distinguished men, of whose actual brain-weights no record exists :

TABLE III.

CRANIAL CAPACITY OF DISTINGUISHED MEN.

	LENGTH.	BREADTH.	CIRCUMFERENCE	ESTIMATED BRAIN-WEIGHT.
Dante.............	....	....	....	51·3
Robert the Bruce....	7·70	6·25	22·25	....
Burns..............	8·00	5·95	22·25	....
Scott (head)........	9·	6·40	23·10	....
Heinse.............	....	5·30	....	48·7
Bunger............	....	5·00	....	49·8
Ugo Foscolo........	6·90	5·70	20·50	48·4

Some of the examples adduced in the above table appear to exhibit instances of mental endowment of high character, without the corresponding degree of cranial, and consequently cerebral development. The following table exhibits recorded examples of a series of actual brain-weights of distinguished men. It seems to lend confirmation to the idea that great manifestation of mental endowment is correlated, in the majority of observed cases, to a brain above the normal average in mass or weight. But even here intellect and brain-weight are not strictly in uniform ratio. Several of the following brain-weights, including that of Tiedemann, are furnished by Wagner, in the "Vorstudien des Menschlichen Gehirns;" but in an elaborate table of brain-weights given in the "Morphologie und physiologie des Menschlichen gehirns als Seelenorgan," the brain of Byron is classed above all except Cuvier; while Vogt gives the same place, by estimate, to Schiller's, as next in rank to that of the great naturalist among highly developed brains. Dr. Thurnam states his authorities for others, when producing them in his valuable contribution to the *Journal of Mental Science* "On the Weight of the Brain." For that of Webster he refers to "the unsatisfactory article on the brain of Daniel Webster, *Edin. Med. Surg. Journ.*, vol. lxxix., p. 355." Dr. J. C. Nott, in his "Comparative Anatomy of Races" ("Types of Mankind," p. 453), says: "Dr. Wyman, in his post-mortem examination of the famed Daniel Webster, found the internal capacity of the cranium to be 122 cubic inches, and in a private letter to me, he says: 'The circumference was measured outside of the integuments before the scalp was removed, and may, perhaps, as there was much emaciation, be a little less than in health.' It was 23¾ inches in circumference; and the Doctor states that it is well-known there are several heads in Boston larger than Webster's. I have myself, in the last few weeks, measured half a dozen heads as large and larger." The circumference, it will be seen, exceeds the corresponding measurement of Scott's head, taken under similar circumstances. But the statement of 122 cubic inches as the internal capacity of Webster's skull seems open to question. If correct, instead of 53·5 oz. of brain-weight, as stated in the following table, it is the equivalent of a brain-weight of fully 65 oz., or one in excess even of that of Cuvier. The brain-weights of Goodsir, Simpson and Agassiz, are given in the following table from the reported autopsy in each case.

TABLE IV.

BRAIN-WEIGHTS OF DISTINGUISHED MEN.

			AGE.	OZ.	GRMS.
1	Cuvier	Naturalist	63	64·5	1830
2	Byron	Poet	36	63·5 ?	1799
3	Abercrombie	Philosopher, Physician	64	63·	1785
4	Schiller	Poet	46	63· ?	1785
5	Goodsir	Anatomist	53	57·55	1629
6	Spurzheim	Phrenologist, Physician	56	55·06	1559
7	Simpson	Physician, Archæologist	59	54·	1530
8	Dirichlet	Mathematician	54	53·6	1520
9	De Morny	Statesman	50	53·6	1520
10	Daniel Webster	Statesman	70	53·5	1516
11	Campbell	Lord Chancellor	80	53·5	1516
12	Agassiz	Naturalist	66	53·4	1512
13	Chalmers	Author, Preacher	67	53·	1502
14	Fuchs	Pathologist	52	52·9	1499
15	Gauss	Mathematician	78	52·6	1492
16	Dupuytren	Surgeon	58	50·7	1436
17	Whewell	Philosopher	71	49·	1390
18	Hermann	Philologist	51	47·9	1358
19	Tiedemann	Physiologist	80	44·2	1254
20	Hausmann	Mineralogist	77	43·2	1226

Dr. Thurnam, in producing fifteen of the above examples, remarks: "Altogether, they decidedly confirm the generally received view of the connection between size of brain and mental power and intelligence:" and he adds his conviction that if the examination of the brain in the upper ranks of society, and in men whose mental endowments are well known, were more generally available, further confirmation would be given to this conclusion. The converse, at least, is certain, that no great intelligence or unwonted mental power is possible with a brain much below the average in mass and weight. But there are unquestionable indications that a large, healthy brain may exist without the manifestation of great mental power; while brains inferior both in size and weight have been the organs of unwonted intelligence and mental activity.

In the "Philosophical Transactions" of 1861, Dr. Boyd published an elaborate series of researches illustrative of the weight of various organs of the human body, including the weights of 2,000 brains. Most of the healthy brains are those of patients in the St. Marylebone Infirmary, and have already been referred to as necessarily representing the indigent and uneducated classes of London. Here, therefore, if an unusually large brain is the index of intellectual power, every probability was against the occurrence of brains above the average size or weight. But the results by no means confirm this assumption. Among the patients in the Edinburgh Royal Infirmary, in like manner, though including the better class of artizans and others from country districts, we might still look for a confirmation of M. Broca's assumption, based on extensive observations of French crania, "that, other things being equal, whether as the result of education, or by hereditary transmission, the volume of the skull, and consequently of the brain, is greater in the higher than in the lower classes." But Dr. Peacock's tables include four brain-weights, three of them of a sailor, a printer, and a tailor, respectively, ranging from 61 to 62·75 oz.; and so surpassing all but two, or at the most three, of the heaviest ascertained brain-weights of distinguished men. Tried by the posthumous test of internal capacity, three skulls of nameless Frenchmen, derived from the common cemeteries of Paris, in like manner showed brains equalling in size that of Cuvier. The following are the maximum brain-weights among the St. Marylebone patients apparently unaffected by cerebral disease.

TABLE V.

MAXIMUM BRAIN-WEIGHTS—ST. MARYLEBONE.

Age.	Male.		Female.	
	Oz	Grms.	Oz.	Grms
7—14	57·25	1622	52·	1473
14—20	58·5	1658	52·	1473
20—30	57·	1615	55·25	1565
30—40	60·75	1721	53·	1502
40—50	60·	1700	52·5	1488
50—60	59·	1672	52·5	1488
60—70	59·5	1686	54·	1530
70—80	55·25	1565	49·5	1403
80—	53·75	1523	48·	1360
All Ages. 7—80	60·75	1721	55·25	1565

The stature, or relative size of body, has already been referred to as an element in testing the comparative male and female weight of brain; and it is one which ought not to be overlooked in estimating the comparative size and weight of the brains of distinguished men. From my own recollections of Dr. Chalmers, who was of moderate stature, his head appeared proportionally large. The same was noticeable in the cases of Lord Jeffrey, Lord Macaulay, Sir James Y. Simpson, and very markedly so in that of De Quincey. The philosopher Kant was also of small stature; and Dr. Thurnam refers to the observation of Carus that he had a head not absolutely large, though, in proportion to the small and puny body of that eminent thinker, it was of remarkable size. Among the large-brained artizans of the Marylebone Infirmary, on the contrary, the probabilities are in favour of a majority of them being men of full muscular development and ample stature. Nevertheless, with every allowance for this, it still remains probable, if not demonstrable, that from the same humble and unnoted class, examples of megalocephaly could be selected little short in cerebral mass, and apparently in brain-weight, of the group of men whose large brains are recognized as the concomitants of exceptionally great mental capacity and intellectual vigour. Unless, therefore, we are contented to accept the poet's dictum, "Their lot forbad,"* and assume that "chill penury repressed their noble rage, and

* Gray's "Elegy."

froze the genial current of the soul," it is manifest that other elements besides those of volume or weight are essential as cerebral indices of mental power. Dr. Thurnam, after noting examples that had come under his own notice of brain-weights above the medium—but which, as those of insane patients, may be assigned to other causes than healthy cerebral development,—adds: "The heaviest brain weighed by me (62 oz., or 1760 grms.) was that of an uneducated butcher, who was just able to read, and who died suddenly of epilepsy, combined with mania, after about a year's illness. The head was large, but well-formed; the brain of normal consistence; the *puncta vasculosa* numerous." In cases like this, of weighty brain with no corresponding manifestation of intellectual power, something else was wanting besides a less circumscribed sphere. The mere position of a humble artizan or labourer will not suffice to mar the capacity to "make by force his merit known," which pertains to the "divinely gifted man."

Arkwright, Franklin, Watt, Stephenson, and others of the like type of self-made men, are not rare. Among those large-brained artizans, scarcely one can have had a more limited sphere for the exercise of mental vigour than the poet Burns, the child of poverty and toil, who refers to his own early years as passed in "the unceasing moil of a galley-slave." In his case the very means essential to a healthy physical development were stinted at the most critical period of life. His brother Gilbert says: "We lived sparingly. For several years butcher's meat was a stranger to the house; while all exerted themselves to the utmost of their strength, and rather beyond it, in the labours of the farm. My brother, at the age of thirteen, assisted in thrashing the crop of corn, and at fifteen was the principal labourer on the farm." Such premature toil and privations left their permanent stamp on his frame. "Externally, the consequences appeared in a stoop of the shoulders, which never left him; but internally, in the more serious form of mental depression, attended by a nervous disorder which affected the movements of the heart." He had only exchanged the toil on his father's farm for equally unremitting labour on his own, when the finest of his poems were written; nor would it be inconsistent with all the facts to assume that the privations of his early life diminished his capacity for continuous mental activity; as it undoubtedly impaired his physical constitution. But, while the possession of a brain much above the average in size might have seemed to account for his triumph over the depressing influences of his limited sphere, the fact that his brain appears to have been rather below than above the average size, points to some other requisite than mere cerebral mass as essential to intellectual vigour.

The brain is influenced in all its functions by the character and the amount of blood circulating through it, and promptly manifests the effects of any deleterious substance, such as alcohol or opium, introduced into its tissues. It depends, like other portions of the nervous system, on an adequate supply of nourishment. In both respects the brain of the Ayrshire poet was injuriously affected, in so far as we may infer from all the known circumstances of his life.

The human brain is large in proportion to the body in infancy and youth; and the opinions of leading anatomists and physiologists early in the present century favoured the idea that it attained its full size within a few years after birth. Professor Soemmering assumed this to take place so early as the third year. Sir William Hamilton explicitly stated his conclusion thus: "In man the encephalon reaches its full size about seven years of age;" and Tiedemann assigns the eighth year as that in which it attains its greatest development. But the more accurate and extended observations since carried on rather tend to the conclusion that the brain not only goes on increasing in size and weight to a much later period of life, but that, under exceptionally favouring circumstances, it may increase in weight long after the body has attained its maximum.

The largest average brain-weights, as determined by observations on the brains of upwards of two thousand men and women in different countries of Europe, have indeed been found in those not above twenty years of age; and from a nearly equal number of English examples, Dr. Boyd determines the period of greatest average weight to be the interval between fourteen and twenty years of age; but this includes cases in which death has ensued from undue or premature brain development.

Other evidence leaves no room for doubt that cases are not rare of the growth, or increased density of the brain up to middle age; while the observations of Professor Welcker indicate this process extended to a later period of life. The average brain-weights, as given by Boyd, Peacock, and Broca, from healthy or sane cases, along with those of Welcker, include the weights of forty-seven male brains from ten to twenty years of age, giving an average of

49·6 oz., or 1405 grms.; and of one hundred and twelve male brains from twenty to thirty years of age, giving an average of 48·9 oz., or 1384 grms.; and the results of a nearly equal number of female brains closely approximate. They embrace English, Scotch, German, and French, men and women. Dr. Welcker's results indicate the period of maximum brain-weight to be between 30-40, as shewn in the following table:

TABLE VI.

AVERAGE WEIGHT OF THE BRAIN AT DIFFERENT AGES.

	Male.		Female	
	Oz. Av.	Grms.	Oz Av.	Grms
From 10—20	47·5	1346	43·1	1221
20—30	49·5	1404	44·1	1251
30—40	49·5	1404	44-8	1272
40—50	48·6	1379	43 5	1234
50—60	48·1	1365	43·5	1234
60—70	46·1	1306	42·8	1213

In the female examples, amounting to thirty-one between seventy and eighty years of age, and six between eighty and ninety, the continuous diminution of brain-weight corresponds with the increasing age; but in the male examples, sixty-five cases between sixty and seventy years of age yield an average brain-weight of 46·1 oz., while twenty-seven cases between seventy and eighty years of age give 47·9 as the average; falling in the next decade to 43·8.

It may be inferred from the number of cases pointing to an early attainment of the highest average brain-weight, not that the brain differs from all other internal organs of the human body in attaining its maximum before the period of puberty, but that physical as well as mental vigour are dependent on the maintenance of a nice equilibrium between the brain and the other organs while in process of development. The observations of Dr. Boyd, including the results of 2,614 *post mortem* examinations of sane and insane patients of all ages, showed that the average weight of the brain of "still-born" children at the full period was much greater than that of the new-born living child. It is a legitimate inference, therefore, that death in the former cases was traceable to an excessive premature development of the brain. Again, when it is shown from numerous cases that the highest average weights of brain in both sexes occur not later than twenty years of age, it appears a more legitimate inference to trace to exceptional cerebral development towards the period of adolescence, the mortality which rendered available so many examples of unusually large or heavy brains, than to assume that the normal healthy brain begins to diminish at that age.

It is a fact familiar to popular observation that a large head in youth is apt to be unfavourable to life. A tendency to epilepsy appears to be the frequent concomitant of an unusually large brain; and with the congestion accompanying its abnormal condition, this may account for the weights of such diseased brains as have been repeatedly found in excess of nearly all the recorded examples of megalocephaly in the cases of distinguished men. But a greater interest attaches to a remarkable example of healthy megalocephaly recorded in the *British Medical Journal* for 1872. The case was that of a boy thirteen years of age, who died in Middlesex Hospital from injuries caused by a fall from an omnibus. His brain was found to weigh 58 oz. He had been a particularly healthy lad, without any evidence of rachitis, and very intelligent. This is a strikingly exceptional case of a healthy brain, at the age of thirteen, exceeding in weight all but two of the greatest ascertained brain-weights of distinguished men.

From the evidence already adduced of relative cubical capacity of the skulls of different races, it appears, as was to be expected, that there is a greater prevalence of the amply-developed brain among the higher and more civilized races. But all averages are apt to be deceptive; and the progressive scale from the smallest up to the greatest mass of brain is by no means in the precise ratio of an intellectual scale of progression. The results of Dr. J. B. Davis's investigations, based on the study of a large, and in many cases a seemingly adequate number of skulls, bring out this remarkable fact, that, so far from the Polynesians occupying a rank in the lowest scale, as affirmed by Professor Vogt, the Oceanic races of the Pacific generally rank in internal capacity of skull, and consequent size of brain, next to the European.

But it is of more importance for our present enquiry to note that, as exceptionally large and heavy brains occur among the most civilized races, in some cases—and in some only,—accompanied with corresponding manifestations of unusual intellectual power: so also it becomes apparent that skulls much exceeding the average, and some of remarkable internal capacity, are met with among barbarian races, and even among some of the lowest savages. Taking the crania in the elaborate series of tables in Dr. J. B. Davis's "Thesaurus Craniorum," with an internal capacity above 100 cubic inches, they will rank in order as follows:

Chinese	111·8
Maduran	110.6
Marquesan	110.6
Kanaka	108·8
Javan	107·
Negro	105·8
Australian	104·5
Kafir	104·5
Bakele	103·3
Tidorese	103·3
Bhotia	102·7
Bodo	100·9
Hindoo	100·9
Sumatran	100·9

Among the European series the largest is an Irish cranium of 121·6 cubic in., and next to it comes an Italian, 114·3, and an Englishman, 112·4; an ancient Briton from a Yorkshire Long Barrow, 109·4: an ancient Roman, 106·4; a Lapp, 105·8; an ancient Gaul, 103·7; a Briton of Roman times, 103·3; a Merovingian Frank, 101·5; and an Anglo-Saxon, 100·9. Those and other examples of the like kind are full of interest as showing the recurrence of megalocephalic variations from the common cranial and cerebral standard among ancient races; and among rudest savages as well as among the most cultivated classes of modern civilized nations. But the order shown in the above instances is derived from purely exceptional examples, and is no key to the relative capacity of the races named.

Opportunities for testing the size and weight of the brain among barbarous races are only rarely accessible to those who are qualified to avail themselves of them for the purposes of science. Some near approximation to the relative brain-weight of the English, Scotch, German, and French, may now be assumed to have been established. Dr. Thurnam instituted a comparison between those and two of the prehistoric races of Britain—the Dolichocephali of the Long Barrows, and the Brachycephali of the Round Barrows of England.* The results are curious, as showing not only a greater capacity in the ancient British skulls than the average modern German, French, or English head; but an actual average higher than that of all but five of the most distinguished men of Europe, whose brain-weights have been recorded. On comparing the ancient skulls with those of modern Europeans, as determined by gauging the capacity of both by the same process, the following are the results presented, according to the authorities named:

TABLE VII.

Skulls of Men.	No.	Weight of Sand.	Cubic Inches	Capacity Centimetres.	Brain-weight oz av.
Ancient Britons, L. Barrows ..	18	82	99	1622	54.
" " R. Barrows..	18	80½	98	1605	53.5
Modern English, *Morton*	28	77	94	1540	52.2
" French, *Broca*	357	74	91	1502	50.6
" German, *Welcker*	30	72	88	1450	49.

The highest average of any nationality, as determined by Drs. Reid and Peacock from the weighing of 157 brains of male patients, chiefly Scottish Lowlanders, in the Royal Infirmary of Edinburgh, is little more than 50 oz., or 1417 grammes; whereas the estimated average brain-weight in the ancient British skulls is 54 oz. for the Dolichocephali of the Long Barrows, which equals that of Sir James Simpson, and exceeds all but six of the most distinguished men. For the Brachycephali of the Round Barrows it is 53·5 oz., which is in excess of the brain-weights of Agassiz, Chalmers, Whewell, and other distinguished men, and exactly accords with that of Daniel Webster and Lord Chancellor Campbell. In so far, moreover, as this illustrates the cerebral capacity of ancient races, it is in each case an average obtained by gauging eighteen skulls, and not the cranial capacity of one or two exceptionally large ones. Dr. Thurnam does indeed suggest that the Barrows may have been the sepulchres of chiefs; nor is this unlikely; but the superior vigour and mental endowment which this implies fails to account for a cerebra capacity surpassing all but the most distinguished men of science a letters in modern Europe. Rather may we conclude from this

* "Mem. Anthropol. Soc., Lond.," Vol. I., p. 465.

from other evidence, that quality of brain may, within certain limits, be of more significance than mere quantity; and that brains of the same volume, and agreeing in weight, may greatly differ in minute structure and in powers of cerebration.

In the case of the ancient British Barrow Builders we seem to have large heads and remarkable development of brain, without any indications of an equivalent in intellectual power; and although the estimated brain-weight derived from gauging the capacity of the empty chamber of the skull proceeds on the assumption of mass and weight agreeing, sufficient data exist to justify the adoption of this for approximate results. The average weight of brain of twelve male Negroes of undetermined tribes, deduced from gauging their skulls, has been determined at 1255 grammes, or 44·3 oz. The actual weight of brain of the Negro of Guinea described by Professor Calori, was 1260 grammes; and other examples vary considerably from the average. Mascagni gives 1458 grammes as the weight of one Negro brain weighed by him; equivalent to an actual brain-weight of 51·5 oz., which is greater than that of Dupuytren, Whewell, Hermann, or Tiedemann. Nevertheless, although the extremes are great, and are confirmed by a like diversity in measurements of the horizontal circumference and of internal capacity, the average result given above appears to be a fair and reliable one. But the same process, when applied to determine the comparative cranial capacities of the native American races, discloses results of a wholly different character, and widely at variance with those above described relating to the ancient races of Britain. On the continent of America the native ethnical scale embraces a comparatively narrow range; and any intrusive elements are sufficiently recent to be easily eliminated. The Patagonian and the Fuegian rank alongside of the Bushman, the Andaman Islander, or the Australian, as among the lowest types of humanity; while the Aztecs, Mayas, Quichuas, and Aymaras, attained to the highest scale which has been reached independently by any native American race. We owe to the zealous and indefatigable labours of Dr. Morton, alike in the formation of his great collection of human crania, and in the published results embodied in he "Crania Americana," the chief knowledge derived from this class evidence in reference to the races of the New World. In one ect, at least, those results stand out in striking contrast to the headed barbarian Barrow Builders of ancient Britain. Dr.

Morton subdivides the American races into the Toltecan Race, embracing the semi-civilized communities of Mexico, Bogota, and Peru, and the barbarous tribes scattered over the continent from the Arctic Circle to Tierra del Fuego. His latest views are embodied in a contribution to Schoolcraft's "History of the Indian Tribes of the United States," entitled "The Physical Type of the American Indians." In treating of the volume of brain, he draws special attention to the Peruvian skulls, 201 in number, obtained for him from the cemeteries of Pisco, Pachacamac, and Arica. "Herera informs us that Pachacamac was sacred to priests, nobles, and other persons of distinction; and there is ample evidence that Arica and Pisco, though free to all classes, were among the most favoured cemeteries of Peru." Dr. Morton accordingly adds: "It is of some importance to the present inquiry, that nearly one-half of this series of Peruvian crania was obtained at Pachacamac; whence the inference that they belonged to the most intellectual and cultivated portion of the Peruvian nation; for in Peru learning of every kind was an exclusive privilege of the ruling caste." In reality, however, the latest additions to our knowledge of the physical characteristics of the ancient Peruvians tend to confirm the idea of the existence of two distinct races: a patrician order occupying a position analogous to the Franks of Gaul or the Normans of England, though more aptly to be compared to the Brahmins of India; and a more numerous class, constituting the labouring and industrial orders of the community, abundantly represented in the Pacific Coast tribes of Peru, the cemeteries of which have furnished the larger number of crania to European and American collections.

To such a patrician order or cast the intellectual superiority and privileges of the governing race pertained. But whatever may have been the exclusive prerogatives of the patrician and sacerdotal orders, there is no doubt that the Peruvians as a people had carried metallurgy to as high a development as has been attained by any race ignorant of working in iron. They had acquired great skill in the arts of the goldsmith, the engraver, chaser, and modeller. Pottery was fashioned into many artistic and fanciful forms, showing ingenuity and great versatility of fancy. They excelled as engineers, architects, sculptors, weavers, and agriculturists. Their public works display great skill, combined with comprehensive aims of practical utility; and alone, among all the nations of the New World, they had domesticated animals, and trained them as beasts of burden. It is not, therefore, without reason that Dr. Morton adds: "When we consider the institutions of the old Peruvians, their comparatively advanced civilization, their tombs and temples, mountain roads and monolithic gateways, together with their knowledge of certain ornamental arts, it is surprising to find that they possessed a brain no larger than the Hottentot and New Hollander, and far below that of the barbarous hordes of their own race. For, on measuring 155 crania, nearly all derived from the sepulchres just mentioned, they give but 75 cubic inches [equivalent, after due deduction for membranes and fluids, to a brain of 40·1 oz. av. in weight,] for the average bulk of the brain. Of the whole number, only one attains the capacity of 101 cubic inches, and the minimum sinks to 58, the smallest in the whole series of 641 measured crania. It is important further to remark that the sexes are nearly equally represented, viz., eighty men and seventy-five women."

Other collections subsequently formed have largely added to our means of testing the curious question thus raised of the apparent inverse ratio of volume of brain to intellectual power and progressive civilization among the native races of the American continent. In 1866, Mr. E. G. Squier presented to the Peabody Museum of American Archæology and Ethnology at Harvard, a collection of seventy-five Peruvian skulls, obtained by himself from various localities both on the coast and in the interior. "The skulls from the interior represent the Aymara on Lake Titicaca, as well as the Quichua, Cuzco, or Inca families; and the skulls of every coast family from Tumbes to Atacama, or from Ecuador to Chili."* Subsequently the curator, the late Professor Jeffreys Wyman, made this collection, along with two others, of skulls from the mounds of Kentucky and Florida, the subject of careful comparative measurements. The following are the results: The crania from Florida were chiefly obtained from a burial place near an ancient Indian shell mound of gigantic proportions, a few miles distant from Cedar Keys. They are eighteen in number, and have a mean capacity of 1375·7 cubic centimetres, or nearly 84 cubic inches. The skulls from the Kentucky mounds, twenty-four in number, show a mean capacity of 1313 cubic centimetres, 80·21 cubic inches, with a difference of 125 cubic centimetres, or 7·61 cubic inches in favour of the males. Yet, small as the Kentucky skulls

* "Peabody Museum Annual Report, 1868," p. 7.

are, they exceed the Peruvian ones. Keeping in view the varied sources of the latter, Professor Wyman remarks: "Although the crania from the several localities show some differences as regards capacity, yet in most other respects they are alike." And the numbers, when viewed separately, are too few to attach much importance to variations within so narrow a range. Nevertheless it is noteworthy that the highest mean is that of the Aymaras of Lake Titicaca; and this difference is considerably increased by measurements derived from subsequent additions to the Harvard collection, received since the death of Professor Wyman from the high valley of Lake Titicaca. In other respects besides their marked superiority in size, the latter crania differ from those of the Coast tribes, and confirm the earlier deduction of an ethnical distinction berween the more numerous race so abundantly represented in the coast cemeteries, and that which is chiefly represented by crania brought from the interior. The numbers from the several localities selected by Professor Wyman as fair average specimens of the whole stand thus: six from burial towers, or chulpas, near Lake Titicaca, 1292; five from Cajamaquilla, 1268·75; fourteen from Casma, 1254; four from Truxillo, 1236; four from Pachicamac, 1195; sixteen from Amacavilca, 1176·2; and seven from Grand Chimu, 1094·28.

In 1872, the collection of Peruvian crania in the Peabody Museum was augmented by a large addition from 330 skulls obtained by Professor Agassiz, through the intervention of Mr. T. J. Hutchinson, British Consul at Callao, in Peru. From those contributed to the Harvard Museum, Dr. Wyman selected eleven as apparently the only ones unaffected by any artificial compression or distortion, and therefore valuable as illustrations of the normal shape of the Peruvian head. They are quite symmetrical. The occiput, instead of being flattened or vertical, as in the distorted crania, has the ordinary curves, and in some of them is prominent. Two of them are marked by a low, retreating forehead; but in all the others the forehead is moderately developed. As, moreover, the larger half appear to be the skulls of females, this accounts for the mean capacity falling below the Peruvian average. But they are all small. The largest of them is only 1260 cub. cent., or less than 74 cub. in.; and the average capacity of ten of them is 1129 cub. cent., or 69 cub. in.

The collection, as a whole, differs from that of Mr. Squier, in having been derived from the huacas, or ancient graves of one locality, that of Ancon, near Callao. Professor Wyman stated as the result of his careful study of them: "The average capacity obtained from the whole collection, including those having the distorted as well as the natural shape, varies but little from that of previous measurements," including those of Morton and Meigs, and his own results from the Squier collection.

Another collection of one hundred and fifty ancient skulls, obtained by Mr. Hutchinson during his residence in Peru, and presented to the Anthropological Institute of London, has the additional value, like that of Mr. Squier, of having been carefully selected from different localities, including Santos, Ica, Ancon, Passamayo, and Cerro del Oro; and the same may be said of those enumerated in the "Thesaurus Craniorum" of Dr. J. B. Davis. We have thus unusually ample materials for determining the cranial characteristics of this remarkable people, and the results in every case are the same. After a careful examination of the Peruvian skulls, in the London anthropological collection, Professor Busk states his conclusions thus: "The mean capacity of the larger skulls, which may be regarded as males, appears, as far as I have gone, to be about 80 cubic inches, equivalent to a brain of about 45 ounces, roughly estimated. This capacity, and the measurements above cited, show that the crania generally are of small size;" and he adds: "this is in accord with the statements of all observers." *

Dr. J. B. Davis has added to the valuable data included in his "Thesaurus Craniorum," a series of measurements of skeletons. Unfortunately that of a male Quichua, procured by him in the form of a "Peruvian mummy," proved to be affected with carious disease about the last dorsal and upper lumbar vertebræ; and consequently the length of the vertebral column essential for comparison with the skeletons of other races, is wanting; but the other measurements indicate in this example a stature below the average, while the skull exceeds it. The average internal capacity of eighteen Quichua male skulls, as given by Dr. J. B. Davis, is 73, whereas this is 78·5. That the ancient Peruvian skulls are, with rare exceptions, of small size, is undoubted; and in view of this it becomes a matter of some importance to determine whether this was in any degree due to a correspondingly small stature. Obscure references

* "Journal of Anthropol. Inst.," Vol. III., p. 92.

are found in the legendary history of Peru to a pigmy race. Pedro de Cieza de Leon, whose travels have been translated by Mr. Markham, refers to the first emigration of the Indians of Chincha to that valley, "where they found many inhabitants, but all of such small stature, that the tallest was barely two cubits high" (p. 260). Garcilasso de la Vega repeats another tradition heard by himself in Peru, of a race of giants who came by sea to the country, and were so tall that the natives reached no higher than their knees. They lived by rapine, and wasted the whole country till they were destroyed by fire from heaven. Traditions of this class may possibly point to the existence of an aboriginal race of small stature. The aborigines of Guatemala, Salvador, and Nicaragua, are described as below the middle size (Bancroft, Vol. I., p. 688); and Von Tchudi divides the wild Indians of Peru into the Iscuchanos, the natives of the highlands, a tall, slim, vigorous race, with the head proportionally large and the forehead low; and those of the hot lowlands, a smaller race, lank, but broad shouldered, with a broad face and small round chin. There appear, therefore, to be traces of one or more aboriginal races of small stature. But Dr. Morton says expressly of the Peruvians: "Our knowledge of their physical appearance is derived solely from their tombs. In stature they appear not to have been in any respect remarkable, nor to have differed from the cognate nations except in the conformation of the head, which is small, greatly elongated, narrow its whole length, with a very retreating forehead, and possessing more symmetry than is usual in skulls of the American race." Some of the characteristics here referred to are, in part at least, the result of artificial modifications; but the small head appears to be an indisputable characteristic of the most numerous ancient people of Peru.

It may not unreasonably excite surprise that Dr. Morton should have adduced results apparently pointing to the conclusion that civilization had progressed among the native races of the American continent in an inverse ratio to the volume of brain; and yet passed it over with such slight comment. The only hint at a solution of the difficulty is where, as he draws his work to a close, he indicates the recognition of a greater anterior and coronal development in the smaller Peruvian brain. "It is curious," he says, "to observe that the barbarous nations possess a larger brain by five and a half cubic inches, than the Toltecans; while, on the other hand, the Toltecans possess a greater relative capacity of the anterior chamber of the skull in the proportion of 42·3 to 41·8. Again, the coronal region, though absolutely greater in the barbarous tribes, is rather larger in proportion in the demi-civilized tribes."* But Dr. Morton also noted that the heads of nine Peruvian children in his possession "appear to be nearly if not quite as large as those of children of other nations at the same age;"† so that he seemed to recognize something equivalent to an arrested cerebral development accompanying the intellectual activity of this remarkable people at some later stage, yet without apparently affecting their mental power. But it was characteristic of this minute and painstaking observer to accumulate and set forth his results, unaffected by any apparent difficulties or inconsistencies which they might seem to involve. In summing up his investigations "On the internal capacity of the cranium in the different races of men," he thus concludes:‡ "Respecting the American race, I have nothing to add, excepting the striking fact that of all the American nations, the Peruvians had the smallest heads, while those of the Mexicans were something larger, and those of the barbarous tribes the largest of all," viz.:

Toltecan Nations	Peruvians, collectively...	75 cub. inches.
	Mexicans, " ...	79 " "
Barbarous Tribes........................		82 " "

The enlarged tables given in the catalogue of Dr. J. Aitken Meigs, increase this inverse ratio of cerebral capacity, thus:

Peruvians	75·3
Mexicans	81·7
Barbarous Tribes	84·0

"The great American group," he says, "is, in several respects, well represented in the collection. It includes 490 crania and 13 casts, making a total of 503 from nearly 70 different nations and tribes. Of this large number 256 belong to the Toltecan race [embracing the semi-civilized communities of Mexico, Bogota and Peru,] and 247 to the barbarous tribes scattered over the continent. Of 164 measurements of crania of the barbarous tribes, the largest is 104 cubic inches; the smallest 69; and the mean of all 84. One hundred and fifty-two Peruvian skulls give 101 cubic inches for the largest internal capacity, 58 for the smallest, and 75·3 for the average of all."§

* "Crania Americana," p 260.
† "Crania Americana," p. 132
‡ "Crania Americana," p. 261.
§ "Introductory Note, Catalogue," p. 10.

The results which Professor Jeffreys Wyman arrived at from a careful comparative measurement of the Squier collection, were confirmed by his subsequent study of that of Professor Agassiz, and may be quoted as applying to both; for he sums up his later investigations with the remark: "These results agree with all previous conclusions with regard to the diminutive size of the ancient Peruvian brain."* Of the Squier collection he says: "The average capacity of the fifty-six crania measured agrees very closely with that indicated by Morton and Meigs, viz., 1230 centimetres, or 75 cub. inches, which is considerably less than that of the barbarous tribes of America, and almost exactly that of the Australians and Hottentots as given by Morton and Meigs, and smaller than that derived from a larger number of measurements by Davis. Thus we have, in this particular, a race which has established a complex civil and religious polity, and made great progress in the useful and fine arts—as its pottery, textile fabrics, wrought metals, highways and aqueducts, colossal architectural structures and court of almost imperial splendour prove,—on the same level, as regards the quantity of brain, with a race whose social and religious conditions are among the most degraded exhibited by the human race. All this goes to show, and cannot be too much insisted upon, that the relative capacity of the skull is to be considered merely as an anatomical and not as a physiological characteristic; and unless the quality of the brain can be represented at the same time as the quantity, brain measurement cannot be assumed as an indication of the intellectual position of races any more than of individuals."†

The only definite attempt which Dr. Morton made to solve the difficulty thus presented to us, curiously evades its true point. "Something," he says, "may be attributed to a primitive difference of stock; but more, perhaps, to the contrasted activity of the two races." Here, however, it is not a case of intellectual activity accompanied by, and seemingly begetting an increased volume of brain; but only the assumption of greater activity in the small-brained race to account for its triumph over larger-brained barbarous tribes in the attainment of numerous elements of a native-born civilization. The question is, how to account for this intellectual activity, with all its marvellous results, attained by a race with an

* "Peabody Museum Report, 1874," p. 10.
† "Peabody Museum Report, 1871," p. 11.

average brain of no greater volume than that of the Bushman, the Australian, or other lowest types of humanity.

The Nilotic Egyptian race, of composite ethnical character, presents striking elements of comparison, in the ingenious arts and constructive skill of the ancient dwellers in the Nile valley; but whether we take the Egyptian of the Catacombs, the Copt, or the Fellah, we seek in vain for like microcephalous characteristics. Among modern races the Chinese exhibit many analogies in arts and social life to the ancient Peruvians. But their cerebral capacity presents no correspondence to that of the American race. Dr. Morton gives a mean capacity for the Chinese skull of 85, as compared with the Peruvian 75·3, while Dr. Davis derives from nineteen skulls a mean internal capacity of 76·7 oz. av., or 93 cubic in.

But another Asiatic race, that of the Hindoos—also associated with a remarkable ancient civilization, and a social and religious organization not without suggestive analogies both to ancient Egypt and Peru,—is noticeable for like microcephalous characteristics. In completing the anatomical measurements with which Dr. Morton closes his great work, he places the Ethiopian lowest in the scale of internal capacity of cranium; but, while including the Hindoo in his Caucasian group, he adds: "It is proper to mention that but three Hindoos are admitted in the whole number, because the skulls of these people are probably smaller than those of any other existing nation. For example, seventeen Hindoo heads give a mean of but 75 cubic inches."* The Vedahs of Ceylon, the Mincopies, the Negritos, and the Bushmen, appear to vie with the Hindoos in smallness of skull; but all of them are races of diminutive stature. This element, therefore, which has been referred to as important in individual comparisons, is no less necessary to be borne in view in determining such comparative results as those which distinguish the Peruvians from other American races. Certain races are unquestionably distinguished from others by difference of stature. Barrow determined the mean height of the Bushman, from measurements of a whole tribe, to be 4 ft. 3½ in. D'Orbigny, from nearly similar evidence, states that of the Patagonians to be 5 ft. 8 in. The internal capacity of the Peruvian skull, as derived from eighteen male and six female Quichua skulls in Dr. Davis's collection, is 70, while he states that of the Patagonian skull as 67 and of the Bush-

* "Crania Americana," p. 261.

man as 65; but it is manifest that the latter figures, if taken without reference to relative stature, furnish a very partial index of the comparative volume of brain.

Professor Goodsir, as already noted, held that symmetry of brain has more to do with the higher faculties than mere bulk. In the case of the Peruvians the systematic distortion of the skull precludes the application of this test. But in the small Hindoo skull the fine proportions have been repeatedly noted. Dr. Davis, in describing one of a Hindoo of unmixed blood, born in Sumatra, says: "His pretty, diminutive skull is singularly contrasted with those of the races by whom, alive, he was surrounded;"* and he adds: "The great agreement of the elegant skulls of Hindoos in their types and proportions, although not in dimensions, with those of European races, has afforded some support to that wide-spread and learned illusion, 'the Indo-European hypothesis.' The Hindoo skulls are generally beautiful models of form in miniature."

Mr. Alfred R. Wallace, in his "Malay Archipelago," discusses the value of cranial measurements for ethnological purposes; and, employing those furnished by Dr. J. B. Davis in his "Thesaurus Craniorum" as a "means of determining whether the forms and dimensions of the crania of the eastern races would in any way support or refute his classification of them," he finally selected as the best tests for his purpose—1. The capacity of the cranium; 2. The proportion of the width to the length taken as 100; 3. The proportion of the height to the length taken as 100. But here again, unfortunately, the systematic distortion of the Peruvian skulls limits us to the first of those tests. There are, indeed, the eleven normal Peruvian crania selected as such from the numerous Ancon skulls brought by Professor Agassiz from Peru. But those are stated by Professor Wyman to be on an average less by six inches than the ordinary skull. Some partial results embodied in the following table admit of comparison with those based on the more ample data of Table IX. Dr. Lucae, in his "Zur Organischen Formenlehre," already referred to, gives the cranial capacity of single skulls of different races, selected as examples of each. In these, as in others already referred to, the capacity was determined with peas; and the results—assumed to be given in Prussian ounces,—are dealt with here, as in the skulls of Heinse and Bünger. The experiments carried on for the purpose of

* "Thesaurus Craniorum," p. 148.

testing the process fully confirmed the results stated by Professor Wyman as to the differences in apparent cubical capacity according to the material employed. Taking a sound Huron Indian skull, a mean internal capacity of 1490 grms. was obtained by repeatedly gauging it with peas, and of 1439·5 with rice. The position of the Negro, heading the list, serve to show the exceptional nature of the evidence; though this is rather due to the inferiority of other examples, such as the Chinese and Greenlander, than to its greatly exceeding the Negro mean. In the first column the unzen, as Prussian ounces, are rendered in grammes. The second column gives the nearer approximation to the true specific gravity, according to the standard referred to, based on a series of experiments undertaken for me by Professor Croft, and assuming 82·5 grms. of peas to occupy the space of 100 grms. of water. The third and fourth columns represent the estimated brain-weight, after the requisite deductions, on the basis of s.g. of brain as 1·0408.

TABLE VIII.

COMPARATIVE CAPACITY OF RACES: LUCAE.

	Internal Capacity. Grms.	I. C. Corrected. Grms.	Brain-weight. Grms.	Brain-weight. Oz. Av.
Negro	1169·28	1424·12	1281·71	45·2
Chinese	1081·58	1364·48	1228·04	43·4
Nubian	1041·24	1313·54	1182·19	41·7
Floris	1033·93	1304·38	1173·94	41·4
Papuan	1030·42	1299·95	1169·96	41·3
Greenlander	1023·12	1290·74	1161·67	41·0
Javanese	995·06	1254·54	1129·91	39·8

In the following table the examples are derived from Dr. J. B. Davis's tables, with the exception of the Peruvians. For these I have availed myself of Dr. Jeffreys Wyman's careful observations on the large collection in the Peabody Museum, the results of which confirm Dr. Morton's earlier data. One further fact, however, may be noted as a result of my own study of Peruvian crania, amply confirmed by the published observations of others, viz., that while the Peruvian head unquestionably ranks among those of the microcephalous races, the range of variation among the Coast tribes appears to be less than that even of the Australian. Of this there is good evidence, based on the comparison of several hundred crania. But exceptional examples of unusually large skulls may be looked for in all races; and a few of such abnormal Peruvian or other skulls would modify the mean capacities and weights in the following table. Nevertheless the average results, as a whole, are probably a close approximation to the truth:

TABLE IX.

COMPARATIVE CEREBRAL CAPACITY OF RACES.

Race.	Number.	Capacity. Cub. Inches.	Brain-Weight. Oz. Av.
European	299	92·3	47·12
English	21	93·1	47·50
Asiatic	124	87·1	44·44
Chinese	25	92·1	47·00
Hindoos	35	82·5	42·11
Negroes	16	86·4	44·08
Negro Tribes	69	85·2	43·47
American Indians	52	87·5	44·64
Mexicans	25	81·7	41·74
Peruvians	56	75·0	38·25
Esquimaux	13	91·2	46·56
Oceanic	210	89·4	45·63
Javans	30	87·5	44·64
Australians	24	81·1	41·38

Looking for some definite results from the various data here produced, the deductions to which they seem to point may be thus stated. While Professor Wyman justly remarks that the relative capacity of the skull, and consequently of the encephalon, is to be considered as an anatomical and not as a physiological characteristic, relative largeness of the brain is nevertheless one of the most distinguishing attributes of man. Ample cerebral development is the general accompaniment of intellectual capacity, alike in individuals and races; and microcephaly, when it passes below well defined limits, is no longer compatible with rational intelligence; though it amply suffices for the requirements of the highest anthropomorpha. Wagner thus definitely refers the special characteristics which separate man from the irrational creation to one member of the encephalon: "The relation of the lobes of the cerebrum to intelligence may, perhaps, be expressed thus: there is a certain development of the mass of the cerebrum, especially of the convolutions, requisite in order to such a development of intelligence as divides man from other animals."

The important data accumulated by Morton, Meigs, Davis, Tiedemann, Pruner Bey, Broca, and others, by the process of gauging the skulls of different races, proceeds on the assumption of brain of a uniform density. But it seems by no means improbable that certain marked distinctions in races may be traceable to the very fact of a prevailing difference in the specific gravity of the brain, or of certain of its constituent portions; to the greater or less complexity of its convolutions; and to the relative characteristics of the two hemispheres. Moreover, it may be that some of those sources of difference in races may not lie wholly out of our reach, or even beyond our control. The diversity of food, for example, of the Peruvians and of the American Indian hunter-tribes was little less than that which distinguishes the Esquimaux from the Hindoo, or the nomad Tartar from the Chinese. The remarkable cerebral capacity characteristic of the Oceanic races is the accompaniment of well defined peculiarities in food, climate, and other physical conditions; and Australia is even more distinct in its physical specialties than in its variety of race.

Looking then to the unwonted persistency of the Peruvian cranium within such narrow limits, so far at least as the physical characteristics of the predominant population of Peru are illustrated by means of the great coast cemeteries; and to the striking discrepancy between the volume of brain and the intellectual activity of the race: I am led to the conclusion that, in the remarkable exceptional characteristics thus established by the study of this class of Peruvian crania, we have as marked an indication of a distinctive race-character as anything hitherto noted in anthropology.

HAECKEL'S "ANTHROPOGENIE."

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The object of the following paper is to give an idea of the present state of the doctrine of evolution. The Jena Professor's name has been so constantly associated with this doctrine since he established himself as its chief champion in Germany by the publication of his "Generelle Morphologie" (1866), that it would be impossible to give such an account without drawing largely on his works for information. Of these I have selected one of the latest, the "Anthropogenie," for a sketch of its contents will afford a general view of the subject, especially in relation to the development of man, together with an account of the more recent additions with which Haeckel has fortified the theory.

The book is essentially a popular one, and no difficulty need be experienced by any one in becoming acquainted with those arguments which are most favourable to the evolution theory. Those facts, however, which are still stumbling-blocks to the evolutionists are noticeable by their absence; and indeed it is difficult to avoid reproaching the author with dogmatism in stating his own case, a reproach of which he is not sparing when his opponents are in question.

The parts of the book likely to be of most general interest are those which are concerned with the history of the science of development and with the attempt to establish a genealogical system. The rest of the work is occupied with an account of the embryology (ontogenesis) of man, and of the mode of development of the various organs (organogenesis). These subjects are treated in an admirably lucid manner, so that from this book some knowledge of the remarkable changes which the human being passes through, from the simple unicellular condition to the complex fully-formed body, can be readily acquired, even without previous physiological training.

That this series of changes presents a great resemblance to different animals has been long recognized, but the cause of the resemblance remained in obscurity till it was brought to light by Darwin, and by him forced upon the attention of embryologists. "Heredity" is the key-word which suffices to indicate the nature of the resemblance: the human being passes through certain stages in his ontogenesis because these were likewise present in his phylogenesis, *i.e.*, among the series of ancestral forms which constitute his pedigree. It is evident that embryology must thus be one of the most important sources from which material for the establishment of a genealogical system can be taken, and Haeckel formulates a law which gives expression to this. "The ontogenesis of any form is a short recapitulation of its phylogenesis." The recapitulation, however, is not complete, nor is it always correct, for not only is the conservative tendency of heredity a factor in determining certain embryological stages, but adaptation to new conditions also steps in with its modifying agency. Certain difficulties are thus placed in the way of the evolutionist. These are not insurmountable, for he is by no means restricted to embryology for his working material; he has comparative anatomy and palæontology to fall back upon, and the conclusions which he forms from one or other of these sciences he is enabled to corroborate or to modify from a study of the evidence afforded by the third. In addition to the arguments from the above-named sciences, those from dysteleology (the science of rudimentary organs) are of great importance, for many matters which seemed incapable of any rational explanation, and were especially puzzling to the teleologist, have had a flood of light shed upon them by the establishment of the relation of ontogenesis to phylogenesis.

These sciences are comparatively new. The former dates from the appearance of Wolff's "Theoria Generationis" in 1759, the latter from that of Lamarck's "Philosophie Zoologique" in 1809.

Aristotle's treatise, "*Περὶ Ζώων Γενέσεως*," remained the sole text book on the subject of ontogenesis for 2,000 years, and from his writings it is evident that he had an inkling of the true doctrine of epigenesis. It was only after the Reformation that new observations began to be made—by Fabricius in 1600, Harvey in 1652, Malpighi in 1672, and others. In the first half of the 18th century, naturalists were incited to the study of classification by the appearance of Linnæus' great work, so that little advance was made in ontogenesis. Theories were rife, however, on the insufficient data already acquired (insufficient through the imperfection of the microscope); and that of "prædelineation," of which the chief champions were Haller and Bonnet, was most generally received. According to the most advanced form of this theory, development is nothing but the growth of parts preformed at the creation, though infinitely small, and the ovum contains within it the rudiments of all its future progeny encased one within the other. Leeuwenhoek's discovery of spermatozoids in 1690 divided the prædelineationists into animalculists and ovulists, the latter having decidedly the best of it, when Bonnet's observations on the parthenogenesis of Aphis were made known in 1745.

Wolff's "Theoria Generationis"—the only true one, that of epigenesis—put forward in 1759, met only with abuse. Especially he showed, in reference to the development of the intestinal canal, that not a trace of it is to be found in the earliest condition of the egg; that the ovum and spermatozoid indeed are entirely different in their structure from the adult. He described the embryo as a flat leaf-like body, divisible into four layers, each layer being converted into a tube by the convergence of its edges, and all giving rise to the four great systems—nervous, muscular, vascular, and alimentary. He recognized the fact that these layers were formed of ultimate vesicles (cells) similar to each other. The translation of Wolff's work into German, in 1812, gave a great impulse to the study of ontogenesis. Würzburg was the seat of the most important investigations: there Pander, in 1817, supplemented Wolff's theory, and described the division of the germ into the serous and mucous layers. Shortly afterwards Baer began his researches, and in 1828 appeared the first part of the classical work on the developmental history of animals. This was followed by the second part in 1837. He showed the mode of derivation of the four secondary germ-layers from the two primary (animal and vegetative), and what Wolff had previously but inaccurately indicated, the mode of formation of the different systems of organs from these different layers. It was he who first described the human ovum as found in the interior of the Graafian follicle, which had formerly been mistaken for the ovum: it was he who first discovered the mode of formation of the blastoderm and of the chorda dorsalis.

Much more important than the above were his comparative observations, which led him to divide the animal kingdom into four groups, radically differing in their types of development; a division simultaneously made by Cuvier from comparison of adult structure. These observations led to the enunciation of the law which bears his name. "Development is from the general to the special;" type of development depends upon the relative position of the parts, grade of development within a type on the amount of histological and morphological differentiation. The former is the mechanical consequence of heredity, the latter that of adaptation.

The application of the cell-theory (1835) to ontogenesis was productive of great advantage in the hands of Remak. He described the mode of formation of the cellular layers from the unicellular ovum in 1851, and by his investigations into the development of the tissues from cells laid the foundation stone of histiogeny.

The most important advance in late years has been the establishment of the occurrence of the two primary germ-layers in all animals except protozoa (by Huxley, in 1849, medusæ; Kowalevski, 1866, in amphioxus, ascidiæ, and afterwards in vermes, echinodermata, arthropods; Haeckel, 1872, calcareous sponges; Ray Lankester, molluscs). The absolute homology of these two germ-layers throughout the whole animal series has been especially contended for by Haeckel.

The recognition of the causes of these facts has only taken place since the appearance of Darwin's work on the "Origin of Species," but the theory of evolution was scientifically sketched half a century before that by Lamarck.

The whole question of phylogenesis depends on that of the nature and origin of Species. Linnæus first definitely applied the word in 1735, and grounded his belief in its nature on the Mosaic account of the creation. No scientific theory of creation could then be formed, for the science of palæontology did not exist. Cuvier, however, the father of palæontology, adhered to the Mosaic doctrine; but recognizing the different sets of animals that had inhabited the world, he explained these by different acts of creation and different revolutions or cataclysms similar to the flood. This catastrophic theory was supported by the geological discoveries of the Wernerian school; but the falsity of the inferences derived from these was first shown in 1830 by Lyell, whose uniformitarian theory is now universally accepted. In spite of this, it was thirty years before the connection of the present with the past inhabitants of the earth was scientifically established by Darwin.

Before his time, however, the theory of evolution had been arrived at by several men, many of them independently—Lamarck, St. Hilaire, Blainville, Treviranus, Oken, Goethe.

Lamarck was sixty-five years of age when the "Philosophie Zoologique" appeared in 1809. In it he formulated the theory of descent, and asserted its extreme consequences, the development of organic from inorganic matter, and the development of man from the ape. In explaining the latter he shows that he well knew the principles of heredity and adaptation, and the development of species by the cumulative effect of heredity. Partly the fact that he failed to discover the principle of natural selection brought about by the struggle for life, partly the incomplete state of all biological knowledge, prevented him from putting his theory on a still firmer basis.

There are many points in Goethe's morphology (to which science he made so many important contributions) which point to a belief in evolution, although he gives no connected exposition of his views on the subject. The use of the terms centrifugal and centripetal force especially indicate his appreciation of the importance of heredity and adaptation.

It is impossible to point out a book which has opened up the way to more research than Darwin's "Origin of Species by Means of Natural Selection," which appeared in 1859. The advantages which he had for the preparation of such a book were threefold: 1st. The enormous strides made by biology in the preceding fifty years. 2nd. The opportunities for observation afforded him by his five years' voyage round the world. 3rd. The time which his circumstances allowed him to spend on the systematic study of domestic plants and animals. The clue to the "struggle for existence" he obtained from reading Malthus' work on "Population." The same solution of the problem was indicated by others about the same time, notably by Wallace, 1855-58.

Several years passed before botanists and zoologists began rightly to appreciate the book, and it is only within the last few years that its effect has been felt on the sciences of anatomy and embryology.

It was not until 1871 that Darwin insisted on the applicability of his theory to man, but this had been done in the meantime by Huxley (1863), and shortly afterwards by Vogt and Rolle. Haeckel was the first (1866) to attempt to establish a genealogical system, the natural consequence of the theory.

The application of the theory to man is only a deduction from the general inductive law of descent. This law is based on evidence derived from different sources. Firstly, from palæontology, we find a gradual increase of number of species and a higher grade of evolution within the "type" reached as we ascend in the series; secondly, from comparative anatomy we find similarities of structure, on which we base the natural system of classification; thirdly, from dysteleology in all higher animals we find rudimentary organs of no use to their possessors; fourthly, from geographical distribution; fifthly, the most important inductive proof, from embryology.

The theoretical nature of species may now be considered definitely settled. There are no limits between genus, species and variety. This is established by Haeckel's researches on the calcareous sponges' which thus afford an analytical proof of the validity of the theory of descent. It is necessary to have a clear conception of the nature of the cell before entering on the study of ontogenesis, for every animal (and plant) consists at one time of its life of a single cell. Such a cell is an independent organism, for it is capable of replying to a stimulus, of movement, of nutrition and of reproduction. This view of the individuality of the cell is expressed by classifying cells along with cytodes as individuals of the first order (plastida). The cytode differs from the cell in that its plasma is not yet differentiated into nucleus and protoplasm. If the cell has a cell wall (as is rarely the case with animal cells), it is entirely an after-production, and is not essential to the constitution of a cell. An organism may remain unicellular, or it may form a commonwealth of individual cells, and the great problem of ontogenesis is, "How is a multicellular developed from a unicellular organism?"

The essential characteristics of the eggs of all animals are the same, as they are formed in the ovary of yolk, germinal vesicle and germinal spot. In many lower animals they remain naked until fertilized, and are thus amœboid in form—sponges, hydroid polypes; indeed, they have been taken in sponges for parasitic amœbæ. Usually, however, there are special additions in the form of protective coverings or extra nutritive matter. The mammalian egg is throughout the series about $\frac{1}{5}$ m.m. in diameter, and is provided with a covering—the zona pellucida—in which there are innumerable porous canals. The bird's egg is, however, very different; it is also unicellular, however large, but is provided with a complicated series of membranous and calcareous coverings as well as nutritive matter, in the shape of food-yolk and albumen. The food-yolk (red) is easily distinguished from the germinal yolk (white), and most of the latter is found at one point on the surface (cicatricula), with the nucleus imbedded in it. It is only this portion of the white yolk which after fertilization and fission forms the germinal membrane.

By the application of Haeckel's "biogenetic fundamental law," we can thus infer a unicellular ancestral form, most likely amœboid from the occurrence of amœboid eggs in the lower animals, and the wide distribution of such cells in the higher animals (blood, &c.) The mode in which the unicellular organism is transformed into a colony of cells might be arrived at *à priori* by reflection on the way in which a colony would be formed by a male and female savage thrown on an uninhabited island. At first merely nutrition and reproduction are attended to; but by the dispersion of children families are constituted, reciprocal relations established, and the principle of the division of labour steps in, its result the development of castes. So it is with the cell: at first the individuals are of equal physiological value; but as the principle of the division of labour begins to operate, different cells are set apart to perform different functions; so that reproductive cells, muscular cells, nerve cells, protective cells, &c., replace the formerly uniform mass.

The functions that are especially engaged in individual as well as in phylogenetic development are the following: Nutrition, adaptation, growth, reproduction, heredity, differentiation, retrogression, concrescence. Of these heredity, adaptation and growth are most efficient in determining form. Heredity, conservative as well as progressive, is intimately connected with reproduction; adaptation, which initiates all variations, with nutrition; in fact, all of these functions are dependent the one on the other. Growth is surplus nutrition, and reproduction surplus growth. Differentiation, or the division of labour, occurs in phylogenesis as it occurs in a state, in ontogenesis as the result of heredity: the gradual disappearance or degradation of some of the cells may be for the advantage of the colony, and this leads us to the formation of rudimentary organs. Concrescence also is connected with reproduction, or rather occurs in both forms of sexual reproduction (true sexual reproduction and conjugation). Those tissues which perform the highest functions are formed of cells which have been fused together, totally losing their individuality. But not only cells; organs also, and even persons, may thus become coalesced with each other.

We now know that development may take place without such concrescence (parthenogenesis); but usually the two elements, sperm-cell as well as germ-cell, are necessary. These are, as a rule, very different in form and size, the sperm-cell being ordinarily flagellate (rarely amœboid) and very much smaller than the germ-cell.

After impregnation the first processes of development are essentially the same in all the animal kingdom, and with regard to the mammalian series precisely the same throughout. First, the nucleus disappears, the cell becomes a cytode (monerula—it is no longer amœboid, but moneroid); second, a nucleus is formed anew only to initiate the process of fission, which being repeated, results in the formation of a mulberry-like mass of cells (morula). By collection of fluid in the interior of the morula, a vesicle, the blastosphere, is formed, the wall of which consists of a single layer of cells except in one spot (area germinativa), where a little heap of cells remain, and which spot alone is concerned in the formation of the body of the animal. By the growth of the edge of the little heap the blastoderm becomes two-layered, and these layers, exhibiting different chemical and physical characters, are distinguished—the outer as the animal, the inner as the vegetative layer, and correspond to the exoderm and entoderm of all animals except protozoa.

Such is a summary of the early developmental processes in mammalia, and essentially the same stages are passed through by all other animals, obscured frequently, however, by the presence of food-yolk, disposed in one way or another in the egg. In the bird's egg, *e.g.*, which belongs to the discoblastic type of development, change merely takes place in the superficial part of the germinal yolk, and the blastoderm thus formed as a patch on the surface of the egg grows round by its edges, so as to be transformed into a vesicle including the food-yolk.

In the lower animals there is frequently formed a gastrula stage by the invagination of part of the blastodermic vesicle, the result being an elliptical body with a primitive intestine and a primitive mouth, the wall of the body being formed of the two germinal layers.

These two layers of the gastrula are homologous with the two layers of the blastoderm; because from the outer layer all the animal organs, from the inner all the vegetative organs, are produced. Even when each of these primary layers splits into two secondary layers (as is the case with all higher animals), precisely the same holds good. A seeming exception to the splitting of the primary layers is afforded by most vertebrates, but this is explained by the fact that the recapitulation which the ontogenesis of an animal gives us of its phylogenesis is not a complete one. The reasons for this have been ably pointed out by Fritz Müller. These are, firstly, that there is a tendency for the record of phylogenesis to be blotted out, in consequence of development always seeking a straighter road to the adult stage; and secondly, that there is a tendency for the record to be falsified by the struggle for existence which the larvæ have to enter. As a corollary of the first law, it is evident that the higher the animal the less complete is the recapitulation.

In consequence of this the phylogenist is compelled to adopt the comparative procedure of the geologist; and thus, by piecing together phylogenetic fragments, he arrives at an approximate evolutionary history of man.

The comparison of the ontogenesis of amphioxus and the ascidia is most important, as both stand on the boundary line between the invertebrate and vertebrate animals. The true position of amphioxus, when first discovered, was not recognized, Pallas (1778) referring it to the genus limax. Müller was the first to give a systematic description of its anatomy (1839). He assigned to it the lowest place in the class pisces, pointing out, however, that it differed from other fishes more than the fishes do from the amphibia. Haeckel placed it in a group apart from all other vertebrata (acrania), asserting that its structure is more different from fishes than that of the fishes is from man. From its isolation we may conclude that it is the last living representative of a previously existing group, although the softness of its body is such as to preclude the possibility of fossil remains.

In structure amphioxus is a highly generalised vertebrate, but it presents many peculiarities worthy of remark, *e.g.*, the branchial chamber, the ciliated hypobranchial furrow (thyroid gland), the arrangement of the vascular system, of the sexual organs, and the primordial renal duct. A comparison of the adult amphioxus with the larval petromyzon (ammocœtes) is also very instructive. Goodsir was the first to point out any relation between the ascidia and amphioxus, showing that the perforated anterior portion of the alimentary canal enclosed in an ætrium is common to both. The resemblance, however, ends here in most adult ascidia, except that the hypobranchial furrow is also represented. It is before their retrograde metamorphosis begins that the likeness is most marked. The discovery of the embryology of amphioxus in 1866, by Kowalevsky, furnished the mode of passage from the invertebrate to the vertebrate group, which seemed so impossible from the point of view of the "type-structure," according to Cuvier and Baer. The egg of amphioxus, after passing through the stages of morula and blastosphere, becomes by invágination a gastrula, with a ciliated exoderm. This stage has since been shown to exist in all the different sub-kingdoms, and this fact has caused Haeckel to propose his "gastræa theory," which is, that all animals, except protozoa, are descended from an ancestral form (gastræa), which consisted of a primitive intestine surrounded by a two-layered body-wall. In amphioxus the gastrula becomes flattened, a primitive groove appears and is transformed into the medullary tube, which remains open anteriorly—the two primary layers of the germ split into the four secondary, and the chorda is developed in the upper of the two middle layers. The gastrula mouth becomes the anus, and a new mouth is formed; metamera begin to appear from before backwards; and a fold growing over the gill fissures, and coalescing with that of the other side, constitutes the atrial cavity.

If we compare the above with the development of an ascidian (phallusia), we shall find agreement to the minutest particulars, excepting in the fact that the chorda does not extend so far forwards between the medullary tube, which has a well marked anterior vesicular expansion, and the intestinal canal. When it reaches this stage of development it bursts the egg-case and swims about freely as the ascidian tadpole-like larva. After some time it becomes fixed, and as retrogression advances, all likeness to amphioxus disappears; the medullary tube shrinks up, and nothing is left but the supra œsophageal ganglion; the chorda disappears with the tail, and a cellulose sac is secreted by the epidermis, which heightens the dissimilarity.

It is thus among animals allied to tunicata that we must look for the bridge which allows us to pass from the invertebrate to the vertebrate group; and the latest invertebrate ancestors of man must have been closely connected with that group.

Phylogenesis is chiefly an inductive science, built up on facts derived from ontogenesis, palæontology, comparative anatomy, dysteleology, &c.; but it must also be regarded as a comprehensive deductive law, inasmuch as it alone is capable of reconciling all the appearances with which we are acquainted. To apply it we must form special deductive hypotheses. Such, however, cannot be complete as long as our sources of information are incomplete, and the construction of a genealogical tree will vary with the amount of material which is at our command to work with. However, somewhere about twenty-two forms can be indicated as ancestral, eight of them invertebrate, fourteen vertebrate, eleven archozoic, three palæozoic, three mesozoic, four cainozoic. In considering these, it will be convenient to refer at the same time to the nearest living representatives, and to the stages of ontogenesis to which they correspond.

The Monera are the simplest organisms with which we are acquainted, being formed of simple plasma, cytodes indeed, and not cells. There are forms which live in colonies (protomyxa), but the simple forms like protamœba must be regarded as the starting point for all organisms, vegetable or animal. One of the most interesting of the monera is bathybius, its existence necessitating spontaneous generation, and showing us how the transition from an organic carbonaceous substance to living matter just as little requires supernatural interference as the slow evolution of higher from lower forms. This ancestral form is repeated in ontogenesis by the "monerula" stage, that which results from the disappearance of the nucleus.

The amœba is a simple cell, differing from the protamœba in the possession of a nucleus, and evidently developed from such a moneron. The similarity between the amœba and the egg-cell cannot be too strongly insisted on, although it is sometimes masked by the development of a limiting vitelline membrane.

The synamœbium was formed from the amœba, and consisted of a colony of amœboid organisms developed by repeated fission, but remaining in connection. The nearest living representatives are cystophrys and labyrinthula; and the "morula" stage recapitulates this in the onogenetic process.

The planæa was a hollow, globular animal, the wall of the body formed of a single layer of ciliated cells, represented in ontogenesis by the blastosphere or planula, and at the present day by magosphæra planula—a peculiar organism discovered by Haeckel on the coast of

Norway, and which, at one period of its life at any rate, would seem to be most nearly related to the flagellate infusoria.

The gastræa, the ancestral form of all animals except protozoa, possessed a simple, primitive intestine, with a primitive mouth, and a body-wall formed of two layers, ectoderm and entoderm. The gastrula stage of all metazoa repeats this in ontogenesis, and the nearest living representatives are to be sought among the simplest calcareous sponges, the asconidæ.

From the gastræadæ development diverged in two lines: one of these, radiate, giving rise to sponges and cœlenterata, the other, bilateral, to the vermes. It is among the latter that we must look for the ancestors of man, from which group the vertebrate bilaterality has been inherited. The recent vermes are divided into acœlomi and cœlomati, according to the absence or presence of a body-cavity. The phylogenetic relationships of the acœlomi are sufficiently patent; but intermediate forms must have existed between the gastræadæ and such highly organized forms as the recent turbellaria. These intermediate forms (necessarily without a body-cavity) may be called archelminthes, and from that group the acœlomi and the cœlomati diverge.

The next stage must be looked for among the archelminthes, may be called prothelmis, and must have resembled a low turbellarian in the shape of intestine, absence of anus, possession of excretory canals, hermaphroditism, &c. Prothelmis represents only one of a very long row of forms which must have connected the gastræadæ with the cœlomati. The passage from prothelmis, with four secondary germ-layers, as many turbellaria have, to a cœlomatous form, is easy to understand, and the formation of a body-cavity would be correlated with a number of other important organological changes. The living cœlomati only represent the terminal twigs of an enormous tree, and the only forms among them which are closely related to the vertebrata are the tunicata. This resemblance, however, is to be observed chiefly in development (and in such a persistent larval form as appendicularia), and we must thus consider the tunicata and vertebrata to be related merely by descent from a common ancestral group, the chordonia, characterized by the possession of a chorda.

Just as in the acœlomi, so in the cœlomati, there must have been a long row of intermediate forms which led from prothelmis to chordonium, and one such stage may be easily arrived at and may be called the scolecida. This seventh stage is characterized by the separation of the intestinal tract into respiratory and digestive parts, by the formation of an anus and a blood-vascular system, by the ciliated external surface and the persistent hermaphroditism. The nearest living representative is the peculiar worm, balanoglossus.

From this scolecida group spring the eighth stage, the chordonia. In these a chorda was developed by the necessity of an axial line of attachment for locomotive muscles, and in correlation with this there took place the backward prolongation of the nervous centres. The nearest living representative of the chordonium is the appendicularia and the larval ascidian; but these must rather be regarded as common descendants from the chordonia than as ancestral forms of the vertebrata.

In considering the phylogenesis of the vertebrata, it is thus seen that we need pay no attention to any of the other great groups of the animal kingdom—annelides, arthropods, echinoderms, molluscs—for these diverged in different directions from the lower cœlomati before the scolecida were developed.

The vertebrata sprung from the chordonia in the archozoic age, for we find in upper silurian strata remains of a primordial selachian. Palæontology can tell us nothing of our oldest vertebrate ancestors, but it is certain that all were derived from a skull-less form, from which the living acrania and craniota have diverged. This constitutes the ninth stage, and may be called provertebratum, of which the only acraniate vertebrate living, "amphioxus," is the nearest representative.

The craniota have diverged in two lines, the living monorrhina and the amphirrhina: the former are represented solely by the lampreys and ray fishes, have advanced little, and are almost extinct; the latter comprise all other vertebrata. The tenth stage would be one of the primordial monorrhina, intermediate between the acrania and the amphirrhina.

Between the amphirrhina (gnathostomata) and the lowest vertebrates there is a wide break, for besides the paired nose, there are other essential distinguishing characteristics, such as the presence of the maxillary and internal branchial arches, of the swim-bladder or lung, and of the two-paired limbs, of the sympathetic nervous system, spleen and pancreas.

The oldest group of the amphirrhina, from which all others diverged, was that of the selachia. The ganoids and the dipnoi form two diverging branches, from the first of which the teleostei were developed in the mesozoic period; from the latter, the amphibia, in the Devonian period. In the ancestral series, then, the selachia constitute the eleventh stage, the dipnoi the twelfth, and the amphibia the thirteenth. The living selachia and dipnoi are mere remnants of formerly much developed groups. The dipnoi represent a considerable advance on the selachia from the change of habit of life, for the dipnoi are true amphibious animals according to the ordinary sense of the word. This advance shows itself in the modification of the air-bladder into a lung, the communication of the nasal cavity with the mouth, and the development of three chambers to the heart. Among living dipnoi, ceratodus is an especially conservative and primordial form, as marked by the skeleton of its fin and single lung, yet the three living forms with which we are acquainted must have differed widely from the common ancestral form. The dipnoi form a stage exactly intermediate between the fish and the amphibian.

None of the existing amphibia can be looked upon as representing the ancestral form from which sprung the higher vertebrate groups, but the group was abundantly represented by highly developed forms in the carboniferous period. The advance on the dipnoi is especially marked in limbs, and is correlated with their new mode of life. The limbs become transversely segmented, and possess each five toes. This number five has been inherited by all other vertebrata, and when there are less this can always be explained by adaptation: the evidence on this point is so complete that no comparative anatomist can doubt that the higher vertebrates have been developed from a four-limbed and five-toed ancestor, *e.g.*, the relation of equus to anchitherium.

The amphibia form a particularly interesting group, on account of the fact that several of the lower forms have stopped at the different stages of phylogenesis indicated by the ontogenesis of the higher forms; and an acquaintance with the comparative anatomy and ontogeny of the amphibia is sufficient to convince one that man, like all higher vertebrates, is derived from a long-tailed branchiate ancestor, and that only this hypothesis is sufficient to account for his rudimentary tail and visceral arches and clefts.

Among the amphibia there may then be established two stages, the thirteenth with persistent gills, and the fourteenth with the tail but without the gills.

The presence of the amnion in the vertebrate embryo is associated with so many important peculiarities of organization, that all amniota must be regarded as descended from a single ancestral form—the lizard-shaped "protamnion," which was developed from an amphibian form, probably in the carboniferous period, as we already meet with certain saurian remains in the permian formation.

From the protamniata, which constitute the fifteenth evolutionary stage, the sauropsida and mammalia diverge in two different lines, and it is to the latter group that man certainly belongs. The anatomical peculiarities of the mammalia necessitate their descent from a common ancestral form (promammalia), one of the two branches of the protamnia, and presenting an advance on the protamnia by the peculiarities in skull and brain, the development of a covering of hair, diaphragm, and of mammary glands. This advance must have taken place in the triassic period, although it is not in the mesozoic age that the mammals were most developed. Especially interesting is it that the mammalian fossils of this age all indicate marsupial and probably monotrematous animals. It is only in the tertiary period that traces of placental mammals are found. Comparative anatomy and ontogeny support the evidence derived from palæontology. The mammalia are divided by Blainville into the ornithodelphia (the monotremes), the didelphia (the marsupial), and the monodelphia (all other mammalia), and this corresponds to the order of appearance in time.

The sixteenth stage is formed by the monotremata, which still retain the cloaca inherited by the protamnia, and are further characterized by the absence of teats. Brain-skeleton, and indeed all the peculiarities of the anatomy of these animals, are inherited from the protamnia. The absence of teeth must be regarded as secondary, for the first traces of mammalia indicate the possession of teeth (microlestes, dromatherium). The ornithodelphia and didelphia form two widely diverging lines of descent from the promammalia, and it is among the latter that we must look for the next stage of development. The didelphia (marsupialia) of the present day are remarkably restricted in their distribution, but this was by no means the case in mesozoic and cainozoic times. Their anatomical peculiarities are so characteristic for all, that they must be regarded as forming one branch of the promammalian stem, and as the seventeenth stage of evolution of man. The remaining stages, (eighteenth–twenty-second), all belong to the placentalia, which were developed either in the end of the mesozoic or in the beginning of the tertiary period. The fact that the placentalia must have been entirely developed during this proportionately very short time (not more than three per cent. of the whole length of the earth's history) accords fully with the phylogenetic hypothesis. The chief anatomical peculiarities of the placentalia, as distinguished from their ancestors, are to be found in the mode of nutrition of the fœtus and the extent of development of the brain. The lower placentalia have no decidua, the higher have; and thus we distinguish the indeciduata from the deciduata. To the indeciduata belong the ungulata, the sirenia, the cetacea and the ant-eaters; to the deciduata, the carnivora, insectivora, rodentia, elephants, bats, lemurs and primates. These two groups diverged from each other, and consequently it is only with the deciduata that we have now to do. According to the shape of the placenta, the deciduata may be divided into zonoplacentalia and discoplacentalia, among which latter group man stands.

The limited distribution and the wide diversity of character of the prosimiæ, point to their being very old forms, and it is easy to trace resemblances in the different discoplacentalia to different groups of that order; so that we may conclude that among living forms the prosimiæ are those which stand nearest to the common ancestral form of discoplacentalia. The eighteenth ancestral stage is thus to be found in the primordial prosimiæ, and has probably its nearest living representatives in the lemurs.

The true apes form the nineteenth stage of evolution, and the question of their relations to man has been finally disposed of by Huxley. The fact of this relationship was recognized by Linnæus when he established his order primates, which, from a misconception of the nature of hand and foot, was afterwards split up into quadrumana and bimana. The primates are naturally divided into two groups, the catarhinæ and the platyrhinæ, the former characteristic of the Old, the latter of the New World. To the former group man belongs, and this is shown by his participation in the anatomical peculiarities of the catarhine group, and notably the form of the nose and the dentition. These two groups must be regarded as divergent descendants of the primordial apes, and consequently the relationship of man to the New World apes is only a very distant one. On the contrary, his relation to the highest catarhines is a very much nearer one than that of those to the lowest catarhines. A long series of catarhine forms must have been passed through before man was developed, before he became accustomed to the upright gait and the correlated further differentiation of anterior and posterior extremities, before the larynx and brain became further developed, along with the functions attaching to these organs.

With reference to these advances, it is possible to mark out four stages which indicate important points in the evolution of man. As the nineteenth stage, then, the lowest catarhine stands forth characterized by the possession of the characteristic nose, dentition and brain; menocerca, existing in the eocene time, as remains teach us; probably semnopithecus is the most nearly allied living form.

The tailless apes, or anthropoids, must be reckoned as the twentieth stage, characterized by loss of tail and partial loss of hair; and among the living forms two well marked groups are distinguishable, an African and an Asiatic. Both the African anthropoids are dark and dolicocephalic, like the Negroes; while the Asiatic forms are brown or yellow and brachycephalic, like their countrymen, the Malays and Mongolians. None of the anthropoids can be reckoned as the absolutely nearest to man. They must rather be regarded as the last widely separated remains of an old catarhine branch, a particular twig of which gave rise to man.

A twenty-first stage will thus be formed by the pithecanthropi, intermediate between the old anthropoid family and man characterized by the complete differentiation of the limbs, but still destitute of speech (alali).

Comparative philology shows that language is of polyphyletic origin; probably it formed after the divergence of the races in the diluvial period. The alali must have thus existed towards the end of the tertiary period.

The twenty-second and last stage is constituted by man endowed with speech, probably formed during the diluvial time in the tropical zone of the Old World, either on the continent of Africa or Asia, or on an earlier continent now sunk, which reached from East Africa to East Asia, the "lemurian" continent.

The above is a mere sketch of the pedigree constructed by Haeckel for man; for the genealogical system of the whole of the animal kingdom, the "Natürliche Schöpfungsgeschichte" must be consulted.

The last chapters of the "Anthropogenie" are taken up with the account of the development of the various organs in man; and here the arguments from comparative anatomy, and the presence of rudimentary organs, are especially brought forward. We find the same assertive tone here, as throughout the rest of the work, about matters that can hardly be regarded as thoroughly settled As an instance may be taken the assertion that the primordial renal duct is developed by involution from the epiblast. Although this mode of development would accord very well with Haeckel's speculations as to the homologies of that organ, it would seem to be at variance with the researches of most embryologists. Such an assertion we hardly think necessary, especially when the great latitude allowed to the evolutionist by the doctrine of heterotopy (p. 364) is considered—if an organ be not developed in the place where theoretically it may be expected, this may be attributed to an early phylogenetic wandering of cells from one germ-layer into the other.

Haeckel's opponents, scientific and unscientific, are treated in somewhat cavalier fashion. Among the former, W. His, and among the latter the theologians, come in for a good share of abuse.

The admirable diagrams with which the book is copiously provided, and the useful synoptical tables, will render it valuable for giving a good notion of the doctrine of evolution. An American translation is announced, so that it will shortly be accessible to all.

ON SOME BLOWPIPE-REACTIONS.

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I.—ON THE REACTIONS OF METALLIC THALLIUM BEFORE THE BLOWPIPE.

The following reactions are given from direct experiments by the writer: *

In the closed tube, thallium melts easily, and a brownish-red vitreous slag, which becomes pale-yellow on cooling, forms around the fused globule.

In the open tube, fusion also takes place on the first application of the flame, whilst the glass becomes strongly attacked by the formation of a vitreous slag, as in the closed tube. Only a small amount of sublimate is produced. This is of a grayish-white colour, but under the magnifying-glass it shews in places a faint ridescence.

On charcoal, *per se*, thallium melts very easily, and volatilizes in dense fumes of a white colour, streaked with brown, whilst it imparts at the same time a vivid emerald-green coloration to the point and edge of the flame. If the heat be discontinued, the fused globule continues to give off copious fumes, but this action ceases, at once, if the globule be removed from the charcoal. A deposit, partly white and partly dark-brown, of oxide and teroxide is formed on the support; but, compared with the copious fumes evolved from the metal, this deposit is by no means abundant, as it volatilizes at once where it comes in contact with the glowing charcoal. If touched by either flame, it is dissipated, immediately, in imparting a brilliant green colour to the flame-border. The brown deposit is not readily seen on

* The reactions given by CROOKES are as follows:—"The metal melts instantly on charcoal. and evolves copious brown fumes. If the bead is heated to redness, it glows for some time after the source of heat is removed, continually evolving vapours which appear to be a mixture of metal and oxide. A reddish amorphous sublimate of proto-peroxide surrounds the fused globule. When thallium is heated in an open glass tube, it melts and becomes rapidly converted into the more fusible protoxide, which strongly attacks the glass. This oxide is of a dark red colour when hot, solidifying to a brown crystalline mass The fused oxide attacks glass and porcelain, removing the silica. Anhydrous Peroxide of Thallium is a brown powder, fusing with difficulty and evolving oxygen at a red heat, becoming reduced to the protoxide, The phosphate and sulphate will stand a red heat without change."

charcoal; but if the metal be fused on a cupel, or on a piece of thin porcelain or other non-reducing body, the evolved fumes are almost wholly of a brownish-colour, and the deposit is in great part brownish-black. It would appear, therefore, to consist of TlO^3, rather than of a mixture of metal and oxide. On the cupel, thallium is readily oxidized and absorbed. It might be employed, consequently, as suggested by Crookes, in place of lead, in cupellation; but to effect the absorption of copper or nickel a comparatively large quantity is required. When fused on porcelain, the surface of the support is strongly attacked by the formation of a silicate, which is deep-red whilst hot, and pale-yellow on cooling.

The teroxide, as stated by Crookes, evolves oxygen when heated, and becomes converted into TlO. The latter compound is at once reduced on charcoal, and the reduced metal is rapidly volatilized with brilliant green coloration of the flame. The chloride produces the same reaction, by which the green flame of thallium may easily be distinguished from the green copper-flame, the latter, in the case of cupreous chlorides, becoming changed to azure-blue. With borax and phosphor-salt, thallium oxides form colourless glasses, which become gray and opaque when exposed for a short time to a reducing flame. With carb.-soda, they dissolve to some extent, but on charcoal a malleable metallic globule is obtained. The presence of soda, unless in great excess, does not destroy the green coloration of the flame.

Thallium alloys more or less readily with most other metals before the blowpipe. With platinum, gold, bismuth, and antimony, respectively, it forms a dark-gray brittle globule. With silver, copper, or lead, the button is malleable. With tin, thallium unites readily, but the fused mass immediately begins to oxidize, throwing out excrescences of a dark colour, and continuing in a state of ignition until the oxidation is complete. In this, as in other reactions, therefore, the metal much resembles lead.

II.—ON THE OPALESCENCE PRODUCED BY SILICATES IN PHOSPHOR-SALT.

It is well-known that most silicates when fused with phosphor-salt are only partially attacked: the bases, as a rule, gradually dissolving in the flux, whilst the silica remains in the form of a flocculent mass technically known as a "silica-skeleton." Very commonly, almost invariably, indeed, if the blast be long continued, the bead becomes more or less milky or opalescent on cooling. This latter reaction was apparently regarded by Plattner as essentially due to the presence of alkaline or earthy bases, such as exhibit the reaction *per se.* He states *(Probirkunst: Dritte Auflage, 468)*—"Da man nun von mehreren Silikaten ein Glas bekommt, welches, so lange es heiss ist, zwar klar erscheint, aber unter der Abkühlung mehr oder weniger opalisirt, so muss man sich von der ausgeschiedenen Kieselsaure überzeugen, so lange das Glas noch heiss ist, und dabei die Loupe zu Hülfe nehmen. Die so eben erwähnte Erscheinung tritt gewöhnlich bei solchen Silikaten ein, deren Basen Kalkerde, Talkerde, Beryllerde oder Yttererde sind, die für sich mit Phosphorsalz, bei gewisser Sättigung des Glases, unter der Abkühlung oder durch Flattern milchweiss oder opalartig werden." Dr. Theodor Richter, the editor of the 4th edition of Plattner's work, leaves out the "gewöhnlich" of the above quotation, and so makes the implication still stronger. In this *vierte Auflage,* the statement runs—"Bei solchen Silikaten deren Basen für sich mit Phosphorsalz, bei gewisser Sättigung des Glases, unter der Abkühlung oder durch Flattern milchweiss oder opalartig werden (Kalkerde, Talkerde, Beryllerde, oder Yttererde) wird die Perle unter der Abkühlung mehr oder weniger trübe." It is true enough that silicates in which these bases are present, exhibit the reaction; but as other silicates, practically all, indeed, exhibit the reaction also, the inference implied in the above statement is quite erroneous. The opalescence of the glass arises entirely from precipitated silica. If the blast be sufficiently kept up, a certain amount of silica is almost always dissolved, but this becomes precipitated as the glass cools. A simple experiment will shew that this is the true cause of the opalescence. If some pure silica (or a silicate of any kind) in a powdered condition, be dissolved before the blowpipe-flame in borax until the glass be nearly saturated, and some phosphor-salt be then added, and the blowing be continued for an instant, a precipitation of silica will immediately take place, the bead becoming milky—or, in the case of many silicates, opaque-white—on cooling. This test may be resorted to for the detection of silica in the case of silicates which dissolve with difficulty in phosphor-salt alone, or which do not give a well-pronounced "skeleton" with that reagent.*

* By whom was the formation of a "silica skeleton" first made known? There is no reference to it in the early treatise of VON ENGESTROM attached to his translation of Cronstedt's "Miner-

III.—ON THE REACTIONS OF CHROMIUM AND MANGANESE WITH CARBONATE OF SODA.

When a mineral substance is suspected to contain manganese, it is commonly tested by fusion with carbonate of soda. But chromium compounds form with that reagent a green enamel much resembling that formed by compounds of manganese.

The chromate-of-soda enamel, however, is yellowish-green after exposure to an oxidating flame, and the green colour never exhibits any tinge of blue.

The manganate-of-soda enamel, on the other hand, is generally greenish-blue when quite cold.

To avoid, however, any risk of error in the determination, the bead may be saturated with vitrified boracic acid until all the carbonic acid is expelled, and a clear glass is obtained. The chrome glass will retain its green colour, whilst the manganese glass will become amethystine or violet. In place of boracic acid, silica may be used if more convenient. In this case, the reaction is assisted by the addition of a very small amount of borax.

IV.—ON THE DETECTION OF CADMIUM IN THE PRESENCE OF ZINC, IN BLOWPIPE EXPERIMENTS.

When cadmiferous zinc ores, or furnace-products derived from these, are treated in powder with carb.-soda on charcoal, the characteristic red-brown deposit of cadmium oxide is generally formed at the commencement of the experiment. If the blowing be continued too long, however, this deposit may be altogether obscured by a thick coating of zinc oxide. When, therefore, the presence of cadmium is suspected in the assay-substance, it is advisable to employ the following process for its detection. The substance, if in the metallic state, must first be gently roasted on a support of porcelain or other non-reducing body. Some of the resulting powder is then fused with

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alogie" (edition 1., 1770; ed. 2, by John Hyacinth de Magellan, 1788), although phosphor-salt is mentioned as a reagent under the term of *sal fusibile microcosmicum*, and was indeed used by Cronstedt before 1758, the year in which his "Mineralogie" was anonymously published. Bergmann, who followed as a blowpipe worker, states that "siliceous earth" is very slowly attacked by microcosmic salt, but he does not seem to have remarked the skeleton formation in the case of any silicate. The reaction appears to have been first definitely pointed out by Berzelius in his standard work on the blowpipe, published in 1821. It was therefore most probably discovered by him, or perhaps—as he lays no claim to its discovery, whilst claiming to be the originator of other tests—it may have been communicated to him by Gahn?

borax or phosphor-salt on a loop of platinum wire, and bisulphate of potash in several successive portions is added to the fused bead. The latter is then shaken off the wire into a small porcelain capsule, and treated with boiling water. A bead of alkaline sulphide is next prepared by fusing some bisulphate of potash on charcoal in a reducing flame, and removing the fused mass before it hardens. A portion of the solution in the capsule being tested with this, a yellow precipitate will be produced if cadmium be present. The precipitate can be collected by decantation or filtration, and tested with some carb.-soda on charcoal. This latter operation is necessary, because if either antimony or arsenic were present, an orange or yellow precipitate would also be produced by the alkaline sulphide. By treatment with carb.-soda on charcoal, however, the true nature of the precipitate would be at once made known.

V.—ON THE SOLUBILITY OF BISMUTH OXIDE IN CARBONATE OF SODA BEFORE THE BLOWPIPE.

Neither in the treatise of Berzelius, nor in the more modern and advanced work of Plattner, is any reference made to the behaviour of oxide of bismuth with carb.-soda in an oxidating flame. In Plattner's "Tabellarische Uebersicht des Verhaltens der Alkalien, Erden, und Metalloxyde für sich und mit Reagentien im Löthrohrfeuer," whilst oxide of lead is stated, correctly, to be soluble in carb.-soda in an oxidating flame, the reference to oxide of bismuth is, simply, that with carb.-soda on charcoal it becomes immediately reduced to metallic bismuth; and none of his translators seem to have thought it necessary to supply the omission. In Hartmann's tabular "Untersuchungen mit dem Löthrohr," in the handy little work of Bruno Kerl ("Leitfaden bei qualitativen und quantitativen Löthrohr-Untersuchungen"), in the "Löthrohr-Tabellen" of Hirschwald, and all other blowpipe books that I have met with, the same singular omission occurs. This seems to bear out very forcibly the somewhat cynical adage that "books are made from books." To supply the omission, it may be observed that bismuth oxide dissolves in carb.-soda very readily in an oxidating flame, if the supporting agent be platinum wire or other non-reducing body. The glass is clear yellow whilst hot, but on cooling it assumes an orange or yellowish-brown colour, and becomes pale-yellow and opaque when cold. As regards their solubility by fusion in carb. soda, metallic oxides fall into three groups: (1), *Easily soluble, e.g.*, PbO, Bi^2O^3, BaO, &c.; (2), *Slightly or partially soluble, e.g.*, Mn^2O^3 CoO, &c.; and (3), *Insoluble, e.g.*, Fe^2O^3, Ce^2O^3, NiO, CaO, MgO, &c.

VI.—ON THE DETECTION OF BROMINE IN BLOWPIPE EXPERIMENTS.

When fused with phosphor-salt and copper oxide, the bromides, it is well known, impart an azure-blue coloration to the flame, much like that produced by chlorides under similar treatment, although streaked more or less with green, especially at the commencement of the operation. To distinguish these bodies more closely, Berzelius recommended the fusion of the test substance with 6 or 7 volumes of bisulphate of potash in a closed tube. Bromides by this treatment become decomposed, as a rule, and give off strongly-smelling brownish or yellowish-red vapours of bromine. But this process does not always give satisfactory results, as in some instances the bromide is very slightly attacked. In this case, the following method, based on a peculiar reaction of bromide of silver, first pointed out by Plattner, may be resorted to. If insoluble, the bromide is fused with 2 or 3 volumes of carb.-soda. A soluble bromide of sodium is thus formed, with separation of the base. To the filtered or decanted solution of the fused mass, a small fragment of nitrate of silver is added, in order to precipitate bromide of silver. This, collected by decantation, is fused with a small quantity of bisulphate of potash in a little flask or test-tube. The bromide of silver will quickly separate from the flux in the form of a blood-red globule, which becomes pale-yellow when cold. The little globule, washed out of the tube by dissolving the fused bisulphate in some warm water, is carefully dried by being rubbed in a piece of blotting or filtering paper, and is then placed in the sunlight. After a short time, it will turn green. Chloride of silver, as obtained in a similar manner, melts into an orange-red globule, which changes to clear-yellow on cooling, and finally becomes white, or nearly so. Placed in sunlight, it rapidly assumes a dark-gray colour. Iodide of silver, under similar treatment, forms whilst hot an almost black globule, which becomes amethyst-red during cooling, and dingy-yellow when cold. In the sunlight it retains the latter colour. A mixture of chloride and iodide of silver assumes a greenish tint somewhat resembling the colour acquired by the bromide globule. This, however, can scarcely give rise to any error, as the presence of iodine is revealed—even if no violet-coloured fumes be emitted—by the dark amethystine colour of the bead whilst hot.

VII.—ON THE DETECTION OF CARBONATES IN BLOWPIPE PRACTICE.

A mineral substance of non-metallic aspect, in nine cases out of ten, will be either a silicate, sulphate, phosphate, borate, carbonate, fluoride, or chloride color: more especially if the streak be uncoloured or merely exhibit some shade of green or blue, or if the substance evolve no fumes when heated on charcoal.

Simple fusion with phosphor-salt on a loop of platinum wire serves at once to distinguish a silicate from any of the other bodies enumerated above, as, whilst the silicate is but slowly attacked, these other bodies are readily and rapidly dissolved. Among the latter, again, the carbonates are distinguished without risk of error by the marked effervescence which they produce in the bead by the evolution of carbonic acid during fusion—the phosphates, sulphates, &c., dissolving quietly. The reaction is quite as distinctive as that produced by the application of an ordinary acid; but, of course, it may arise in both cases not only from a carbonate proper, but from the presence of intermixed calcite or other carbonate in a silicate or other body. It was by its use, upwards of twenty years ago, that the writer detected the presence of carbonate of lime in certain specimens of Wernerite (the "Wilsonite" variety), portions of which had previously been analyzed without the impurity having been discovered. It need scarcely be stated that the test-substance must be added to the phosphor-salt, on the platinum loop, only after the quiet fusion of the flux into a transparent glass. The reaction is, of course, manifested equally well with borax.*

VIII.—ON THE USELESSNESS OF TURNER'S FLUX AS APPLIED TO THE DETECTION OF BORACIC ACID.

Many years ago—about 1827 or 1828—TURNER proposed, in examining a body for the presence of boracic acid, to mix the test-substance with bisulphate of potash and fluor-spar (in the proportions

* It is singular that this very marked and useful reaction should not have been alluded to in any of the standard treatises on Blowpipe Practice. The only work known to the writer in which a passing reference is made to it, is that of Hirschwald ("Lothrohr-Tabellen"), published in 1875. The present writer called attention to it in 1871.

of $4\frac{1}{2}$ parts of the former to 1 part of the latter), and to expose the mixture on a clean platinum wire to the point of the blowpipe flame. Fluo-boric acid is thus produced; and by its volatilization, a momentary green colour is imparted to the edge of the flame. MERLET recommends the employment of 3 or 4 parts of this flux to 1 part of the substance under examination. This test is much quoted in blowpipe books and works on chemical analysis generally; but it is altogether superfluous. With borate of soda it fails entirely, or yields very unsatisfactory results; and although it answers for most other borates and for boro-silicates, it is uselessly applied to them, because these bodies colour the flame equally well, *per se*. BERZELIUS seems strangely to have overlooked the coloration of the flame as produced by many substances under blowpipe treatment. In his work on the blowpipe, for example, he fails to notice the character in describing the reactions of lepidolite, sulphate of baryta, datolite, triphylline, and other minerals, which exhibit it most distinctly. Under axinite, moreover, he has the following statement: "Turner asserts that a flame tinged green by boracic acid is obtained by the aid of sulphate of ammonia (or bisulphate of potash) and fluor spar." This "assertion" is true enough; but *all specimens of axinite colour the flame green, per se.* The uselessness of the flux was pointed out, I find, by BUZENGEIGER as long ago as 1829. In the *Annales des Mines* for that year (tome v., p. 36), he states: "J'ai essayé, pour reconnaître la présence de l'acide borique, d'employer le flux indiqué par M. Turner, mais ces tentatives ne m'ont pas réussi, probablement par défaut d'habitude. Quoi qui en soit, tous les mineraux que M. Turner a vu colorer la flamme en vert en les melant avec son flux, m'ont donné la meme réaction en les introduisant avec quelque soin dans la flamme bleue, sans les mélanger avec aucun réactif." BUZENGEIGER, whose name does not seem to be quoted in any blowpipe work, appears to have first proposed the sloping blowpipe-wick, long before it was adopted by PLATTNER; and he noticed, at the same early date, that the crimson coloration of the strontium-flame was entirely obliterated by the presence of barytic compounds.

IX.—ON THE COMPORTMENT OF CERTAIN ALLOYS UNDER THE ACTION OF THE BLOWPIPE.

In examining these reactions, about equal portions of the metals (forming the alloy) may be placed together, on charcoal, and subjected to the action of a reducing flame.

1. *Platinum and Tin* unite with violent deflagration and emission of light, forming a hard, brittle, and infusible globule.

2. *Platinum, Zinc and Tin* unite with violent action, the zinc throwing off long flakes of oxide.

3. *Platinum and Zinc, per se,* do not combine, the zinc burning into oxide.

4. *Platinum and Lead* unite quietly, forming a brittle globule.

5. *Platinum and Thallium* unite quietly; the resulting globule is dark externally, gray internally, and quite brittle.

6. *Platinum and Bismuth* unite quietly, or with merely slight spitting, into a dark brittle globule.

7. *Platinum and Copper* combine quietly, though not very readily, into a hard, light-coloured, malleable globule.

8. *Platinum and Silver* unite quietly, but not very readily unless the silver be greatly in excess, into a white malleable globule.

9. *Platinum and Gold* unite quietly, forming (if the gold be somewhat in excess) a yellow malleable globule.

10. *Gold and Tin* unite quietly into a very brittle globule.

11. *Gold and Zinc* do not combine *per se;* the zinc burns into oxide.

12. *Gold and Lead* combine quietly, forming a gray brittle bead.

13. *Gold and Thallium* unite quietly, but separate again to some extent during cooling. The globule may thus frequently be flattened out, but not without cracking at the sides. If the metals remain united, the button is dark blackish-gray, and quite brittle.

14. *Gold and Bismuth* unite quietly and readily, forming a very brittle globule.

15. *Gold and Copper,* and 16, *Gold and Silver,* unite, and form a malleable globule.

17. *Silver and Tin* unite quietly into a malleable globule.

18. *Silver and Lead* unite readily into a malleable globule.

19. *Silver and Thallium* combine readily: globule, malleable.

20. *Silver and Bismuth* unite readily and quietly: the globule is brittle, but admits of being slightly flattened out.

21. *Silver and Copper,* and 22, *Silver and Gold,* form malleable globules. The gold alloy, even with gold largely in excess, is quite white. If it be flattened out, and heated in a platinum spoon with some bisulphate of potash, it will become yellow from the silver

on the surface being dissolved. On re-melting the flattened disc, a silver-white globule is again obtained.

23. *Copper and Tin* unite into a gray and partially malleable bead, the surface of which, in the O. F., becomes more or less thickly encrusted with cauliflower-like excrescences of oxide.

24. *Copper and Zinc* do not unite *per se* into a globule, the zinc burning into oxide. Under carb.-soda, or carb.-soda and borax, brass is readily formed.

25. *Copper and Lead* form a dark-gray globule, which is sufficiently malleable to admit of being extended on the anvil.

26. *Copper and Thallium* melt into a dark-gray malleable globule.

27. *Lead and Tin* unite readily, but the globule commences immediately to oxidize, throwing out excrescences of white and yellow oxide. On removal from the flame, it still continues in ignition, and pushes out further excrescences. The unoxidized internal portion (if any remain) is malleable.

28. *Lead and Bismuth* unite readily: the molten globule acquires a thin dark coating of oxide on the surface only, and admits of being flattened out, more or less, upon the anvil.

29. *Lead and Thallium* form a malleable globule.

30. *Bismuth and Tin* unite readily, but the fused mass immediately throws out excrescences, and becomes covered with a dense crust of oxides. The reaction, however, it not so striking as with lead and tin.

31. *Thallium and Tin* exhibit the same reaction as lead and tin, but the cauliflower-like excrescences are brownish-black.

SOME CANADIAN NOMS-DE-PLUME IDENTIFIED:

WITH SAMPLES OF THE WRITINGS TO WHICH THEY ARE APPENDED.

BY HENRY SCADDING, D.D.

I suppose all countries that have a literature at all, have a certain number of pseudonymous writings to shew, which have become classic, so to speak; a certain number of productions under feigned names, that have acquired a repute or a notoriety beyond anything perhaps that their authors had ever anticipated for them. The oldest literatures of which we have any knowledge exhibits examples of such writings. To this day we have in circulation compositions assigned to Orpheus, Musæus, Homer, Hesiod, Pythagoras, which it is certain those personages never penned. In like manner, in the far east of Asia, the names of Confucius, Mencius, Manes, Sakyamouni, Mahomet, are abused. And all this not, in every instance, originally from a gross intention to deceive. It seems to have been an early practice, everywhere perhaps, and one held to be within certain limits legitimate, to give importance to compositions by attributing them to great men long previously deceased.

And then the sophists and rhetoricians, and, at later periods, the disputants in the schools at universities, have now and then unintentionally misled posterity by their declamations, in which illustrious characters were personated and their style imitated. These productions, intended simply as exercises of subtlety and skill, have been, in the lapse of time, occasionally assigned to the authors respectively mimicked, as their genuine offspring. Thus we now have a Plato and a pseudo-Plato; an Aristotle and a pseudo-Aristotle; a Lucian and a pseudo-Lucian; a Cicero and a pseudo-Cicero. Thucydides and Livy have much to answer for in this regard, having led the example of putting into the mouths of their heroes formal speeches, which, however worthily and truthfully conceived, were never uttered.

In theology, sad to say, a like practice has prevailed, to such an extent that the modern divine has to be very wary in regard to the writings which he quotes as authority. For among the Fathers and the Decretalists it is discovered now that, as the French say, "*Il y a fagots et fagots.*" When we buy the Glenfield starch, are we not constantly told to see that we get it? It is just so with Cyprian and Athanasius, and many others of that class; when you cite them, you have to see to it that it is they.

At later periods, pseudonyms have been used for purposes of concealment, and the writings to which they were attached became famous. The Abbé St. Cyran in 1635 wrote his famous defence of the French hierarchy, under the title of Petrus Aurelius; and Paschal originally subscribed the name of Louis de Montalte to his well-known Provincial Letters. There is in France a whole Dictionary of "Auteurs Déguisés sous les noms Etrangers, Empruntés, Supposés, Feints à plaisir, Chiffrés, Renversés, Retournés, ou Changés d'un Langue en une autre." Baillet, the compiler of this work, has also a department in his "Jugements des Savants" for "Auteurs Déguisés." The name by which Paul Sarpi was known as historian of the Council of Trent was Pietro Soave Polano, an imperfect anagram of Paolo Sarpi, Venetiano. That Sarpi had some reason to protect himself by a disguise, is shown by what befel him on the Bridge of St. Mark's, where he was waylaid by assassins and stabbed all but mortally. In Germany, Frederick von Hardenberg, author of "Hymns to Night" and the mystic romance entitled "Heinrich von Ofterdingen," is usually known and quoted as Novalis.

In Great Britain and Ireland, while yet open criticism of the policy of Ministers was held to be seditious—when the publication of parliamentary debates was forbidden, and the press generally was gagged—a pseudonymous literature of a wide range of course sprung up. It was only under disguised names that enlightened men, in many an instance, ventured to promulgate their doctrines which, however salutary to mankind, were yet inacceptable to those in power, and sometimes to the bulk of the community likewise. Sometimes the mask assumed was so effectually retained that, in spite of considerable curiosity on the point, posterity has been left in doubt. Whole shelves are filled with conjectural replies to the queries, Who was Martin Marprelate? Who was Junius? But Peter Pindar's secret was quickly discovered; as also was Peter Porcupine's and Peter Plimley's, no particular pains having been taken in any of these cases to preserve it. The same may be said of Runnymede and Historicus.

In very recent times, several literary ladies have veiled their sex under such *noms-de-plume* as George Sand, George Eliot, Currer Bell, Acton Bell, Ellis Bell; and by the adoption of this course, they have created for themselves an entity, so to speak, independent of their proper persons; a thing which has happened in similar manner to some male authors also. When we hear or read of Sholto and Reuben Percy, of Thomas Ingoldsby, of Father Prout, of Arthur Sketchley, of Barry Cornwall, who is not inclined to think of each of them as substantial, real personages?' We hear sometimes of persons carving out a name for themselves; here the process is reversed—names carve out and create for themselves persons.

In the United States they have closely followed the literary practices and caprices of the mother country. Some years before the Revolution, Franklin was widely known as Richard Saunders, the "Poor Richard" of the Almanac from 1732 downwards. In later times, Dietrick Knickerbocker, historian of New Amsterdam, *i.e.*, New York, became a quasi-actuality, whilst the second assumed name of the same author, Geoffry Crayon, became a familiar expression throughout England as well as the United States, and was regarded by many as almost a real cognomen. In late years, Mr. Hosea Biglow has nearly equalled Geoffry Crayon in extent and degree of reputation. Numerous other appellations of this class have likewise become household words, throughout the United States at least; for example, Ik. Marvel (Donald Mitchell), Jack Downing (Seba Smith), Gail Hamilton (a lady, Miss Dodge), Mark Twain (T. L. Clemens), Petroleum J. Nashby (D. R. Locke), &c. The supposed United States characteristic practice of citing only the initial of an intermediate Christian name, as here, has given rise to the not very elegant *nom-de-plume* of Orpheus C. Kerr (R. H. Newell), intended to be a bit of satire on carpet-baggers and other hungry parasites of the several governments and municipalities.

Now, our Canadian literature has something to shew analogous to these developments in the literatures of older communities. Our Canadian literature, indeed, in what may be called its more infantile stage, has consisted, in great measure, of productions to which, for reasons arising out of the times, were affixed fictitious signatures. And I have thought that it might be a matter of some interest, and even of some utility, to collect the more important of these feigned names, giving at the same time samples of the writings to which they are appended, and naming their authors where possible or proper to do so. I do not pretend to give a list of the innumerable Agricolas, Justitias, Catos, Pro-bono-publicos, &c., that from time to time have abounded in our Canadian papers and periodicals, as in all papers and periodicals, each treating, fitly doubtless, and reasonably, of a topic of the moment just once, and then emerging to the view no more, and so passing into complete oblivion. This would be an endless task, and to identify the respective writers would be a matter perhaps of not much moment. But there have appeared from time to time amongst us, under fictitious signatures, during our short history, especially in what seems to us now a rather remote past, writings which deserved and have acquired more than an ephemeral repute, and which have exerted over our mixed yet plastic Canadian society, an influence that may be said, in some sense, to continue to the present time. It is the authors of such productions as these that I am to trace and put on record, as contributors in some sort to our nascent Canadian literature, and perhaps to the formation of our Canadian national character.

On subjects then that may be roughly classed as follows, I find writings of the kind described:

1. Our Politics: our politics while Canada was yet known as the two Canadas, Upper and Lower; and our politics just after the re-union of the two provinces into one. 2. The promotion of emigration. 3. The question of education. 4. Miscellaneous subjects; as, for example, the fostering of patriotism towards Canada, and love and reverence for the mother country, the cultivation of literature and taste in general. And these writings divide themselves into prose and verse.

On the prose side we have, in relation to the politics of the first-named period, the writings of Veritas and Nerva. In relation to the second, those of Patrick Swift and Legion. On the subject of emigration we have the Backwoodsman, the Pioneer of the Wilderness. On the educational question there are Graduate, Scotus, British Canadian. Under the general head of the inculcation of taste in art and literature, the promotion of patriotism, loyalty, attachment to the mother country, we have Guy Pollock, Alan Fairford, Solomon of Streetsville, Maple Knot, Maple Leaf, The Whistler at the Plough, and Libertas.

On the poetical side, touching of course lightly and gracefully on subjects more or less identical with those just enumerated, we have Roseharp, Cinna, Isidore, Plinius Secundus, Claud Halcro, Zadig.

I exclude with regret, from a kind of necessity, Lower Canadian French *noms-de-plume*, not having convenient access to the early journals and other publications which from time to time have appeared in what is now the Province of Quebec; but I know there are several which are duly honoured by literary men there. I also exclude the writings of Mr. Samuel Slick, the famous clock-maker of Slickville, the decease of their author having occurred before his native province, Nova Scotia, was comprised within the Canadian boundaries.

I begin with the prose writers; and of these I dispose first of those whom I have classed as miscellaneous.

In the periodicals of 1833 and of several successive years, published at Toronto, appeared many communications on miscellaneous subjects, signed Guy Pollock. They attracted general attention, being marked by an elevation of thought and culture beyond the ordinary, and by a good style. I give a passage from a description of the Falls of Niagara, by Guy Pollock, in the *Canadian Literary Magazine* for April, 1833, in which he offers some strictures on the great cataract thus: "Were I to write a criticism on nature—which, by the way, would be something like presumption—I would say," Guy Pollock writes, "that for producing a grand emotion, the cascade is too low when compared with its extent across the river. The architectural proportions, as builders express the idea, are not preserved, the river even grows broader immediately above the Falls—a circumstance which gives the cascade too much the appearance of an immense mill dam—an appearance which excites a very ordinary, although, no doubt, a very useful idea. The Falls of Niagara are great," he continues, "and therefore in some measure grand; but, unless for their magnitude, which in that respect gives them a decided superiority, they are, in respect of sublimity of aspect and grandeur of surrounding scenery, far inferior to the Falls of Clyde, round which the jackdaws are screaming, above the goshawks are soaring, and under the overhanging groves the bat flies at noon. Compared with the Falls of Clyde, those of Niagara have a lifeless appearance."

The following is from a chapter on craniology in the same periodical, by the same writer, under the same signature: "The common reproach of wanting brains, a round head, and a thick skull, are mere colloquial expressions, often spoken at random, to suit the humour of the moment," Guy Pollock says; "but on inquiry they are found to be strictly philosophical expressions, sanctioned by the experience of ages. This physical deficiency in the position and quantity of the brain, explains, on philosophical principles, the grand secret why the Ethiopians have so long been retained in a state of slavery. That knowledge is power is an undisputed aphorism, which applies well to the present condition of the Ethiopian species; they want knowledge to discover and appreciate their own power, otherwise they would have broken the gyves of slavery in pieces long before this evil hour: for the first use that every man makes of knowledge is to turn it to his own advantage. It is the same want of knowledge, in a still greater degree, which constitutes what we call docility in the horse or elephant. The strength of either of these animals is far beyond that of a man: but they know it not; they cannot avail themselves of their natural superiority in this respect, therefore they are confounded by the commanding skill of their drivers, and tamely submit to their dominion."

Guy Pollock is understood to have been Robert Douglas Hamilton, a Scottish M.D., who had seen service as a surgeon in the army and navy. He emigrated to Canada in 1830, and died in Scarborough, near Toronto, in 1857. Before his emigration Dr. Hamilton was known in Scotland and England as the author of works of fiction, and of essays on medical and other subjects.

The *Canadian Literary Magazine*, published at Toronto in 1834, was edited by a gentleman afterwards well known in the literary world of Canada by the *nom-de-plume* of Alan Fairford. Under this signature appeared in a widely-circulated Canadian periodical a series entitled "The English Layman." The subjects handled therein were such as the following: The connection between Democracy and Infidelity, Duties of the Laity, Plain Reasons for Loyalty, the Press, Sacrilege, &c. In all the productions of Alan Fairford there is noticeable a fine, manly sentiment expressed in remarkably vigorous and pure English. I quote from the introduction to his paper entitled, "Plain Reasons for Loyalty." The scene is Cobourg, on Lake Ontario. We are reminded of the style, now of Paley, now of Washington Irving. "I sit," Alan Fairford says, "while I write, beneath one of those lofty, drooping elms which, having been spared from the general havoc of their sylvan brethren, are to be found here and there, erect in single beauty, relieving the eye after it has been wearied in gazing on extended masses of unbroken foliage. It stands on a ridge in the midst of an open country, and when seen from a distance on a summer's evening, with a sky as yet glowing with a thousand inimitable tints, it displays so minutely all its tracery, branches, and even leaves, that it appears as if it would be no difficult task to count them. But the day is as yet in all its meridian splendour. The shrill, cheerful chorus of the grasshoppers rings in my ears. The echoes of the flail mingle with the softer murmur of the breeze that wantons with the leaves over my head; and every sound and sight proclaims that the sand has still some hours to run before the hum of industry and the voice of creation will be mute. Rich, various and beautiful is the landscape on which I gaze. At my feet the country descends into a gentle slope; to this succeeds a narrow, fertile valley, with a stream winding through it that waters the meadow, turns the wheel of the mill, and contributes alike to the sustenance and health of man, the cool refreshment of the panting cattle, the growth of manufactures, and the promotion of agriculture. Beyond the valley the ground ascends into a gentle undulation. Fields that have consigned their produce to the barn, lie denuded of their wealth, but dotted here and there with browsing cattle. A range of woods, with many a crested eminence wrapped in the blue haze of an autumnal day, terminates my view. The frost has not yet scattered the colours of the rainbow over the forest, but there is nothing like sameness in the glorious landscape. Orchards laden with reddening fruit, the white farm house with its commodious outbuildings, the country inn, flanked by a long line of Lombardy poplars, which here need not droop for want of Italian skies, the towering mill with its pointed angles, and the broad Ontario stretching to the right, are objects that successively attract the eye as it travels with human restlessness in search of novelty and variety. Now I turn my head, and perceive that the picture is incomplete, for I have not yet introduced into it a pleasing scene of the unfinished harvest—the sheaves that you cannot look upon without thanking God for your daily bread, and the rising stack on which they will shortly be piled. Alongside of the gathered and gathering treasures of the present year, the husbandman is committing to the rich fallow the promise of the next; and my mind is at once regaled with the sight of a present plenty and the prospect of its undiminished succession. To whom do these woods and meadows, these streams and valleys, these smiling homesteads, these flocks and herds, belong? Does their possessor reside in some baronial hall—the rural king of his surrounding tenantry? Or is the soil the property of a few, while the many rise up early and lie down late, and eat the bread of carefulness? The inequalities of condition and wealth—the characteristics of an old and densely-peopled country—are not as yet known in Upper Canada."

The following has reference to the Duke of Wellington: "We are prepared to view him meditating gigantic schemes and laying down the plans by which they are to be accomplished. We find no more than we expected when he compresses a life of truth and experience into a single hour, and with an intuitive glance foretells the catastrophes of the various dramas enacting on the world's wide stage before him. We perceive no cause for special wonderment in his untiring sagacity, in his combination of the aggressive vigour of Marcellus with the defensive caution of Fabius, in his unrivalled practical sense, his unshaken magnanimity, and his lofty disinterestedness. These, it must be confessed, are signal and noble qualities, but they fill us with esteem rather than with affection; they dazzle rather than fascinate our eyes; and their combination is not a novel feature in the character of the world's foremost men. The traits which these Despatches exhibit to us for the first time, and which previously were not in general accorded to the Duke of Wellington, are those which add love to admiration, and heighten national gratitude into personal attachment. It is ennobling to our species, and delightful to our feelings, to find that the highest excellences of private station are not irreconcilable with the stern career of the victorious warrior, and that the household virtues and the peace-loving humanities of life may be found among the demoralization of camps and the carnage-covered fields of battle."

I select one more passage from this excellent master of English style. It is from a paper in a humorous strain, entitled, "A Defence of Little Men," and it professes to be, not by Alan Fairford this time, but by Sir Minimus Pigmy. "Perhaps some tall gentleman is laughing at what I have written," Sir Minimus says, "but he had better take care not to laugh in my face. Little men are as choleric as Celts; and Sir Jefferey Hudson (a name ever to be venerated by me) has shown that little men are not to be insulted with impunity. On the breaking out of the troubles in England, the pigmy knight was made a captain in the Royal Army, and in 1644 attended the Queen to France, where he received a provocation from Mr. Crofts, a young man of family, which he took so deeply to heart that a challenge ensued. Mr. Crofts appeared on the ground armed with a syringe. This ludicrous weapon roused the indignation of the magnanimous little hero to the highest pitch. A real duel ensued, in which the antagonists were mounted on horseback, and Sir Jefferey, with the first fire of his pistol, killed Mr. Crofts on the spot. I cannot refrain from lingering on the history of the gallant Hudson. Sir Walter Scott, in his novel of 'Peveril of the Peak,' has immortalized the chivalrous little knight, and I humbly wish to lend my feeble aid in making known to the Canadian public the deeds of departed littleness."

These remarkable papers were from the pen of Mr. John Kent, chief secretary for a time to Sir George Arthur, one of the Lieut.-Governors of Upper Canada, and afterwards private tutor and confidential secretary to the present Earl of Carnarvon. The influence of Mr. Kent's character and writings on the minds of many of his contemporaries during his sojourn in Canada was very marked.

Between 1848–58, our Canadian Streetsville acquired great distinction and *éclat* as being the scene of the publication of the *Streetsville Review*, a periodical which managed to gain for itself a reputation altogether beyond the average for originality and spirit. Its editor occasionally spoke of himself as Solomon in the columns of this journal, and under this sobriquet, innumerable oracular utterances of the Review were quoted and circulated in most of the newspapers of Canada. Dry Scotticisms and quaintly-formed words and expressions gave a kind of pungency to Solomon's observations on current events. The following will serve as specimens:

From the *Weekly Review* of June 17th, 1854. "Lyrical Lunacy. Solomon has ever regarded it as a leading feature of his mission to check, by judicious application of the taws, that itch for engendering idiotical rhymes which so calamitously characterizes this cranky age. The latest escapade of this description, calling for stripes, appears in the *Commercial Advertiser* of Montreal on Tuesday," &c. He then transcribes and remarks on the doggerel referred to. Again: "Solomon in his slippers. It is a common superstition among the million that editors are fashioned out of cast-iron, and that they can engender articles from the primary day of January to the final ditto of December without experiencing lassitude or performing the muscular action of a yawn. Never was there a more monstrous fallacy. Solomon at least can speak for himself, that he is subject to all the weaknesses of our common humanity, and desiderates an occasional modicum of repose quite as much as the balance of Adam's multitudinous family." Again: "The rival settlements of Hamilton and Toronto being witnesses, Streetsville is progressing at railroad speed. Like the fabled bearer of the mythical Jack, a sharp-eyed observer can twig the perpetual motion of its growth. Our grist and saw-mills are too numerous to be recapitulated without drawing sundry breaths; our stores emulate the dollar-coining emporiums of King Street (Toronto); and before long, the magic wand of an act of incorporation will call into being crops of civic fathers, wise as Solon, and inflexible as Brutus senior. In these circumstances, we are patriotically desirous that our beloved sucking city should put her best foot foremost, and exhibit to an admiring universe smooth-kempt hair and a shining well-washed face. Now, nothing would tend so much to improve the frontispiece of Streetsville as a sprinkling of trees judiciously emplanted before her churches, marts and villas. Stern truth compels us to admit that the village does not possess an overly inviting appearance to the stranger who, whirled past in the accommodating machine of Squire Harris, snatches a passing glance at her charms. Tardily doth the plasterer and bricklayer repair the dilapidations which accident or senility makes in her dwellings; and too frequently doth the stocking or superannuated Kilmarnock night-cowl usurp the place of plate or crown glass in the windows of her sons. If all these flaws were redressed, most assuredly we would rise in the scale of cityhood so far as appearance went. But chiefly and above all would the arborical immigration which we advocate heighten the witcheries of our far-famed clachan. Let the sceptic on this head pay a visit to the neighbouring republic, and he will frankly admit that we have got the legitimate sow by the ear." Kossuth's avoidance of the British side of the Lakes in 1852 is thus spoken of: "We esteem it as a high compliment that Kossuth has not visited Canada. We thank him for the tacit admission that the spurious metal which so tickled the vulgar taste of our republican neighbours would be altogether thrown away upon the denizens of

British North America. There is, there must be, a lingering fragment of shame about the man after all. It is a redeeming feature in Kossuth's character that he lacked assurance to preach to a free people, like the subjects of Queen Victoria, about freedom, after coming from the land of bondage, redolent with the foul kisses of the tyrant, and gorged with money earned by the toil of the slave."

This Solomon, under another guise, edited the *Anglo-American Magazine*, a valuable periodical published for several years in Toronto by Mr. Maclear. One conspicuous feature of this monthly was a department in which, after the pattern of *Blackwood* of old, a group of friends discuss matters in a free and familiar manner. The personage who figures as the editor in these "Sederunts," as they are called, is "Culpepper Crabtree, Esq.," major in the militia, at whose shanty events and books are made to pass under review; the other interlocutors are the Doctor, the Laird, the Squireen, and Mrs. Grundy. The shanty itself is on the banks of the Humber. It is thus spoken of: "On a gentle slope, some four miles to the westward of the 'Muddy clearing,' as Solomon of Streetsville delighteth to call our city, *i.e.*, Toronto, may be seen one of those primitive fabrics, yclept in Cannuckian vernacular a 'shanty.'" It is further described. The conversation then proceeds in a natural, chatty way, with a plentiful intermixture of anecdote and humour. Thus in the year of the Duke of Wellington's death (1852), we have:—

"LAIRD.—Ha'e ye read, Crabtree, the vidimus which the *Times* gives of the great Duke's life and character?

MAJOR.—I have, and with unmixed enjoyment. It is one of the most masterly essays which has graced the periodical press for many a long day, far surpassing, in my humble opinion, the highest flights of that showy but intensely superficial writer, Thomas Babington Macaulay.

LAIRD.—You are a thocht too hard on Tummus, Major. His sangs o' auld Rome rouse my blood like the blast o' a border trumpet.

MAJOR.—By your leave, Laird, you are creating a man of straw for the mere purpose of demolishing your handicraft. I said nothing against Macaulay as a poet, but merely demurred to his pretensions as a historian.

DOCTOR.—The less a fossil such as you are, Crabtree, says respecting a Whig historian, the better. You know that I, as a Whig, can never agree with your opinion. We are wandering, however, from the point in hand. What a wonderful establishment the *Times* must be, which, almost at an hour's notice, can turn out such an article as that to which I referred."

Again, in 1852, thus closes a discussion on Cooper, the United States novelist. The Major, or editor, thus speaks of the book before him, viz., a "Memorial of Cooper," as a pleasingly compiled record of certain proceedings which have recently taken place in New York, with the view of giving expression to the public sentiment on the death of that illustrious novelist. On the Doctor's observing that "Cooper's Leatherstocking" is a *chef-d'œuvre,* the Laird rejoins: "I like his writings weel eneuch; but ah, man, he's no to compare wi' Walter Scott," &c. The peroration of a eulogy by W. C. Bryant is quoted, of which the language is somewhat high-flown. This draws from the Squireen the observation: "Ah! how swately the dew of praise must fall on the sensibilities of departed genius, if the spiritual essence be cognizant of the incense of corporeal votaries at its shrine and susceptible of its influence." To which the Laird gruffly replies: "Nane o' your poetical flights o' fancy! Dinna forget we ha'e four miles o' limestone to hirple o'er afore the sma' hours come ringing frae the St. Lawrence Ha'. Guid nicht, Major." (*Exeunt.*) Thus the sederunt closes.

Solomon of Streetsville was the Rev. J. MacGeorge. Mr. MacGeorge, prior to his emigration to Canada, was an experienced litterateur, a contributor to *Fraser* and other English periodicals. In his graver moods, Mr. MacGeorge was a poet of no mean grade, as we shall perhaps hereafter see.

I observe in Morgan's *Bibliotheca Canadensis* that in 1858 a work of fiction, highly spoken of, appeared in Montreal, entitled "The Life and Adventures of Simon Seek; or, Canada in all Shapes," by Maple Knot. I regret that I have it not in my power to give a sample of Maple Knot, who was Mr. Ebenezer Clemo, now deceased. The nom-de-plume Maple Knot suggests to me the mention here of "Maple Leaf," or rather "The Maple Leaf," a very handsome Christmas or New Year's gift book, which was published in Toronto in 1847, and in several successive years. The "Maple Leaf" introduced to the Canadian public a goodly company of creditable local writers, who, without the stimulus afforded by this publication, would perhaps never have ventured to try their hand at such work. The "Maple Leaf" thus contributed much to the genesis of a high-class Canadian literature. It were to be wished that the editor of this volume had identified himself with Maple Leaf as a nom-de-plume instead of resigning it altogether to the volumes of which he superintended the issue. The papers in that book are all anonymous. If none of them are from his own facile and elegant pen, it is certain that the prefaces are his handwork. From these accordingly I venture to make an excerpt or two, treating them as though they had appeared under the signature of Maple Leaf.

First, I give a pleasant account of our Canadian London as it was in 1848, with some remarks on the Canadian habit of transplanting local names from the "Old Country." "The good custom," Maple Leaf says, "of naming places, as they spring into existence in this new world, after the old localities with which the early associations of the settlers are connected, at once attests the affectionate remembrance of the fatherland, and preserves unimpaired the sweet ties which bind us to 'home,' as we still fondly call the far-distant land of our birth. In the present case the town of London, the county of which it is the capital is Middlesex, the stream the banks of which it graces bears that name so closely associated with the most thrilling events of English history, the Thames. The toll-gate on the right of our view opèns on another Westminster Bridge; and a second Blackfriars would meet the eye if we could but see a little more to the left."

"Procedo et parvam Trojam, simulataque magnis
Pergama, et arentem Xanthi cognomine rivum
Agnosco, Scææque amplector limina portæ."

"Nor is the Canadian stream," Maple Leaf continues, "wholly wanting in historic interest; for in a battle in its neighbourhood fell the noblest Indian warrior that ever drew bow, or raised rifle, in defence of the 'White Father' of the tribes. It was at the battle of the Thames that the gallant *Tecumseth* was lost to his brother warriors, and to his country; but this, however, was at a distance from the scene more immediately under our notice. Elevated on a pleasant bank, which looks down upon the junction of two streams, stands our Canadian London. As it stretches itself towards the waters that flow on either side of it, it seems as if fondling them into that amity with which they embrace and flow on united, ere they leave the reconciler of their variance. From this 'meeting of the waters'—ah! how unlike that sweet valley in our own dear isle, with

'Her purest of crystal and brightest of green!'

—the rapid river hastens on through a fertile country, until it pours its tribute into the lap of St. Clair, some miles below Chatham. Long previous to the foundation of the town, the surrounding country was well settled, and contained many wealthy farmers, and the spot was called by the uncouth familiar appellation of 'The Forks.'"

In another place, we have a reference to the University of Toronto, or, as it was called in 1848, the University of King's College. At that time the work of the University was carried on in the Parliament Buildings, the Government having been removed, when the two Canadas were united, from Toronto to Montreal. A flagstaff is also spoken of in Government House grounds, whereon, when the Governor was here, a flag used to be displayed. After numerous vicissitudes of local history, it is pleasant in 1876 to have our Parliament Buildings at Toronto again put to their proper use; and to see the symbol of a Governor's presence amongst us again floating over the same Government House grounds, which had been for a time deserted. A humorous allusion occurs to the fact that while the University was in occupation of the central Parliament Building, one of the wings of the same building was made a receptacle for lunatics. It is singular that it has been the fate of the University, since its removal to its present magnificent quarters, to have again become a close neighbour to a receptacle for lunatics. "The long ranges of red brick, towards the left of the view," Maple Leaf says, speaking of an engraving of Toronto, "were once tuneful with the eloquence of our legislators, but are now the peaceful retreat of learning. In the main structure and west wing are the temporary halls and lecture rooms of our noble university, while the building on the east is at present occupied by the Lunatic Asylum, a playful illustration of the poetic adage,

'Great Wit to Madness nearly is allied.'"

"A little in the rear," the account of the engraving goes on to say, "above a thick plantation, may be seen the staff which, in days gone by, was wont to bear the flag that indicated to the lieges of Toronto the presence of the Lieutenant-Governor, in the official residence embosomed by those dark trees."

Maple Leaf, who thus in 1848, and ten years earlier it may be said, was the first to call forth with sensible effect, and mould into respectable form, a higher Canadian literature, was the Rev. Dr. McCaul, still among us, engaged in the same work; not now single-handed, so to speak, but surrounded by compeers of the first class, all "minding the same thing," seconded, too, more or less, by a younger generation scattered throughout Canada, who, having received from such hands the sacred torch of learning and light, are ambitious, it is hoped, to pass it on, trimmed and brilliant, to their successors.

I next make an extract from a volume of a very miscellaneous character, published in Montreal in 1860, bearing on its title page, in addition to the real name of the author, the *nom-de-plume* by which he had previously been extensively known, viz., "One who has whistled at the Plough!" This work is entitled, "The Conservative Science of Nations; being the first complete narrative of Somerville's Diligent Life in the Service of Public Safety in Britain." The mass of the book consists of matter with which Canada has little concern, but the passage which I quote relates to Canadian affairs. It criticises, it will be seen, the tone adopted by the editor of the *Quebec Mercury* towards the Canadian French, and hints that the politics of that paper are, in his opinion, "small," *i.e.*, somewhat narrow in their range. He also gives his views on the Science of Political Economy.

"Of difficulties in governing Canada, on which you remark with emphasis, I do not," the Whistler says to the editor of the *Quebec Mercury*, "as a stranger, presume to speak beyond this, that the unenfranchised working class of Britain does not inherit an enmity of race, language and religion, against the throne, church, laws and constitution. If you see no difference between the French Canadians who are enfranchised here and the unenfranchised men of Britain, I do. You date the difficulties of Canadian Government from the advent of the Whigs to power at the Reform era, 1830, 1831, 1832, and rail at me for being their ally, while I call myself a Conservative. Sir," he then shrewdly observes, "the difficulty in governing Canada dates from the 13th of September, 1759. Difficulty of government is a penalty of conquest everywhere. Not all the wisest or sternest Tories ever born to the inheritance of power, could govern Canada by a compulsory sword and proscription of race, as you seem to desire, in presence of the United States and of free institutions in Britain. As for Radicals, Whigs, Tories and any such party alliances, I never was of them. Mine has not been a life of small politics. Much of my literary life has been spent, and my brain worn to even incapacity for literary labour, in rescuing the science of Political Economy from the soulless materialism which had made it, in mouths of Whigs and Radicals, odious to the People. It has been my self-imposed task to humanize and Christianize Political Economy. I assert man to be the primary element in national wealth."

The Whistler, Mr. Somerville, still, I believe, resides in Canada, and occasionally addresses a communication to Canadian journals. It was his intention, at one time, to identify himself with a periodical on Canadian Agriculture. In the preface to "The Diligent Life," he thus speaks of himself: "Having been bred in the toils and joys of agricultural and rural life, its associations have for me a charm beyond all other objects of literature."

By right of subsequent intimate association with our country, we may fairly claim as a Canadian writer, Libertas, the author of a book entitled, "The Fame and Glory of England Vindicated," which appeared at New York in 1842, with that *nom-de-plume* on its title-page. It was a review and a refutation in detail of the work of a United States writer named Lister, who, after a visit to England of a few weeks, in 1840, undertook to pronounce judgment on what he saw and heard there, and to give the pre-eminence in most things to the United States. The book was entitled, "The Glory and Shame of England." Libertas exposes the mode in which Lister's book was manufactured, and the numerous misstatements and unwarrantable inferences it contained respecting England and her institutions; and in the course of the discussion he is led to give his views—which are enlightened and broad—on the English Corn Laws, the Poor Laws, British and American Tariffs, Taxation, Education, Church and State, Slavery, and other interesting questions; and "in reversing," Libertas says, "the low position in which Lister has placed Britain and her institutions, and the high elevation he has assigned to the United States, we conceive that we have done no more than justice requires, and which, we feel assured, impartial history will award to the two countries, when the transactions of the present generation shall be placed on record. * * * The author will think his time well bestowed," Libertas continues, "if he shall succeed in shewing the impossibility of such works as 'The Glory and Shame of England' being published without risk of detection and exposure, or in throwing any additional light on those questions which are now agitating the public on both sides of the Atlantic." I give a passage from the thirteenth chapter as a specimen of the writer's clear and vigorous style. Lister had asserted that "English liberty had its broadest foundations during," as he chose to call it, "Cromwell's splendid administration." Libertas then proceeds: "Now, we never knew any man who was a genuine friend of liberty, who admired Oliver Cromwell. With such persons you will invariably find that it is republicanism, not liberty, that they admire. It is not tyranny that they dislike, but monarchy. Cromwell was, like many republicans, a seeker of power. Republicanism was with him, as with Napoleon Bonaparte, the ladder by which he reached that power. Both kicked away the ladder when the power was attained. Will our author say," asks Libertas, "what stone was ever laid on the temple of freedom by Cromwell after he reached his elevation? He broke up the remains of the Rump Parliament with a military force, crying out as the last vestige of popular power disappeared, 'Take away that bauble.' He summoned another Parliament, consisting of his own creatures, who went such lengths in folly that even their master was ashamed of them." Then a little further on: "We have often been astonished to hear men, styling themselves democratical republicans, praising Napoleon Bonaparte. That unprincipled man went farther lengths than Cromwell; and yet because he was not born to royalty, and because he overturned ancient dynasties, he is still looked on with respect by republicans, and all his tyranny and ambition are forgotten. The splendid administration and splendid talents of these ambitious men, only rendered them more dangerous to the liberties and independence of nations. The solution of such strange inconsistency is plainly this: that many republicans are not favourable to liberty, and many understand nothing of its genuine principles. It is too readily assumed that republicanism is synonymous with freedom, but such is not necessarily the case. Oppression by a majority is just as much oppression as by a king or aristocracy; and the oppression becomes truly fearful, when that majority delegates its power to wicked and selfish men, and is so ignorant that it is not aware when that power is abused."

Lister, the very unfair, and in fact ignorant criticiser of old England and her ways, was an American clergyman. Hence the motto from Burns on the title-page of the "Fame and Glory of England:"

"Some books are lies frae end to end,
And some great lies were never penn'd;
E'en *ministers*, they ha'e been kenn'd,
In holy rapture,
A rousing whid at times to vend,
And nail't wi' Scripture."

Libertas is known to have been the late Peter Brown, Esq., the founder of the *Globe* journal in Toronto; a Scottish gentleman, freshly remembered in our community for his eminent talents as a journalist, for his high literary attainments and skill, and for many estimable traits of character, as a genial and benevolent member of society.

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THE EASTERN ORIGIN OF THE CELTS.

SECOND PAPER.

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In my last paper on this subject I mentioned an important Celtic family which did not trace its descent directly from Gilead, but which, nevertheless, sustained intimate relations with his line. Gael and Cymri, according to Niebuhr, were the two great components of the Celtic stock.[1] Josephus long before had been struck with the connection of the two names, and accounted for it by deriving the Galatians from the patriarch Gomer, in which he has been followed by a large number of writers coming down to the present day.[2] It was, however, with no intention of tracing the family of Gomer or the origin of the Cymri that I commenced the researches in the departments of comparative geography and mythology that have resulted, as I believe, in fixing the relations of the latter. The result, entirely unexpected and even astonishing to myself, was the consequence of a legitimate and full, but by no means exhaustive, induction from geographical facts and mythological statements extending over a wide field. It rests to a great extent, although far from exclusively, upon the collocation of names in the topographical nomenclature and mythological genealogies of many peoples. I do not claim that all the names mentioned by me refer to the personages whose descendants I seek to trace. These are so numerous that time has not permitted me to make that minute investigation into their history which would enable me to write with certainty. A few of them I have already brought forward in totally different connections,

[1] History of Rome, ii. 520. [2] Josephus' Antiquit. I., vi. 1.

and the present state of my knowledge does not allow me to assert which of these connections is the most worthy of confidence.[3] I may not even have discovered the precise relations in which the personages with whose history I deal stood to one another. Yet this, I think, will be found indisputable, that they were intimately related, and that their descendants constituted an important element in the great Celtic family of nations.

My starting point is the family to which Gilead belonged. This family I believe to have been that of Bethlehem. However, this for the present is immaterial. We read that Gilead had a sister, whose name was Hammoleketh, or, The Queen.[4] This remarkable lady, for such her name would indicate her to have been, has no husband assigned her in the Bible, but the names of her three sons are given. These are Ishod or Ishchod, Abiezer, who is also called Ezer, and Mahalah. In seeking for a fuller genealogy of the family of Hammoleketh, I found it impossible to associate any of the Ezers of Chronicles with her second son, and for the first no connections appear. A geographical trace is, however, afforded for the identification of the former in a place in Abiezer of Palestine, called Ophrah.[5] Now Ophrah is mentioned among the descendants of Othniel the Kenezite. His father is Meonothai, who seems to have married Hathath, the daughter and only child of Othniel. It is very probable, therefore, that Meonothai was the son of Ezer or Abiezer.[6] A more interesting connection has been found for Mahalah. His name is identical, not only with that of the place called Meholah or Abel Meholah, which was Gileadite, as was also Ezer, Jazer or Abiezer, but also with Mahol, the name of a sage mentioned in the book of Kings.[7] There his three sons are spoken of, their names being Heman, Chalcol and Darda. These sons of Mahol again appear in the book of Chronicles among the descendants of Judah with slight changes, Calcol and Dara presenting variations illustrative of the mutable character of early language.[8] Heman, Calcol and Dara are in Chronicles called sons of Zerah, an honour which they shared with

[3] Eponyms like Ishod and Eshton, Moleketh and Molid, Abishur and Abiezer, Mamre and Zimran, Eshcol and Chalcol, cannot fail to present great difficulties in the attempt to distinguish their traces in many languages.

[4] 1 Chron. vii. 18.

[5] Judges vi. 11.

[6] 1 Chron. iv. 13, 14.

[7] Judges vii. 22; Numb. xxi. 32; 1 Kings iv. 31.

[8] 1 Chron. ii. 6.

Zimri and Ethan. In Kings, however, Ethan is spoken of as the son of Zerah or Ezra; Zimri is ignored; and Mahol is made the father of the wise triad. There can be no doubt that these are the same persons. My conclusion, the grounds of which will appear in the sequel, is that Zimri, the first mentioned among the sons of Zerah, was the father of Mahol or Mahalah; that Heman, Chalcol and Darda were his grandsons; and that Zimri accordingly was the husband of Hammoleketh. But who was Zimri himself? For many reasons I have been led to regard him as the same person with Zimran, the eldest son of Abraham by Keturah.[9] Why he is called the son of Zerah I cannot with absolute certainty say, but think it probable that his mother Keturah, after the death of Abraham, married Zerah, an Ethiopian.[10] The above may seem a meret issue of hypotheses. I grant it, and do not ask belief in the alleged facts on a simple *ipse dixit* or plausible statement of theory. My own convictions did not arise from any such arbitrary interpretation of scripture passages, nor did I upon these frame any theory whatever. The evidence which constitutes the remainder of this paper, and which is intended not to trace the family of Zimran but the origin of the Cymri, will, I think, show that the foregoing necessary statement has at least strong probability on its side. Another connection of the family of Zimran may be mentioned here. His mother was Keturah, and his brothers, Jokshan, with a son Dedan and grandsons Asshurim, Letushim, Leummim; Medan; Midian, with his sons Ephah, Epher, Hanoch, Abidah and Eldaah; Ishbak; and Shuah.[11] As for Keturah, I am inclined to believe that she was a sister or near relative of the Amorites, Aner, Eshcol and Mamre, with whom Abraham was confederate.[12] I have some light upon the story of Zerah, his son Ethan and grandson Azariah, but to set it forth here would involve unnecessary complications.

I purpose restricting myself in the main to the family of Hammoleketh, the sister of Gilead, uniting with her, as it seems to me I must, a certain Zimri or Zimran. As part of this family I count Heman, Chalcol, and Darda, the sons of Mahol or Mahalah. For

9 Gen. xxv 2

10 Zerah or Tirhacha long remained an Ethiopian name, 2 Chron. xiv. 9. I do not by any means suppose that Zerah was a Cushite. He was a son of Achumai or Kames, the Horite King of Egypt, and the ancestor of the Zorathites or Caphtorim.

11 Gen. xxv. 1-4.

12 Gen. xiv. 13 This connection is antecedently very probable, and the association of the names of Eshcol and Mamre, at least, with those of Keturah and her sons tends to confirm it.

Ishod no other connections have yet been found; and the relations of Abiezer with Meonothai and Ophrah I shall only indicate in passing. In a similar cursory manner I intend referring to the brothers of Zimran and their descendants, as well as to their mother Keturah and her supposed relatives, Aner, Eshcol and Mamre. The following is the genealogy as I propose to restore it, the names in capitals being those which form the subject of geographical and mythological comparison:—

Amorite

Zerah=Keturah=Abraham   Aner   Eshcol   Mamre

Ethan   ZIMRAN=HAMMOLEKETH   Jokshan   Medan   Midian   Ishbak   Shuah

Azariah   ISHOD   ABIEZER   MAHALAH   Dedan   Ephah   Epher   Hanoch   Abidah   Eldaah

Meonothai   HEMAN   CHALCOL   DARDA   Asshurim   Letushim   Leummim

Ophrah

Out of thirty-two names, therefore, I at present, in order to avoid confusion and to guard against hypothetical connections, direct attention to eight only. The list is larger than that which formed the subject of my last paper, and is thus sufficiently large to enable one to predicate something from a mere geographical comparison. Unfortunately, however, there is a lack of determinateness in the character of the names which hinders their presenting that identity of form in different languages, which has appeared in those belonging to the family proper of Gilead. The Greek form of Zimran is Zambran, so that an adventitious *b* or *p* sound may be expected in the body of the word. The final *n* of proper names in Hebrew is exceedingly inconstant, and generally disappears in patronymics.[13] Even the initial *z* may not only be replaced by *c*, *k*, *d*, *t*, or *s*, but may be reduced to an aspirate or even an open vowel. Ishod or Ishchod may be deprived of its initial *i* and appear as Shochad, its root. Abiezer presents peculiar difficulties, the prefix Abi being unnecessary, and the word Ezer itself, as commencing with *ayin*, and containing the changeable letter *zain*, being liable to appear in such forms as acr, agr, adr, atr, asr, azr, or as the same preceded by c, g, or some equivalent, Gadr, Actr, &c. Mahalah may aspirate or altogether omit the

[13] An example is found in Ithrite, a noun derived from the name Ithran. Ithri is to Ithran as Zimri to Zimran.

medial *cheth*, as in Machalah, Malla; it may admit a prosthetic *a*, and, as in the case of Zimran, insert a *p* or *b* sound between the consonants, such as we find in Amphiclea, Amphiale, &c. Heman, commencing with a mere aspirate, may be found preceded by *d* or *t*, Deman, Teman. Chalcol or Calcol can hardly be expected to retain its final *l*, which may be altogether omitted or replaced by *r* or *s*. Dara or Darda has two forms to begin with, and the final letter being *ayin*, will be found to end with *c*, *g*, *s*, or *ng*. Our subject is thus encompassed with philological difficulties of no mean order, and for this reason I have supplemented the geographical comparisons with others derived from mythology and tradition, which I trust may tend to confirm the evidence that geography supplies.

Palestine affords evidence that the children of Hammoleketh were counted as part of the family of Gilead. Abiezer was situated near the land of Gilead, and Jazer, presenting another form of the name, constituted a region of it; Abel Meholah was in similar proximity, and Barzillai the Meholathite is also called a Gileadite.[14] The name Abel Meholah, if like Abel Mizraim it denotes "the mourning of Mahalah," may furnish the clue to a tragical story. It may, however, simply mean "the meadow." As such we may expect it to reappear in other parts of the world in some form like Philomelium. It is worthy of note that the family is not only represented as one of pre-eminent sages but also of musicians, so much so that the name of Meholah was applied in different forms to musical compositions, and the meaning of the root from which it is derived is *singing*. But the word Zimran itself means *a song*. Abiezer or Ezer indicates *the helper*, and appears in a remarkable Greek word for which no root can be given, *Epikouros*, meaning the same thing. The etymology of Heman and Chalcol is obscure, unless the former, like Jamin, denote *the right hand*. Darda is supposed to signify *the pearl of wisdom*. A similar Celtic connection to that which comparative etymology afforded in the case of the descendants of Gilead is found for three of the names of his sister's family. Zimran, *the song*, is the Erse Amhran, with the same meaning. Mahol or Mahalah is the Welsh Moli, *to sing*, Mawlganu, *to chant*, and the Erse Mal, *a poet*. But, still more remarkable, the obscure word Ishod or Ishchod, from the root Shochad, *a gift or present*, is reproduced in the Erse Asccadh, bearing an identical signification.[15] Were I sufficiently conversant

[14] 2 Sam xxi. 8 Compare 2 Sam xvii 27
[15] The Persian Shekhaut, meaning *liberal, generous*, is probably the same.

with the Celtic languages, I doubt not that similar agreements of the Hebrew and the Celtic might be found in the case of the other names.

As, in tracing the wanderings of the Celts, Persia was my starting point, it is fitting that the Cymri should first meet us in the same ancient, historic land. It is there, between the Oxus and the Indian Ocean, that Ptolemy and other geographers placed the Comarians.[16] There, also, we find the Gimiri of the Persian inscriptions; and from the same region Pezron derived his Cymri, in which he has been followed by more recent and more scientific investigators.[17] Now, the Bible should shed some light upon this large portion of the population of a country which had important relations with Palestine. And so it does. In Jeremiah xxv. 25, we find the people of Persia classified as Zimri, Elam and the Medes. Elam I have already identified with the Gileadite or Celtic line. I do not at present enter upon the origines of the Medes, who, I am convinced, were like Zimran of the so-called Midianite family, deriving their name, as Matieni itself indicates, from Medan and Midian, two of the sons of Abraham by Keturah.[18] Zimri is identical with the name we have already found in Chronicles, and is the form in which we should naturally expect the Zimranites to appear. I have indicated that the word Zimran presents a variety of modifications in transliteration. The initial *z* may be represented by *c*, *g*, *d*, *t*, or *s*, and may even be replaced by a breathing or an open vowel. An illustration of the latter has been seen in the identity of the Hebrew *Zimran* with the Erse *Amhran*. But a better illustration is afforded in the Arabian Homeritæ, who, according to the testimony of Philostorgius, were the descendants of one of the sons of Abraham by Keturah; and this son can be none other than Zimran.[19] Another form is that of the LXX., in which Zambran is the equivalent of the Hebrew word. Such a form meets us in the modern Persian name, Gombroon. In addition to this name, which belongs to Persis, we find Amarieæ in Media; Amarusa, Asmura, Samariana and Tambrax, in Hyrcania; Ambrodax in Parthia and Margiana; Semiramides Montes in Car-

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16 Ptolem. vi. 11. Pomp. Melæ, i, 2.

17 Rawlinson's Herodotus, App. Book iv, Essay 1. Pezron's Antiquities of Nations, i. 2, 3, &c.

18 The traces of the Midianites are found in all the Zimrite regions of Asia, Africa and Europe, extending even to the Modona or Slaney in Ireland. Were I to add the traces of Jokshan, this paper would double its size.

19 Philostorgii Epit. iii. 4, ap. Photium.

mania; Tamorus in Gedrosia; Zimyra in Aria; Amares and Chomora in Bactriana. The eldest son of Hammoleketh was Ishod, a name derived from the root Shochad. In his name we discover the reason why Segistan, Segeste, and similar terms, so constantly accompanied the Celtic stock, as I set forth in my last paper. The Soxotæ and Systa of Persis; the Astaceni and Socanda of Hyrcania; Issatis, Astasana and Tastache of Parthia; the Isatichæ of Carmania; Asthæa, south of Gedrosia; Asta, Astauda, Astaveni, and Sacastene of Aria; Astacana of Bactria; and Basistis of Sogdiana, are his Persian record. The family of Ezer or Abiezer is exceedingly hard to trace; and it is with diffidence that I present Azara of Media with Tigrana and Tachasara; Agra of Susiana; Gadar of Parthia; Gedrosia itself; Casirotæ of Aria; and Icarus of Bactria. The names of Mahalah and his mother Hammoleketh or Moleketh, seem to have been frequently associated, and it is hard to say when one and when the other is to be found commemorated in a geographical name containing as its chief elements the letters *M. L.* Such are Amul and Maltai of Media, Melitena of Susiana, and Malana of Gedrosia. The paucity of Mahalah's geographical records may be accounted for by the superior fame of his children. These may be found in Amana, Acola and Dariausa with the Derusiæi of Media; in Deera of Susiana; the Daritæ of Hyrcania; Dordomana of Parthia;[19*] Omœnus and Dara of Carmania; Cocala of Gedrosia; Dammana of Aria; and Dargidus of Bactria. The Daritæ must furnish us with the originals of the Celtic Druids, being the descendants of Darda or Dara, which, in the latter form, with the full power of the Hebrew *ayin* is the Erse Darag, *the oak.* The Persian Dur, *a pearl,* agrees so far with the Hebrew. The Chaldeans and the Daritæ were the early Culdees and Druids; and with the latter the oak has ever been connected, both in the matter of worship and of name. Aristotle, Diogenes Laertius, and other writers associate the Druids with the Persian Magi; and Pliny expressly says that the Druids of Britain so cultivated the magic art that they would appear to have taught it to the Persians.[20]

In regard to mythology, we find two early Persian names resembling that of Zimran. One of these is Kaiomers or Gayomers, who has often been identified with Gomer; and the other is his

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19* The Parthians are also made the descendants of Keturah by Moses of Chorene. Euseb. Chron. Ed. Migne, p. 618.

20 Plinii H. N. xxx. 4.

descendant, Tahmouras.[21] Mirkhond speaks of the latter as the father of Fars, so that he is thus made to connect with a son of Gilead, for nothing is plainer than that Peresh was the namer of Fars or Persis.[22] But the line of which Kaiomers was the first, was called the Pischdadian, and a son or grandson of that primitive king was Houcheng or Pischdad. The name Pischdad is sufficiently near, with the prefix of the Coptic article, to that of Ishod to make the connection of Kaiomers and Pischdad significant. The statement of Mirkhond, that Houcheng or Pischdad was by some writers supposed to be the same as Mahaleel, may point to an early tradition which united his name with that of his brother Mahalah.[23] It is somewhat remarkable that Pliny should mention among the inventors of magic the Median Apusorus and Zaratus.[24] The name Apusorus is so uncommon that it is pardonable to associate it with Abiezer, and to suggest the possibility that Zaratus may represent his nephew, Darda.

The ancient geography of India contained names that fitly set forth the whole family of Zimran. Such are the Kamarupas, Kimpurushas, Tumburas, Mlechhas, Nishadas, Apsarasas, Mekhalas, Yamunas, Kulakas and Daradas.[25] Already we have found Amares in Bactria on the Indian borders; and farther north on the Jaxartes were Comari. The Moguls and Tartars may have claimed kindred with them, as the descendants of Machalah and Darda. During the classical period, the north-western part of India about the Indus was peopled by the descendants of Zimran. Such were the Astaceni and Malli; and such, in the time of Darius Hystaspes, the Abissares and the Dardæ.[26] Near them dwelt the Glaucæ, while farther south the Jomanes or Jumna commemorated Heman, and Agra, situated upon it, was another record of Ezer. In the basin of the Indus we also find Nagara, representing Ezer, and the Soastus with Suatene as traces of Ishod. To the east, in the region of Patna, lay Miyulu or Mithila, the modern name of which, Tirhut, exhibits a replacement of Mahalah by his youngest but most distinguished son. One of the mouths of the Ganges was called Camboricum, and near at hand was Cocala. Above the lower range of the Himalayas, in a

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21 Vide Shah Nameh. It is worthy of note that Tahmouras is made the founder of Madain in Irak Arabi: Geographical works of Sadik Isfahani, Or. Trans. F., 46.

22 Mirkhond's History of the Early Kings of Persia, translated by David Shea, 134.

23 Mirkhond, 66.

24 H. N. xxx. 2.

25 Muir's Sanscrit Texts.

26 Lenormant & Chevalier's Manual of the Ancient History of the East, ii. 141.

direct line from Tirhut, flowed the Dyardanes, and near it dwelt the Aminachæ. South of Amara or Ambra in Central India appeared Mesolia, with another Cocala and, better still, a Caliguris; while Hippocuria Regio seems a mere Hellenized form of the name Abiezer. Comaria and the Tamra river in the south would indicate that the descendants of Zimran had penetrated to the extremity of the peninsula. Mr. Hyde Clarke's valuable Researches in Prehistoric and Protohistoric Comparative Philology, &c., first drew my attention to the Sumerian or Zimrite character of Farther India, including Malaya and Cambodia.[27] This distinguished philologist points out the interesting fact that the Cambodians call themselves Kammeren Khmer, and connects them with the great Sumerian family. He also holds that Malacca and not Britain furnished the supply of tin of which the Sumerians made use from an early period. Samarade in Malaya is a mark of Zimrite occupation, and so are Pagrasa, Acadra, Thagora, which may be forms of Abiezer or Ezer; Maleucolon, in which Mahalah or his mother may find a record; Calligicum, a reminiscence of Chalcol; and Tharra, which commemorates Dara.

The regions inhabited by the Zimrites in India were at one time peculiarly Buddhist, especially Miyulu or Mithila.[28] The musical dewa Timbara, pertaining to Buddhist mythology, may have been Zimran. He must certainly have been the Sumuri or Sambara of the Brahminical mythology, which plainly betrays enmity to the Buddhist families. He was slain by Indra.[29] The queen Mallika answers to Hammoleketh, but she is wrongly made the wife of Ajasat or Ishod, instead of his mother.[30] Ajasat, as a wicked king, may be the same as Chetiya, who built Astapura and Daddara.[31] If so, he is improperly called the son of Upachara or his brother Abiezer, and the father of Muchala or Machalah, the youngest of the three sons of Hammoleketh. Mahali, a famous king of Buddhist story, is no doubt the same person as the latter.[32] The ornament Mekhali, which Buddhist writers treat of, will yet be found to connect with similar

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[27] Researches in Prehistoric and Protohistoric Comparative Philology, Mythology and Archæology, in connection with the Origin of Culture in America, and the Accad or Sumerian Families, 42.

[28] Hardy's Manual of Buddhism, 129.

[29] Wilson's Vishnu Purana. He must also be Cumara, the god of war, a character that will yet appear to have been borne by two of his descendants. Vide Crawford's Indian Researches, ii. 185.

[30] Hardy, 285-86.

[31] Ib. 128.

[32] Ib. 282.

decorations in other lands.[33] The Tirttakas, a religious sect, may have been Darda's descendants, and an early class of Druids.[34] Certain it is that Druids and Buddhists alike held the doctrine of metempsychosis and other beliefs, which have led many writers to associate them equally with the philosopher Pythagoras. The learned Davies has not hesitated to associate Druidism with what he knew of Buddhism.[35]

Following the course adopted in the last paper, we return to the basin of the Tigris and Euphrates. In Chaldea, Zimran was represented by Camarina or Gomereek; his son Abiezer by Abn-Shahrein; and his grandson Darda by Teredon or Diridotis. Babylonia furnishes Thamara, the Nahar Malcha, Issedea, Sittace, Otris, Teredata and Dorista. Assyria is more full, for it was the home of the Sumerians. There we find Sumere, Samaran, Gomara, Saccada or the Sakad of Ptolemy, Aturia, Meso-Pylæ or Mosul, Calchas and Chalachene, Dartha and Dura. In Mesopotamia appear Himeria, Ombræ, Semiramidis, Saccada, Auxaris, the Mallii, Achaiakala, Cæcilium, Dura, Dadara, and Daradax. Turning from geographical to mythological and historical evidences, the great Sumerian family seems to exhibit its ancestry in the lists of Bar Hebræus and other chroniclers.[36] There we discover among the earliest monarchs, Nmrud, Cambirus, Smirus or Smirm, Zmarus and Semiramis, setting forth Zimran, unless Nmrud be a form of the name of his uncle Mamre. These must represent the so-called Medians or Midianites, who at an early period ruled in Chaldea. In other lists appear such names as Ascatades, Ephecheres, Mancaleus, replaced by Ascalius and preceded by Mamithus, who may have been Eshcol and Mamre, Mamylus and Amyntes, who, as Heman, properly succeeds Ascatades.[37] Berosus seems to have known Mahalah in Amelon and Heman in Amenon, his successor, while Darda may have been his Euedoreschus.[38] The uncommon name Chalcol is preserved in full in Khalkhalla, a surname of Nin or Bar.[39] Enyalius will yet appear as

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[33] Hardy, 281. It was also called Mela, and was a girdle.

[34] Ib. 275, &c.

[35] Celtic Researches and British Druids. Vide Higgin's Celtic Druids. Pococke, India in Greece, 102, associates the Druids with Buddhism.

[36] Cory's Ancient Fragments. In support of the Eshcol connection, it is worthy of note that Semiramis was of Ascalon.

[37] Du Pin, Bibliothèque des Historiens, Amsterdam, 211, &c.

[38] Ap Euseb. Chron.

[39] Rawlinson's Herodotus, App. Book i., Essay 10.

a form of the word Mahalah. It is therefore interesting to find Hestiæus saying that priests brought his worship into Sennaar of Babylonia.[40] Molis or Mylitta, the great goddess connected with Semiramis, if not identical with her, was undoubtedly Moleketh, the queen and wife of Zimran.[41] Her relations with the worship of Sacti and Vesta are explained by the fact that these names were derived from that of her son, Ishod.[42] The land of Milidia, mentioned in the cuneiform inscriptions, and Milisihu, who appears in Mr. George Smith's list of Babylonian kings near Ulam-Buryas, may easily represent Mahalah, the cousin of the latter's father, Peresh.[43] It is a little striking to find three brothers named Muranu, Gatiya (the Indian Chetiya), and Musalimu, sold as slaves in the reign of Simmasihu, who follows Kurigalzu, the supposed father of Milisihu.[44] This may simply indicate that the names, being those of royal personages, were common at the time, for such names do not belong to later Babylonian history. Usati, the name of the father of the three slaves, is nearer to that of Ishod than Gatiya. Aswad, the name of Akkerkuf, is probably a restored form of Ishod. There is every reason to believe that the Sumerians or Cymri, Chaldeans or Culdees, and Daradæ or Druids, made their first home somewhere near the junction of the Tigris and Euphrates. Marmarus, the Babylonian whom Pliny mentions along with the Medes Apusorus and Zaratus, as an inventor of magic, was probably Mamre, the uncle of Zimran.[45] I am not disposed to heed the unscientific modes of connecting sacred and profane history prevalent in last century. The connection which the Abbe Banier established between Druidical worship and the oaks of Mamre, however, I hold to be worthy of the most serious attention.[46]

If any part of the world possessed a Zimrite population before Chaldea, it was Arabia. Abraham sent his sons by Keturah eastward into the east country, which would embrace these two regions.[47] The Katoorah were a famous people in Arabian history, whom Pliny

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40 Cory's Ancient Fragments.

41 Rawlinson's Herodotus, i. 131 note, and App., Essay x.

42 Cox's Aryan Mythology, ii. 117.

43 Transactions of the Society of Bib. Archæology, i. 1, 65.

44 Records of the Past, v. 79, 85 note.

45 H. N. xxx. 2. Sinuri, a mythical diviner, whose name has been discovered by Mr. George Smith, may have been Zimran. The Chaldean account of Genesis.

46 The Mythology and Fables of the Ancients explained from History. London, 1740, iii. 224.

47 Gen. xxv. 6.

knew in his day as the Kataræi, and whose chief settlement was Katara, now called Katura, appearing about midway on the eastern coast.[48] Beginning at the north, however, we find certain features of Hyrcanian geography reproduced, in the Zamareni, with a place Chamara, who appear a short distance south of the Saraceni, just as Samariane and Syracene connect in Hyrcania. The Chaulothæi, Bene Khalid or Gileadites, with the Agræi or Ezrites, are not far off; while Madiana, farther south, affords another proof of Midianite connection. On the Arabian Gulf of the Red Sea opposite Berenice were situated the Malichæ, Darræ, Ausara and Agra. Lower down on the same side we meet with the Minæi, Mamala, Nagara or Agra, and Amara. The *N* of Nagarā arises out of the nasal pronunciation of the initial *ayin* of Ezer, which is found in Arabic. But in the Persian Gulf about Katura, and in a direct line with the home of the Malichæ and Darræ, other Agræi or Gerræi appear, together with Asateni and Sata. In the south-east a galaxy of Zimrite names attest Midianite occupation. Such are Thamar, Sambracata, Omanitæ, Darræ and Acilla, to which may be added Masthala. Coming further westward, but keeping to the southern coast, Hamirei in the Smyrnophoros Regio commemorate Zimran. The Ascitæ were the descendants of Ishod; the Ausaritæ of Ezer; and Massala was a record of Mahalah. Omana Sinus, south of which Marmatha may have been a reminiscence of Mamre, betrays Heman's posterity, and Cumacalum on the Sachalites Sinus may unite Chalcol with Eshcol. This leads to the great region of the Homeritæ, whom tradition has already identified with the family of Keturah. Among them Theophanes found the Amanitæ, to whom he attributed a similar descent.[49] The rite of circumcision prevailing among these tribes tends to confirm their Abrahamic parentage.[50] In the same region Burckhardt found traces of the Omran Arabs, although their principal settlement according to him was the northern tract in which we found the Zamareni.[51] Omran is an Arabic form of Zimran, exhibiting the same change as the Erse word *Amhran* has already presented. Sacatia, Mela Mons, Ocelis and Thuris in the land of the Homeritæ,

[48] Lenormant & Chevalier, ii. 289 seq. Jervis, Genesis Elucidated, 358.
[49] Jervis, 359.
[50] Ib.
[51] Notes on the Bedawin, &c, 221. Another Stonehenge was found by Chardin and other travellers at Ujan in Persia: Sadik Isfahani, 9 note. Still another in Phœnicia is described by Finn: Byeways in Palestine, 283.

among whom the Abideh or descendants of Abidah, the son of Midian, were found, set forth Ishod, Mahalah, Chalcol and Dara. The Camareni and Malichi Islands off the same coast were memorials of Zimran and his wife. If we suppose Chalcol to have been represented by the Chaulasii, who dwelt towards the northern extremity of the Persian Gulf, we shall find the whole family of Zimran appearing in Arabia as the eponyms of powerful tribes. Such were the Zamareni, Homeritæ or Omran, the Ascitæ, Agræi, Malichæ, Omanitæ, Chaulasii and Dardæ. In Kasseem, south of Jebel Shammar, or in the land of the old Zamareni, Mr. Palgrave found a Druidical circle, identical in character with Stonehenge, the work of Emrys or Ambrosius, who gave its name to Ambresbury in Wiltshire. Concerning it he says: "There is little difference between the stone wonder of Kasseem and that of Wiltshire, except that one is in Arabia and the other, more perfect, in England."[52]

If Strabo's statement, with which the accounts of Arabian historians seem to agree, be true, we cannot expect to find in the lists of early Arabian monarchs that hereditary descent which would enable us to speak positively of their Zimrite relationships.[53] Himyar or Hamyer, however, the greatest of Arab sovereigns and the ancestor of the Homeritæ, like the Persian Kaiomers and the Chaldean Zmarus, must have been Zimran himself. He is called a son of Abd Shems or Saba, and his brothers were Amru, a repetition of his own name, Ashar or Ezer, and Amelah or Mahalah, his sons.[54] Malik was an early king of Oman; and Shammir a descendant of Himyar.[55] The descendants of Amelah are said to have emigrated to Damascus, and there the Trachones, a memorial of Darda, are found, together with a Gerra that may be a record of Ezer.[55*] Two modern names, Dummar and Aswad, in the same region may preserve the memory of Zimran and Ishod.

Unlike the family of Gilead, that of his brother-in-law Zimran seems at some remote epoch to have passed over from Arabia into Ethiopia, and to have dwelt for a time also in certain parts of Egypt. We find them in the Sembritæ of the former country, who were

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52 Travels in Central Arabia, i. 251.

53 Strab xvi. 4, 3. He states that the son does not succeed the father, but the first son of a noble family born after his accession to the throne.

54 Sale's Koran, Genealogical Tables.

55 Lenormant & Chevalier, ii. 312.

55* Sale's Koran, chap. xxxiv. note.

governed by a queen.[56] These are the modern Amharas. There dwelt the Agrii, and there we meet with Esar, Tasitia, Mosylon or Mosylicus, Eumenes, Acila, and Darada. Deire, which is said to have denoted "the neck," and thus to have been a Greek word, may have been originally derived from Dar, *a pearl*, a string of pearls forming an ornament for the neck, for it is the *Torqué* of the Celts, in whose language *dorc* or *torch* signified a collar or necklace.[57] Although generally of gold, the torques were sometimes composed of amber beads. The Indian ornament Mekhali, the necklace of Manlius Torquatus, the golden collar of the Irish Malachi, serve to unite Mahalah and his son Darda in the invention of this article of dress.[58] Circumcision prevailed among some of these Ethiopian tribes.[59]

The Zimri passed into Lower Egypt, whether by way of Arabia Petræa or upwards from Ethiopia I cannot tell. An early historical notice of the sons of Keturah is given by Josephus, in which he unites them with the Egyptian Hercules, and makes Epher, the second son of Midian, the namer of Africa.[60] A part of Zimran's family must have entered the land of the Pharaohs in this migration. Milukhi, a kingdom mentioned in the Assyrian inscriptions, and which Lenormant at first identified with Meroe, the land of the Sembritæ, was in the Delta.[61] Metelis and Menelaus, which, according to Aristides, had its origin long before the time of the Lacedemonian hero, doubtless indicate the position of this Mahalite kingdom.[62] Schædia, near at hand, is a perfect representation of Ishod; and two places named Taposiris, in the same region, are in all probability the memorials of Abiezer. Glaucus, near Libya, may unite Chalcol. There was a Deirut between Metelis and Schædia, and a Tarichæa north of the latter city. It is worthy of note that the god Malouli was worshipped at Talmis, in Ethiopia.[63]

The old tradition that Northern Africa was in great part peopled by the Homeritæ is undoubtedly true.[64] It is also true that Celts,

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56 Strab. xvi. 4, 8.

57 Ib. xvi. 4, 4.

58 The necklace of Eriphyle is the key to this association of terms and legends, in so far as mythology can afford a key.

59 Strab. xvi. 4, 5.

60 Josephus' Ant., i. 15.

61 Lenormant & Chevalier, i. 394.

62 Ap. Bryant, Analysis of Ancient Mythology, iv. 315.

63 Rawlinson's Herodotus, App. Book ii. ch. 3. The authors of the Ancient Universal History mention among the Arab rulers of Egypt, Asmar; Sedeth; Ecros, Hadares, Budesir; Malinus, Malil; Culcan; Darkun. An. U. Hist. ii. 109 seq.

64 Russell's Connection of Sacred and Profane History, ii. 248.

whom Pritchard calls Cumbrians, were found in the same region.[65] These are alike the Zimri, whose record in Cyrene, Semeros, connects them with the Assyrian Sumerians. A part of the Cymri followed the course pursued by the main body of the Celtic emigrants, and passed into Europe from Asia by the Black Sea, the Sea of Marmora, or the Ægean. But a very considerable portion of this family followed the route of the Trojan fugitives in Roman story, and of the Celts who peopled Britain and Ireland, according to their native traditions, that, namely, which lay along the northern coast of Africa from Egypt to Carthage, whence they set sail for Sicily; or to the pillars of Hercules, where they passed over into Spain.[66] Three Cymric tides at different periods thus set in to Europe from Asia and Africa. That which traversed a Greek and Sarmatian area probably became Germanized, and developed the Cimbri of Jutland with other Germanic tribes. These were Asiatic Cymri. The first in point of time of the two African migrations, that which set out from the neighbourhood of Carthage, furnished the Cymric element in the Italian populations, and fused in part with the two other streams from the east and west in Rhœtia and Helvetia. The western migration filled Spain, occupied part of Gaul, and sent colonies into the British Islands. Still another stream, I believe in common with Mr. Hyde Clarke, visited the Azores, the Canary and Cape Verde Islands, and moved westward into the New World.[67] I propose devoting a separate paper to the Celts in America. To return, however, to the traces of the Cymri in Northern Africa. We have already found Semeros in Cyrene. In the same Libyan region we meet with Auschitæ, as in Arabia, with Nausida, Aziris, Menelaus, Masadalis, Ampelus and Ampeliotæ. In Africa and Numidia appear Zamora, Sidetani, Pisida, Azarath, Sizar or Usar, Sizara, Mascula, the Misulani and Machlyes, Amuncla, Damensii, Igilgilis, Culcua, Culucitanæ, Durga, Tarychiæ, Tritonis, and a host of similar names. There also the Mideni carry out the Midianite connection, that has more than once helped to attest the Keturite origin of the Zimri. Sallust, quoting from the library of Hiempsal, states that among the ancient inhabitants of Africa and Numidia there were Medes, Persians and Armenians, who had followed the fortunes of Hercules, and that the

65 Eastern Origin of the Celtic Nations, 70.

66 Virgilii Æneid; Keating's General History of Ireland; Geoffrey of Monmouth's British History; Fordun's Chronicle.

67 Researches, &c.

name Mede became corrupted into that of Moor.[68] Some ancient tradition must have given rise to such a statement. The Medes of Sallust were no doubt the Midianites, and his Persians the descendants of Peresh, the nephew of Zimran, some of whom I traced to Libya in my last paper. Mauretania was pre-eminently a Zimrite country. Thamarita, Tumarra and Camarata were records of Zimran. The great river Molochath, like the Nahar Malcha of Babylonia, commemorated his wife, whose name is identical with it in form and meaning. Usceta, Sigatha, Sitisi, set forth the relations of Ishod's descendants, and the Massæsylii, Malliana, Amilos and Ampelusia, those of Mahalah's progeny to this African province. Asarth, Tigrisis and Tasagora might easily be reminiscences of Ezer. In Mina Heman's name may appear in an abbreviated form; the Chalcorychii mountains should preserve that of Chalcol; and Durdus Mons, the Dryitæ, Daradæ and Dracones, and similar words, recall the name of Darda.

Having taken Palestine virtually as our starting point, and having explored the lands east and west, we now return to it, and pass northward into Phœnicia and Syria. Already we have made an excursus into the neighbourhood of Damascus, in connection with the history of the Banu Amelah. With them we have associated Dummar, Aswad, Gerra and Trachones. There was an Azar also in Syria; and Mahallib and Ampeloessa may have been traces of the Amelah. Amana and Haminea, Trieres and Daradax should relate to Heman and Darda. Turning to the Phœnician history of Sanchoniatho, I am conscious of a wrong identification which I proposed in a former paper. It is that of the hero Demaroon.[69] He was the son of a well beloved concubine of Ouranos, who had been taken from him by Ilus or Cronos. In him we must find Zimran once more appearing, as he has already appeared in the Persian, Chaldean and Arabian histories. The fact that the son of Demaroon was Melcartus, and that Adodus was associated with him, tends to prove this connection.[70] Melcartus is Mahalah, and Adodus probably Ishod. In Melcartus we find an assumption by Mahalah of the name of his mother Moleketh. He is Moloch Mars, Enyalius and Miles, the soldier *par excellence.* The Tamyras river of Phœnicia commemorated Demaroon or Zimran. The mughazils, or phallic monuments of Phœnicia,

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68 Sallustii Bel. Jug. xviii

69 The Primitive History of the Ionians, Can. Jour., Nos. 5 and 6, vol. xiv.

70 Sanchoniatho's Phœnician History by Cumberland, 34, 35.

probably retain a name once given in memory of the youngest son of Hammoleketh to rites characteristic of her worship.[71] The Phœnician colonies indicate that the family of Zimran was once powerful there. Camirus in Rhodes, named after Camirus, the son of the nymph Hegetoria, is undoubtedly a record of Zimran, the son of Keturah.[72] Malta, with its phallic monuments, received its designation from Moleketh or Mylitta.[73] Cossura may have retained the name of Ezer. Melos and Thera can hardly be dissociated from Mahalah and Darda. In Spain Abdera and Malaga, in connection with the Bastitani and Turdetani, also afford traces of Abiezer, Mahalah, Ishod and Darda.

In Armenia we find vestiges of the family of Zimran, as well as of that of Gilead. It contained Zimara, Astacana, Testis, Azora, Molchia and Acilicene. Darda appears to have had no memorials there. The region of Caucasus, besides the Cimmerii upon its borders, furnishes Sioda of Albania, Seumara and Vasæda of Iberia, Absarus and Mechlessus of Colchis. In the Glaucus river, the Cilici of Colchis, Colchis itself and the Tarsura, we may discover footprints of Chalcol and Darda. Madia, like Motene of Armenia and similar names elsewhere, keeps us in mind of Midian's relationship with Zimran.[73*] Pontus, in Pimolisa, Megalopolis and Collucia, perhaps exhibits the marks of occupation by Mahalah's and his son Chalcol's descendants. Cappadocia, so rich in Gileadite names, was not altogether destitute of the records of Zimran's line. There we find Imbarus and Sinoria, the Scydices Mountains, Aziris, Melitene, two rivers named Melas, Eumeis, Gaolasera and ad Dracones. Cilicia was pre-eminently a Gileadite habitat. There Zimran's name survived in Commoris. Posidium, built, according to tradition, by Amphilochus, and Mallus, which contained his oracle, together with Melania and Mylæ, show that Ishod and Mahalah went hand in hand.[74] The family of Heman appears prominently in the Amanides and Homonadenses. Amphilochus, as the namer of Mallus, was undoubtedly Mahalah, and his father Amphiaraus, Zimran. At Mallus Calchas was associated with Amphilochus, and he was his second son Chal-

[71] Lenormant & Chevalier, ii. 230.
[72] Diod. Sic., v. 35.
[73] Lenormant & Chevalier, ii. 230
[73*] The circumcision of the Colchians and some of the neighbouring tribes in Asia Minor may have been an indication of their Abrahamic ancestry. There were circumcised tribes in Thrace.
[74] Herodot. iii. 91; Strab. xiv. 5, 16.

col.[75] Pococke has well set forth that the name Calchas and all the associations of that hero point him out as a Buddhist priest.[76] The character for wisdom and the skill in gnomic poetry attributed to Amphiaraus, Amphilochus, Calchas and Tiresias, clearly indicate that in their history the Greek writers preserved part of the story of Zimran, Mahalah, Chalcol and Darda.[77] In Paphlagonia, the same family appears. Gazora reproduces Ezer; Timoleum, Mahalah; Domanitis, Timonitis and the Amnias, Heman; and Callichorus, Chalcol. Galatia recalls Ishod in Vasada; and it will be remembered that Josephus unites Galatia with Gomer. Phrygia presents us with Thymbrium and Amorium, Isauria and Achara, Melissa, Nacoleia and Philomelium, which is Abel Meholah, Eumenia, Glaucus and Cillexuga, Trogitis and Tyriæum. Midæum once more connects the Midianites. Bithynia, a settlement of Bedan, shows that Celt and Cymri rarely parted company. Thymbrius and Smyrdiana, Astacenus, Astacus or Nicomedia, Posidæum, Aminias and Callica give Zimran, Ishod and the two elder sons of Mahalah. Thymbrius in Pisidia and Chimæra in Lycia are alike memorials of Zimran. Pisidia, Isauria and Milyas in proximity, were tracts bearing the names of his three sons.[77*] As Herodotus informs us that the Pamphylians were the people of Amphilochus and Calchas, we must find in Pamphylia the name Mahalah, with the prefix of the Coptic article.[78] Amblada in Pisidia and Melas in Pamphylia are other forms of the same name. In addition to Pisidia itself, which precedes Ishod with the Coptic article also, he was celebrated in Side of Pamphylia and Isionda of Lycia. The Agrioteri palus of Pisidia may be added to Isauria as a record of Ezer. Hanona and Darsa in Pisidia, with the Glaucus of Lycia, perfect the Zimrite record in Heman, Chalcol and Darda.

In Caria, Zimran, Ishod and Mahalah are found as Thymbria, Pystus, Posidium, Miletus and Mylasa. In Lydia, Smyrna, near which ran the Meles and to the back of which rose Tmolus, has been identified by Mr. Hyde Clarke as a Sumerian city.[79] Ephesus also was called Samornia, deriving its chief name doubtless from Ephah,

[75] Strab. xiv 1, 27.

[76] India in Greece, 249.

[77] Banier, iv. 204.

[77*] The Milyæ, or descendants of Mahalah, were Lycians, as belonging to the family of Lechem; and Solymi, since Salma was the head of that house. Beth Millo in Shechem, where a Shalem was found, may have been an early tribe of Milyæ.

[78] Herodot. vii. 91.

[79] Researches, &c., 43.

the eldest son of Midian. Thymbræ was another memorial of Zimran. There likewise appear Melæna, Mycale and Ampelus. Mysia contained a Cimmeris, a Thymbris and a Thymbrium. Mallus reproduces a feature in the nomenclature of Cilicia. Callicolona, Troas and Tragasæ set forth Chalcol and Darda. The Tragasæan salt pan recalls the Tarichæas of Palestine and Africa, which were pickling stations, and, taken together with the supposed meaning of Malaga as the town of salt and the occupation of its inhabitants, suggests an association of Mahalah and Darda.[80] Lydian history affords valuable aid in the work of identification. In the time of Atys, the Lydians, compelled by famine, emigrated from Smyrna to Umbria, thus carrying with them their Zimrite name.[81] Meles and Tmolus appear in different lists as Lydian kings.[82] They are the same person, who is Mahalah. An obscure narration concerning Tmolus, taken in connection with similar stories that will yet meet us, confirm this statement. The Abbe Banier says: "Tmolus, King of Lydia, if we may credit Clytophon, was the son of the god Mars and the nymph Theogena, and, according to Eustathius, of Sipylus and Eptonia. One day as that prince was hunting, he perceived one of Diana's companions who was named Arriphe. The king, bent on gratifying his passions, eagerly pursued that young nymph, who, that she might not fall into his hands, thought to find a sanctuary in the temple of Diana. Arriphe was violated at the feet of the altar. So cruel an outrage plunged her into the deepest anguish, and she would not survive the misery that had befallen her. The gods did not allow her death to be unpunished. Tmolus, carried off by a bull, fell upon stakes, whose points ran into him and made him expire in the most exquisite pain. Thus perished that prince, who was buried upon the mountain that went afterwards by his name."[83] It is in Palestine, at Abel Meholah, or in Chaldea, that we must find the scene of this tragical, and, as will yet appear, oft repeated story. The Lydian dynasty of the Mermnadæ, and Ascalus, connected with the early history of that kingdom, illustrate the relations of Zimran with Eshcol and Mamre.[84] Claros, in the same country, relates to the story of Amphilochus and Calchas.[85] The most remarkable feature in Lydian history, however, is that which

80 Anthon's Class. Dict., Tarichæa; Strab. xiii. 1, 48; Lenormant & Chevalier, ii. 178.
81 Herodot i 94.
82 Rawlinson's Herodotus, App. Book i., Essay 1. Apollodorus ii. 6, 3.
83 Banier ii. 404.
84 Vide note 82, and compare note 99.
85 Strab. xiv. 1, 27.

connects with the poet Homer. Chios, lying off the coast of Lydia, possessed a class of men called Homeridæ.[86] They were singers, and I cannot but think that their name is the old word Zimran or Amhran, *the song*. Ilgen gives such a meaning to the name Homer itself.[87] Smyrna laid claim to be his birth-place, and undoubtedly Zimran's descendants named that city. But the names of Zimran and his son Mahalah are constantly found in the genealogies of the blind poet. Thus he is called the son of the Smyrnean river god Meles. His mother again is the daughter of Menapolus and a daughter of Omyretis, or of Theseus, the son of Eumeles, and a nymph Smyrna. Her name Critheis is like the Scandinavian Gerda, the daughter of Gymir. In another account, Mæon of Lydia, whose name may have been the same as Heman, was his father. It is remarkable that Hesiod is made a nephew of Mæon, bearing, as the name does, such a close resemblance to Ishod. Perses also, the brother of Hesiod, is identical in form with Peresh, the cousin of Ishod.[88] I do not by any means assert that Homer was Zimran, or even that Mahalah or Heman was his father, but these names must indicate that the great poet was a Zimrite. It is also very probable that he never saw Asia Minor, and that the scenes and peoples he sang of were to be found somewhere between Palestine and Arabia, Egypt and Babylonia, where all the names he mentions may be discovered in a truer Homeric order and of a more thoroughly Homeric character than in Asia Minor and Greece.[89] Ishod can hardly fail to have been the old Æsyetes, whose

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86 Pindar Ap. Strab. xiv. 1, 35.

Athenæus also refers to the Homeritæ. The song Nomium, which he connects with Eriphanis, the mistress of Menalcas the hunter, and the refrain of which was "the tall oaks," may have arisen out of the story of Heman, Eriphyle and Mahalah, with Darda, the man of the oak Athen xiv 11. According to Pausanias, two persons named Melan were early colonists of Chios, vii 4.

87 Anthon's Class. Dict., Homerus.

88 Ib.

89 I do not consider that the researches of Dr. Schliemann, although of great historic value, by any means establish the fact that the Troade was the scene of the Trojan war. Strabo (I., ii. 22) tries to meet the objections of those who affirmed that Homer knew Egypt, Syria and other regions better than Greece. Again (XII, iii 26, 27) he specifies many places intimately connected with the Troade which Homer does not mention. The Egyptian priests, according to Dion Chrysostom, had a version of the war of Troy different from that of Homer. We find Memnon, the Ethiopian or Susian, appearing as one of its heroes Egypt is visited by Menelaur and other of the Greeks. Northern Africa is the course of the Trojan fugitives. Paris carries Helen to Sidon. Mr. Gladstone shows that according to Homer the Phœnicians were a border people on the north-west instead of on the south-east Menestheus, in whose time the was occurred, was the son of Petes, an Egyptian. Diodorus Siculus connects the knowledge of Homer with Egypt. We have no indications that any states existed in Asia Minor so early as the period of the Trojan war, which Pliny places in the time of Rameses III., Manetho in that

tomb was supposed to be in the Troade.[90] Molion, the charioteer of the Trojan Thymbræus, presents an interesting union of Zimrite names; and Caria long retained a love for that of Mahalah.[91] If the Cimmerians and Treres overran this part of Asia Minor during the historical period, it must have been, like the Galatians, to regain a former home.

Passing over into Europe, Thrace first engages our attention. Ismarus, Himærium and Tempyra preserved the name of Zimran; Sestos, Satiæ and Astica that of Ishod; Abdera, Agora and the Agrianes that of Abiezer or Ezer; and Melas, Ampelus and Naulochus those of Mahalah and Moleketh. Darda finds many memorials, as in the Dorsæi, Treres, Doriscus, Drys, Tirizis, Tyrodiza, &c.; and it is possible that the very name Thracia came from the form Darag. It is true that the name Zamolxis is not very like Mahalah, yet as he is called the teacher of transmigration to the Druids, and as a god of the Thracians, I incline to the belief that they are the same person.[92] Thamyris, the blind Thracian bard, unites the character of Zimran and the Homeridæ with a name like that of the Phœnician Demaroon or Baal-Thamar.[93] Macedonia contained comparatively few Zimrite names, for Gileadites occupied a great part of the country. Still Combræa, Satis, Schiate, Pissantani and Ægestea, Abderites and Agrianes, Æmonia and Derrhis appear as records of Zimran, Ishod, Ezer, Heman and Dara. What is wanting in Macedonia, Thessaly supplies. Zimran lives in Amyrus, Ambrysus and Chimærium; Ishod in Hestiæotis, Phæstus and Sciathos off the Thessalian coast; Ezer in Azorus; Mahalah in Melia, Mallæa, Milæ, Melas, Homolium and other places; Heman in Æmonia; Chalcol in Œchalia, Iolcos, Igliaco; and Darda in Tricca, Titarus, Titaresius, Dyras and the Dryopes. The Melian territory of Thessaly was possessed at an early period by

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of Thothmes III., others in the time of Moses, and Mr. Gladstone long before 1209 B C., when Sidon was destroyed. The Lycians, Mysians, Dardanians and other peoples who afterwards settled in Asia Minor, were at that period found in Palestine warring with the Hittites against Egyptian supremacy. We must look for the old Ilium not in the Troade but in Palestine, the scene of nearly all the wars of the same age, and must connect it with the declension of the Egyptian monarchy. The topography of the Troade is far from according with that of the Homeric poems, and Mr Gladstone is justified in stating that the old poet was all astray in his geography, if any point in Asia Minor be the scene of his epics, or the stand-point from which he surveyed the world.

90 Iliad, ii. 793.

91 Ib. xi. 320-2. Strab xiv 2, 13, &c., gives Malaca, Melon, Menecles, Mausolus, &c.

92 Maio-zimalka in Babylonia, which I have already connected with Hammoleketh or Mahalah, is a form that might give us Zamolxis. In this case Mahalah would take his mother's name.

93 Philammon, the father of Thamyris, links him with the family of Bethlehem, with which Zimran was united through his wife. Demaratus, the Zimran of Etruria, was a Lucumo or man of Beth-Lechem, and Vetulonii sets forth the whole Hebrew name.

Eumelus, who is called the son of Admetus, but who is also made an ancestor of Homer.[94] Melia and Meles indicate, as does Mallus in the case of Amphilochus, something of the true form of his name. The Dryades, whose appellation has always been connected with the oak, are called Meliadæ, and belonged to Melia of Trachis.[95] The story of Thamyris the Thracian relates to Œchalia and Tricca. Hestiæotis was a famous Doric region, and from it descended the Dymanes and Pamphylians.[96] I can hardly think that the Dorians were of Darda, although the memorials of the Zimri are to be found largely in Doric areas, and the love of swine was common to Dorians and Druids. Dymanes and Pamphylians, representing Heman and Mahalah, are called descendants of Ægimius, whom I have elsewhere identified with the early Persian Achæmenes and with Ochime, the husband of Hegetoria, from whom came Camirus.[97] This personage is Achumai the Horite, whom I have already made the real head of the Dorian line. He was, I think, the father of Zerah, who married Keturah after the death of Abraham.[98] Zerah will thus be the head of the Zorathites or Dorians, of whom the mythic King Ægimius was the ancestor. The Myrmidons of Æmonia, like the Mermnadæ of Lydia, connect the family of Mamre. As Asciamus, the Lydian king who sent Ascalus to found Ascalon, has been shown by me to be the same as Achumai, Achæmenes, Ægimius and Ochime, we properly find him synchronizing with the family to which Zimran belonged.[99] Epirus is far from deficient in traces of the Cymri. Such

94 Strab. ix. 5

95 Soph. Phil. 725.

96 Herodot i. 56. Muller's Dorians, ii. 76

97 The Horites, Canad. Journal, Vol. xiii. No. 6.

98 As I have identified Achumai with Ægyptus, we must find in Zerach, or, as his name would be in Greek, Kerak, the Cercestes who is called his son He is also the Egyptian god Harka united with Khem, and, better still, the son of Amenemes the namer of Coptos, whom Mr. Osburn gives as Cherucheres. Amenemes, the son and successor of Achthoes, is Achumai, the son of Jachath.

99 Since Ascalus or Eshcol was a general, or, at any rate, a tributary of Achumai, Aciamus or Amenemes, it is not surprising that the son of the latter should marry Keturah after the death of Abraham, seeing that she was Eschol's sister. An important Egyptian date is afforded us in the association of these names, by which we are able to arrive at the period when Egyptian monarchy began and at the same time its mythology.

about 2000 B C. Shobal, Seb or Sebek

about 1960 B C. Reaiah or Ra

about 1920 B C. Jachath or Actoes

about 1880 B.C. Achumai or Kames

about 1850 B.C. Zerach or Cherucheres=Keturah or Hegetoria

Ethan

The Arabian historians make Ascalus a man of Ludim. Lahad or Lydus was the brother of Achumai. 1 Chron. iv. 2.

are Chimærium, the Chimærian promontory, Comarus, Tomarus,[99*] and, better still, Ambracia, a state founded by Torgus.[100] Posidium, Issoria, the Molossi and Omphalium were probably named after the three sons of Zimran, and the Amyntæ after Heman. The story of Milo, who slew Laodamia in the temple of Diana, where she had taken refuge—through whom a curse fell upon the whole of Epirus; and who, seized with anguish, tore out his own bowels and died in extreme agony on the twelfth day after the murder—bears a very close resemblance to that already narrated concerning Tmolus.[101] More light may thus be shed on the meaning of Abel Meholah. Acarnania contained an Astacus, which may have commemorated Ishod. Ætolia is a supplement of Epirus. On the borders of Ambracia, the land of Zimran, appears Amphilochia, founded by Amphilochus or Mahalah.[102] There also we find Thestia, the Agræi and Acræ, the Dymæi and Œchalia. The stories of Tmolus and Milo are reproduced in that of Meilanion and Atalanta, the scene of which is laid in Calydon, the Gilead of Greece, unless we are to transfer it to Arcadia, the home of Atalanta's father. While Meilanion and she were hunting together, they profaned the sacred enclosure of Jove with their love, and for this offence were metamorphosed into lions.[103] Meilanion can hardly be a different person from Meleager, whose history is more closely linked with that of Atalanta, and who was of Calydon. Meleager is made a son of Œneus or of Mars; and Thireus his brother, like Dryas and Tereus, other sons of Mars, recalls the name of Dara, the son of Mahalah. He perished under a curse, that of his mother Althæa, who may be Alitta or Mylitta. Amphiaraus and Thestius connect with his history.[104] Ino Leucothœ, the Colchian goddess, wife of Athamas and mother of Melicerta, is more like a form of Hammoleketh.[105] Athamas I have associated with Etam or Abi-Etam, who named Etham in Egypt and Arabia.[106] As Abi-Etam

99* Tomarus and the oaks of Dodona are associated. The Tomuri were diviners. Strab. vii 7, 11

100 Strab. vii 7, 6

101 Justin xxviii 3

102 Strab x 2, 26.

103 Vide authorities in Anthon's Class Dict, Atalanta A similar story meets us in Arabian tradition, where we learn that Asaf, the son of Amru, and Nayelah, the daughter of Sahal, were for a like offence converted into stone Sale's Koran, P. D

104 Apollodorus, i 8 Pausan x 31, 3.

105 Apollodorus, i 9 Atalanta is made a daughter of Schœnus, the son of Athamas, thus confirming the association of names Melas was a son of Phryxus, another son of Athamas.

106 The Coptic Element in Languages of the Indo-European Family, Canad. Journal, Vol. xiii., Nos. 4 and 5

he furnishes the name Amphidamas, which is that of the father of Meilanion, and as Etam, Admetus, that of the father of Eumelus, who also is made Mahalah. Etam had no such son, his eldest born being Jezreel. Hammoleketh was not of his family; so I come to the conclusion that Mahalah was his connection by marriage, an hypothesis which another legend, the scene of which is laid in Achaia, confirms.[107] In Locris, the geographical names Phæstus and Tritæa probably refer to Ishod and Darda. There we find that certain Theoi Meilichioi were worshipped, and these Bryant derives from the Semitic Melek.[108] Phocis furnishes Ambrysus, Tegyra, Amphiclea, Hyampolis, Callichorus and Tritia.[108*] In Homer we find Schedius as a Phocian name.[109] The Phocean colonies also had Zimrite names, and, in particular, Massilia in Gaul, which was called after Mahalah. In Bœotia, Amphiaraus had a place dedicated to his worship; and Agra, Mycalessus, Hæmon and Ocalea commemorated two of his sons and an equal number of his grandsons.

In Attica, the descendants of Darda were pre-eminent, exhibiting their traces in Thria, Thoreæ, Thoricus and Deriades. But Amphiaraus had a sanctuary there; Agræ and Acharæ were memorials of Ezer; and Amphiale and Melænæ of Mahalah. Zeus Meilichios was also worshipped in Attica.[110] With Attica, Ægina must be associated. Thence came the Myrmidons, whom I have already asserted to be the progeny of the Amorite Mamre. Myrmidon himself is confounded with his nephew Zimran, for Pisidice, a name derived from Ishod, is made his wife, and Actor or Ezer his son.[111] Actor married Molione, a name recalling Mahalah, and among his sons were Menœtius and Echeclus.[111*] The latter is plainly Chalcol his nephew, and the former Meonothai, whom, in the commencement of this paper, I asserted to be the son of Ezer. Menœtius married a certain Sthenele, who should be Hathath, the daughter of Othniel, with whom Meonothai is thus united in the book of Chronicles.[112] Argos

107 Vide Note 118

108 Pausan. x. 38. Analysis of Ancient Mythology, i 87.

108* At Ambryssus Dictynna was worshipped, and near at hand was Medeon. These names set forth Zimran, Jokshan, *the nets*, and Midian

109 Iliad, ii. 517, xv. 515.

110 Pausan. i. 37.

111 These Myrmidons were connected also with Æmonia in Thessaly

111* Actor is also made to have married Ægina, thus keeping up the nominal connection. Æginetas also appears among the descendants of Amyclas or Mahalah Paus vii 18.

112 1 Chron. iv. 13, 14. Sthenelus is the Greek form of Othniel, the first letter of which is an *ayin*. Menœtius is also made the son of Ceuthonymus, which is a corruption of the Septuagint name for Othniel, Godoniel. For the geographical connections of Meonothai and Ophrah his son, see the end of this paper.

exhibits few geographical traces of the Cymri. Zeus Meilichios, however, was worshipped within its borders; and Umbilicus, near Phlius, which contained a place sacred to Amphiaraus, may have been a corruption of Amphilochus.[113] Epidaurus may be a record of Abishur; the rivers Sythæ of Ishod; and Thyrea of Dara. Argolis is famous as the supposed home of Amphiaraus. His reputed father Oicles may have been Eshcol his uncle, and his son Amphilochus, as naming Mallus and similar places, should represent Mahalah. Alcmæon was made another son of Amphiaraus.[114] This name must relate to the family of Hammoleketh, which I have already intimated was that of Beth-Lechem, or the Arabian Lakm and Lokman and the Indian Lakshman. With it also the Etruscan Lucumo is connected. Tiresias and Calchas, intimately associated with Amphiaraus and Amphilochus, and, like them, famous soothsayers and poets, point to Chalcol and Darda, two wise men who were thought worthy of comparison with Solomon.[114*] Baton, the charioteer and relative of Amphiaraus, must be Bedan, the grandson of Peresh, the nephew of Zimran.[115] His wife Eriphyle seems to exhibit a confusion of Zimran with Mahalah, for he was the violator of Arriphe; and the famous necklace of Eriphyle is the Indian Mekhali, the collar of Malachi, the torque of Manlius Torquatus.[115*] A curse rests upon Alcmæon, similar to that which fell upon Tmolus, Milo, Meilanion and Meleager. The relation of Meleager to Œneus may find an illustration in the flight of Alcmæon to the Œniadæ. The Zimrite names Megacles and Hippocrates, forms of Mahalah and Abiezer, belonged to the Alcmæonidæ. It was Megacles that directed the slaughter of Cylon and his companions, who at Athens had risen in rebellion against the legal code of Draco, and who, having fled for refuge to the sanctuary of the Eumenides, were slain at the altars.[116] The name Megacles, the Alcmæonid connection, the profanation of the temple, and the curse which followed it, seem to refer us to the ancient story which already five times has appeared in relation to

113 Pausan. ii 20.

114 It is probable that Alcmæon is but another name of Mahalah, derived from his mother's family.

114* Chariclo, the mother of Tiresias, bears a Kurigalzu or Jezreel-like name.

115 Pausan. x. 10

115* For the connection of Eriphyle with Hammoleketh see note 147. Mylitta or Beltis was sometimes made "the Lady of Arbela," and Harpalus is called the son of Amyclas. Eriphyle, Hierophile, Arbela and Harpalus are the same word.

116 Herodot. v. 71. Vide Rawlinson's notes in loc.

persons who have links of union with Mahalah. Amphiaraus disappeared from view, we are told, at Oropus in Attica.[117] I do not as yet understand why this name is associated with his, but have found similar geographical terms accompanying the wanderings of Zimran's family.

On the Isthmus, Ægosthene and Minoa of Megaris; Amphiaraus, Icaria and Molychium of Corinth; and Derus of Sicyon may have been traces of the Cymri.[117*] Achaia contained Ægira, a record of Ezer, and Melas, with perhaps Megalopolis, commemorating Mahalah. I need not apologize for supposing that names thoroughly Greek in structure, and bearing well defined Greek meanings, may have been manufactured out of Zimrite materials. The rage for etymologies prevailed among the Greeks, and every proper name that was susceptible of a Hellenic form and signification was tortured into these. The same process which fabricated Tarry Hut out of Terre Haute, in Indiana, could easily, in more ancient days, transform Mahalah into Megale, and explain Mycale as Mygale, *the shrew-mouse.* What renders this probable is, that a river Milichus or Ameilichos, reproducing the Malcha of Babylonia and the Molochath of Mauretania, flowed through part of Northern Achaia into the Corinthian Gulf. According to Pausanias, this river received its name from the adventure of Melanippus and Comætho in its neighbourhood.[118] Melanippus, the son of Mars and Tritia, and Comætho, the daughter of Pterelaus, who was a priestess of Diana, satisfied their love in the temple of that goddess. A curse accordingly fell upon the country, and the guilty parties were immolated at Diana's shrine. This is the third time that a similar act of sacrilege in connection with Diana's worship has come before us, associated with a name which more or less resembles that of Mahalah, and the seventh in which a similar name has been identified with sacrilege and a curse. Tmolus and Meleager, like Melanippus, were called sons of Mars, and Milo was one of the names of that god. Tritia also, as a form of Darda, is a Mahalite appellation. The fathers of this or of other Melanippi are given as Astacus, Hicetaon and Agrius, names which recall Ishod and Ezer. I have already

117 Pausan. i 34

117* Phæstus, King of Sicyon, may have been Ishod, and his son Rhopalus, the person from whom Arbela, Eriphyle, &c, derived their names, as well as Beth Arbel in Palestine Ishod was Hammoleketh's eldest son.

118 Paus vii. 19.

given reasons for supposing that Mahalah married into the family of Etam or Abi-Etam, whom I identified with Athamas and Amphidamas. The eldest son of Etam was Jezreel, or Jezregel if the power of the medial *ayin* is made prominent. With the prefix of the Coptic article, Jezreel becomes Pterelaus, and he was the father of Comætho.[119] But, as I have stated in a previous paper, the Chaldean Jezregel was Kurigalzu, and he, by Mr. George Smith, is made the father of the Babylonian Milisihu.[120] I am justified, therefore, in believing that, when the history of Milisihu is recovered from the tablets, the tragical story of Mahalah will appear to the world as the original of all the legends concerning Melcartus, Melicerta, Meleager, Meilanion, Milo, Tmolus, Megacles, Amphilochus and Melanippus.[120*] Glaucus and Tritæa, in Achaia, add Chalcol and Darda to the other Zimrite traces of that state.[120†]

Arcadia evidently at some time had a Cymric population. They left behind them Sciathus, Asæatis and Acidus, Agra, Amilus, Malæa, Malæna, Molossus and Megalopolis, Æmonia, Aminius, Œchalia and Calliæ, Trachys and Thyreum. Thamyris was associated with the Œchalia of Arcadia as well as with that of Thessaly, or, in other words, both of these reproductions of an ancient seat of the Zimri in the East preserved the memory of the ancestral poet and sage. The name of Heman appears in Arcadia as Euæmon, who is called a son of Lycaon or Beth-Lechem. I have already drawn attention to the remarkable Greek word Epikouros, meaning, like Abiezer, *the helper*, while it bears to it a close resemblance in form. The Latin Ajutor presents also a perfect transliteration of Jaazer in Gilead. Apollo Epikouros was worshipped in the neighbourhood of Phigalia, and he was honoured with the sacrifice of a boar on Mount Lycæus.[121] The Arcadian Orchomenos has many links to unite it with that of Bœotia, and the Actors who are associated with its history are Ezers of the Zimri. Elis contributes Pisatis, another Pisidia, Acidon, Omphalium and Amphidoli, Scollis and Dorium. Another Œchalia and another Dorium, with Thuria, in Messenia, illustrate the story of Thamyris. Laconia, a Doric

119 Apollodori ii, iv 5, viii 1.

120 Records of the Past, v. 85 note The Primitive History of the Ionians. Canad. Journal, Vol xiv, Nos. 5 and 6.

120* Is it possible that the name of Mahalah connects with the Pictish Meilochon, meaning the seducer of virgins Jamieson's Scottish Dictionary, Dissertation.

120† Eumelus once more appears in connection with Glaucus. Paus., vii. 18.

121 Pausan. viii. 41.

state, affords some of the best exemplifications of the constancy of proper names. Such are Scotitas, Acriæ, Mesola, Malæa, Menelaus, Amyclæ, Œchalia, Ægila, Derrhium and Thyrides; while Cythera, off Malea, represents a memorial of Keturah. Laconia was the land of Beth-Lechem. Amyclas himself was Mahalah; his brother Cleocharis should have been his son Chalcol; and Deritus, his son, is Darda.[122] At Sparta Enyalius and Amphilochus had statues; and at Therapne there was a temple of Mars Therita.[123] Amphiaraus also was worshipped at Sparta. Eumelus and Tyrtæus, as Spartan poets, must have belonged to the Homeridæ. Mr. Cox has drawn attention to the parallel which the story of Agamemnon, the brother of Menelaus, presents to that of Amphiaraus.[124] The wife of the hero in either case was slain by his sons, and the relation of Amphiaraus to the Tyndaridæ seems to suggest, along with the appearance of such an Ishod-like name as Ægisthus in the story, that a confusion of legends pertaining to the Zimrite family had taken place in the Spartan mythology. The family of Agamemnon at least fell under a curse similar to that which has already so often been associated with a name akin to that of Mahalah. Zaleucus, the Doric lawgiver, connecting with Draco, and who has been supposed to have relations with Pythagoras and Zamolxis, may have been Chalcol. Mr. Cox unites him with Horatius Cocles, the Cyclopes, Oxylus, and other one-eyed heroes.[125] As he also connects them with the Scandinavian Mimir, I incline to the belief that Eshcol and Mamre are the originals of all the fables concerning these heroes.

Turning to the islands of the Levant, Cyprus, which had intimate relation with Phœnicia, maintained a priestly class of Tamyrads; and its geographical names, Golgoi and Treta, may have had for their originals Chalcol and Darda.[126] Crete contained almost all the names; Cimarus, Camara, Phæstus, Aptera, Metallum, Amyclæum, Omphalia, Ampelus, perhaps Amphimalla, Minoa, Tarrha and Tityrus. In Crete lived the ancient king Melisseus, whose daughter, Amalthea, may easily have been a Mylitta or Hammoleketh.[127] Her horn,

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122 Pausan. vii. 18.

123 Ib. iii. 19

124 Aryan Mythology, ii. 189.

125 Ib. ii. 72, 88, 183. I find no reference that the union of the one-eyed heroes to whom Mr. Cox frequently alludes has been made by myself, unless it be that I have overlooked the passage in which it occurs Mr. Cox, however, notices the monocular character of all the persons mentioned.

126 Guigniaut, Religions de l'Antiquité, ii. 211, 1021.

127 Diod. Sic., v. 70.

according to Mr. Cox, connects with India in the cup of the Malee's wife.[128] Eubœa had Amarynthus, Hestiæa, Tamynæ, Œchalia and Trycha. It was from Hestiæa that Amphiclus went to Chios, where he is said to have reigned after Œnopion.[129] Amphiclea of Phocis contained an oracle of Bacchus. The Amycleans claimed kindred with the people of Imbros and Lemnos. The latter island, like Limnæ in Laconia, may have been an abode of the Hemanites, since Hitzig supposes that Eiamene is the root of the name.[130] Lasharon and Leophrah, the Greek Laphria and Leucophrys, are two Palestinian forms illustrating such a prefix.[131] Lemnos was famous for the extinct volcano Moschylus. Imbros, with its deity Imbramus and port Naulochus, was a Zimrite island. Lesbos contained a Malea. Zimran and his son Mahalah were commemorated in Samos, which Tembrion colonized, and where Imbrasus, Ampelus and Amphilissus appeared.[132] Melos and Thera I have already associated with Mahalah and Darda. In Rhodes we find Camirus, and the person of that name, as the grandson of Ochime and Hegetoria, I have identified with Zimran, the son of Keturah. His father, Cercaphus, must be Zerach or Kerak, whom I have supposed to be the son of Achumai and stepfather of Zimran.[133]

The great Sarmatian territory contained the Cimmerians, or early Cymri and Cimbri, who inhabited the Crimea and adjacent regions. Their sea, which was the sea of Azor, they called Temerinda, after Zimran, and the Amalchian after their great mother Hammoleketh. Among them were found such geographical names as Tamyraca, Sagastene, Sittaceni, Agri, Acria, Apaturium, Ambenus, Taman, Chalca, Treres and Tauri. Few traces of the Zimri appear in Mœsia and Dacia.[134] In Illyria, however, we meet with Dæsitiates, Epicaria, Absorus, Metulum, Dimallum, Æmonia, Amantes, Clausula, Cylices, Derrii, Daorisi and Turres. Etymologically Dimallum bears the same relation to Mahalah that Dyrrhacium does to Rekem. Pannonia I have shown in the former paper to have been a great Celtic centre.

[128] Aryan Mythology, i 134 note.
[129] Pausan. vii 4.
[130] Die Philistær, 128
[131] Josh. xii 18; Micah i. 10 The latter is not apparent in the English translation.
[132] Strab x. 2, 17; xiv. 1, 2.
[133] Vide note 98.
[134] Some, however, will be found in the geographical table at the close of the paper. Medianum, a trace of Midian, appears in Mœsia.

Comare or Komorn and Sumerein retain the name of Zimran; Segeste and Segedunum that of Ishod; Agria or Abieta that of Ezer in its two forms; and Æmona and the Amanteni that of Heman. In Noricum we discover Ambilici, Ambisontii, Cuculle and Trigisamum. Vindelicia had an Ambre; and Rhætia, Isarus, Maletum and Oscela.

We have thus arrived at the borders of Italy. In Venetia and Istria a few names appear, such as Atria, Motila, Malum, Aquilegia and Tergeste.[134*] Gallia Cisalpina is naturally much more full. There we meet with Umbranum, Sessites, Testona, Isarci, Acerræ, Edrum, Æmilia, Mediolanum of the Insubres, Mutilum, Cameliomagus, Colicaria, Ocelum, Duria, Duriæ and Tarus. Tusculum is an indication that Eshcol's family was here represented; and Orobii reproduces the Oropus that accompanied the line of Amphiaraus. Liguria furnishes Asta, Cestiæ, Segeste, Ampelus and Monilia. Mr. Hyde Clarke, to whose important work I have so frequently had occasion to refer, unites the ancient Etrurians with the Sumerian stock.[135] Among their geographical names we find Umbro and Amerium, Hasta and Pisatæ, Auser, Pistoria and Magliana or Manliana. Demaratus, the Lucumo, is Amphiaraus, the head of the Alcmæonidæ, and Zimran, united with the house of Lechem. He was the father of Tarchon, and the son of Etymon, who has already been before us as Athamas, Admetus, Amphidamas, &c.[136] Umbria was pre-eminently the land of the Cymri.[137] Besides its own name, those of its cities Ameria, Camerte and Camarinum attest this fact. The Æginetæ sent colonies to Umbria, and there Myrmidones, or the posterity of Mamre, were found.[137*] Asitia or Assisium, probably Suasa, Pisaurum, Matilica, Meuaniola, Gallicana and Clusiolum set forth Ishod, Abiezer, Mahalah and Chalcol. Cumerium, Tria and Tetricus of Picenum seem to indicate that Darda occupied the same position in that state as Chalcol occupied in Umbria.

Virgil brings his Latins from Africa.[138] Among them appear Semurium and Simbruinæ, Setia, Amyclæ and Trerus. Thymber and Tmarus are Rutulian names that Virgil did not create, but found doubtless

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134* For Atria, see note 176.

135 Researches, &c 35.

136 Livii, i. 34. The colonization of Tyrrhenia by the Lydians must not be forgotten.

137 Pezron, i. 19, quotes many authorities in support of the opinion that the Umbrians were a Gallic people.

137* Strab viii. 6, 16.

138 Æneid i., &c.

in ancient traditions.[139] But Cimber was a distinctively Roman name, and appropriately it appears in connection with Metellus. The Metelli, however, were Cæcilian, and thus add Chalcol to Mahalah and Zimran. It was Cæcilius Metellus that threw himself into the flames of the burning temple of the Vestals, and thus acquired immortal fame.[140] The name Vestal, derived from Hestia and supposed to connect with the Persian Avesta, I have already associated with Ishod. A famous Vestal was Æmilia. Her virtue being doubted, she threw her veil into the sacred embers, and the fire kindled of its own accord.[141] This fire, which was allowed to die away on the last day of the year, is the fire in which the mother of Meleager consumed the fatal billet and thus terminated his life. At Festi in Latium the Sabine sacrifices called Ambarvia were offered, and these Strabo associates with the story of Romulus the son of a Vestal.[142] Amulius, another form of Mahalah, who caused his niece to become a Vestal, cannot be foreign to our subject. The Æmilian gens, although distinct from that of the Metelli, may have descended through another branch of Mahalah's family. It was Sabine, and Mamercus, a name derived from Mamers the Sabine god of war, was its ancestor.[143] Mamers or Mamercus is Mamre, the uncle of Zimran. Enyalius, Milo and Thurius were other names of the Sabine Mars, indicating that Mahalah and Darda kept up his martial character.[144] The story of Manlius Torquatus I have already referred to as connecting verbally with other legends of a similar character. Manlius is a form of Mahalah, and Torquatus, of Darda.[145] Dracon in Greek denoted a necklace as well as a dragon. The Dracæ or water sprites of Gervase of Tilbury, referred to by Mr. Cox as enticing children into their power by the semblance of gold rings floating upon the water, may relate to the same word as torque and dracon.[146] Sabinum exhibited its Zimrite affinities in Simbruinæ, Vestini, Adria, Mesula, Mandela and Cucullum. In Samnium we find Imbrivium, Histonium, Meles, Aquilonis, Eculanum and Aquilonia.

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139 Æneid, x. 391, ix 685. He also mentions Thymbris and Thymbræus, Trojans

140 Banier, ii. 569-70.

141 Ib.

142 Strab v. 3, 2

143 Festus, sub voc., Æmil.

144 Banier, ii. 319

145 It is not enough to say that the stories of Torquatus and Malachi belong to comparatively late periods of Roman and Irish history respectively, in order to destroy the force of the connection; for the legend of Tell, and others which belong to the Christian era, have been proved adaptations of old traditions.

146 Aryan Mythology, ii. 116 note.

Campania contained a Cimmerian region with Plutonic associations.[147] There also appear Sestia, Setium, Acerræ, Megalia, Nola, Aminea, Gallicanus, Callicula and Tirata. The Lampadophoria of Naples, recalling the adventure of Gideon of Ebal, the present Nablous, were instituted by Eumeles.[148] Diotimus, associated w th Eumeles, is a name like Etymon, Athamas, &c. Basta, Mateola, Calela, Drium, Turum and Taras are Apulia's contribution to Zimrite identification. It contained Asculum, which, like many another similar Italian name, related to Eshcol and Ascalon of Palestine. Pæstum of Lucania was Doric like Hestiæotis, and, together with Aciris, sets forth the sons of Zimran. Lucania was a western Laconia or home of the house of Lechem. Bruttium furnishes Æsarus, Malleæ and Thurii. Its town Crotona was founded by Myscellus, who is called an Achæan by some, but by others a son of Alcmon of Argos.[149] Crotona also was famous for Milo the athlete, who was a disciple of Pythagoras, and whose name has already appeared in connection with a tragical story and as that of Mars. Milo himself had a tragical end; and, strange coincidence, he was the son of Diotimus.[150] I do not insinuate that the whole story of Milo is a fable. It can easily be that facts relating to a much more ancient personage were confounded with the life of the Crotonian wrestler, just as incidents which plainly belong to the Noachian Deluge were interpolated in many narratives of more recent and local floods. Scyllacium and the Mamertines of Bruttium again indicate the relations of Eshcol and Mamre with their nephew Zimran and his line. Sicily, which was above all others the land of Eshcol, and whose Zancle was no doubt the Ziklag of Palestine, is full of Zimrite names. Such are Himera, Camerina, Damyrias, Thymbris, Ægesta,[150*] Acithis, Acrae, Imachara, Milichie, Mylæ, Macella, Mascalis, Nau-

147 Strab. v. 4, 5 Amalthæa the Sibyl of Cumæ in Campania, was also named Hierophile Her names unite Hammoleketh with Eriphyle, wife of Amphiaraus.

148 It is worthy of note that Gideon was a man of Ophrah, that he led the Abiezrites; and fought his famous battle of the lamps and pitchers near Abel Meholah. Judges vi 11, 34, vii. 22 I have called him Gideon of Ebal, because his history, and more especially that of his son Abimelech, is associated with Shechem or Nablous, so called from Ebal, although the Greeks Hellenized it into Neapolis Judges viii. 31; ix. The house of Millo, Judges ix. 6, may connect with Mahalah

149 Strab vi 1, 12

150 Pausan vi. 14.

150* Macella was on the Crimisus. Ægesta was founded by Acestes, the son of the river god Crimisus As the Cimmerian Chersonesus is the modern Crimea, a river Cimmerius might easily become a Crimisus.

lochus, Monalus, Amenanus, Menæ, Callicum, Torus, Terios and Tiracia. Himera was said to have been founded by the Zanclæi of Mylæ; and Camarina, by Menecolus a Syracusan.[151] In either case a place named after Zimran is colonized by Mahalah, who on the one hand is connected with the family of Eshcol, and on the other with Sheresh of Gilead. I cannot but think that the earliest population of Sicily came from Africa, for on the opposite coast of Carthaginia appear Sicilibus and Membresa, setting forth the migrations of the Amorite line of Eshcol and Mamre. Melita, south of Sicily, I have already claimed for the posterity of Mylitta or Moleketh. Bastia in Corsica is a reminiscence of Ishod; and Metalla and Tarrhæ of Sardinia, of Mahalah and Darda.

In Gaul we would naturally expect the Zimri to be well represented. And so in fact they were. In Narbonensis, Ambrum, Ambrussum, Comaria and the Sambracitanus Sinus illustrate Zimran; and the Caturiges with Cotorissium, the Katoorah of Arabia, or those who took their name from his mother Keturah. Setius Segustero, Badera, Mantala, Calagorris, Salsulæ and Tarasco are traces of most of his descendants. But the best Zimrite record is Massilia or Marseilles, which appears in a thoroughly Cymric region, and which was said to be a Phocean colony. The Ephesium of this city seems to link its history with Samornia of Asia Minor and with the family of Midian, of whom Ephah was the eldest son. There was a famous college of Druids near Marseilles in a sacred forest or grove of oaks, and this wood the Abbe Banier does not scruple to associate with the oaks of the Amorite Mamre.[152] Aquitania preserved few if any traces of Zimran himself, but his descendants were commemorated in the Vasates, Sociatum, Segodunum, Acitodunum, Atures, Segora, Meduli, Mediolanum, Tamnum and Limonum. The Caderci may have been a later Caturiges or Katoorah. Pezron cites Eustathius, Jerome, Isidore of Seville, the Paschal Chronicle and Joseph Ben Gorion as authorities for deriving the Gauls proper from Gomer.[153] It is exceedingly doubtful whether ethnological researches will ever succeed in taking us back to the time of that ancient patriarch, and much more, whether any tradition but that of the Bible will ever be found making mention of the great men of the antediluvian world,

151 Thucyd VI. 5.

152 Banier, III. 223-24. He also connects the Druids with Pythagoras and the Persian Magi, 228.

153 Pezron, i. 3.

whom some writers have been so prone to discover on every page of ancient history. Ludgunensis contained the Ambarri, Semuren, Segustani, Segessera, Meldi, Melodunum, Mediolanum, Salioclita, Aquæ Calidæ, which I believe to have been a Latin version of a word foreign to that language, Tricasses, Turones and Druidæ or Durocasses. Belgica was a great home of the Cymri. Samora, Samarobriva, Camaracum, Cambresis, the Ambrones of Helvetia, Sambre and Kemerland of Flanders, were records of Zimran. The Suessiones may have been the descendants of Ishod. The Isara commemorated Ezer; and the Mosella, with Medialænum and Mechlin, Mahalah. The Ambiani of the modern Amiens and Ambiatinum were certainly of Heman. Galusiacum may set forth Chalcol; and Turicum, Duroicoregum and the modern Dort, Darda. Time does not permit me to dwell upon the geographical propinquity of the various names mentioned, but this will be found important in establishing the connection of the different tribes with one another and with their common ancestors.[153*]

Spain received its Cymric population from Africa, and probably sent the stream into Gaul. In Bætica, so closely associated with the memory of the Gileadite Bedan, there was no record of Zimran, but Ishod was represented by Asta, Asito, Segida, Setia, Setida, Bastia, and the Bastitani; Abishur by Abdera and Hactara; Hammoleketh by Malaca; and Darda by the Turdetani. Lusitania furnishes Tomar, Ambracia, Emerita, Egitania, Gerea, Metallina, Æminium, Cæcilium and Durius. Tarraconensis was fuller. There we find Tamara, Sambroca, Ampuriæ, Melsus, Cesada, the Ausetani, Cosetani and Vescitani, Agiria, Nucaria (an occidental Nagara), Massilia, Amphilochia, Amallobriga, Amænum, Calagurris, Dertosa, Turias, and Tritium. Already I have supposed a Gallic Aquæ Caldensis to be a corruption of Chalcol. This receives probability from the fact that Amphilochia, which Amphilochus, who was ever attended by Calchas, is said to have visited, was also called by that name.[154] Orippo and Orubium of Spain are, like Aripa and Herpis of Mauretania, links to unite Zimran or Amphiaraus with Oropos.[155]

Cambria, and Cymri the name of the Welsh, are sufficient indica-

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153* Pictet mentions Æsar and Molk among Celtic divinities; Higgin's Celtic Druids, 167.

154 Strab iii. 4, 3.

155 Other names that may possibly connect with Oropus are Arabis of Gedrosia and Orebatis of Persis; Europus of Mesopotamia; Harpasus of Armenia; Herpe and Arabissus of Cappadocia; Arrubium of Mœsia; Euboea of Epirus; Orobiæ of Eubœa; Arba off Illyria; Arabona of Pannonia; Orobii of Gallia Cisalpina; and Urba of Gaul.

tions that the Zimri passed the sea and peopled the British Islands, along with their relatives the Celts or Gileadites. Cambria or Britannia Secunda does not, however, present us with many names illustrating Zimran's line. The Seteia may be a reminiscence of Ishod, Mediolanum and Machynleth of Mahalah, and Mona of Heman. But Britannia Prima, or the region south of the Thames and the Bristol Channel, was, according to Richard of Cirencester and other writers, a home of the Cimbri.[156] They left their name in the Tamar and Tamara of Cornwall, in Somerset itself and in Ambrius and Ambresbury of Wiltshire, where Stonehenge is a memorial of Druidical occupation. Ishod's name may have been shortened to Isca, and may appear in the modern Seaton. St. Michael's Mount probably had nothing to do with the archangel, but was a close imitation of Machalah. The Damnonii, whose cities were Tamara, Isca and Uxella, and among whose rivers appear the Tamarus, Isca and Durius or Dart, were undoubtedly the descendants of Heman, associated with those of Ishod, Chalcol and Darda.[157] Ischalis and Calcua may be added to the records of Chalcol; and Darda finds abundant representation in the Durotriges, Truro, Dorset, and a large number of similar names further east. Ocrinum, the name of Lizard Point, was perhaps a disguised Ezer. It is interesting to find Termolus as one of the chief towns of these British Cimbri, as it recalls the Termilyæ of Lycia, whom, as Milyæ, I have already associated with Mahalah. Turmuli in Lusitania, and Tremuli in Mauritania, are two connected names. Flavia Cæsariensis cannot have contained so large a Cymric population as Britannia Prima. Yet we find there Camborium, Combretonium, Mediolanum, Durocina, Durocobrivæ, &c. Maxima Cæsariensis, although in the Roman period destitute of names directly denoting its Cymric relationships, betrayed these at a later period in the Humber on the East and Cumberland on the West, as well as in Deira. Segedunum, the Sistuntii, Isurium, Maglove, Amboglana, Galacum, Oxellum and Calcaria, are earlier vestiges.[157*] In Caledonia Dumbriton, Malua, Damnii and Uxellum, may have been outlying pickets of the family of Zimran.

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[156] Six Old English Chronicles, Bohn, 440.

[157] Ib. 441.

[157*] Cataracto or Catterick in this province recalls the Caturiges of Gaul and the Arabian Katoorah Similar names are Catarrhactes of Mesopotamia; the Catarrhactes of Pamphylia, Crete and Laconia; and Cataracta of Samnium. It is hardly likely that they are all Greek.

In the Welsh legends, Emrys or Ambrosius was a famous name.[158] It was this Aurelius Ambrosius who, with the aid of the magician, Ambrose Merlin, a fatherless personage, set up the megalithic structure called Stonehenge. The mother of Ambrose Merlin was a daughter of the king of Dimetia.[159] Among the mythical British sovereigns, many seem to claim kindred with Zimran and his descendants. Besides Ambrosius, we meet with Kimarus, who is called the son of Sisilius, as Amphiaraus is termed the son of Oicles. The British and Greek names must equally denote Eshcol, the uncle of Zimran. The brother and successor of Kimarus was Danius, who may easily have been Dedan, the son of Jokshan, the brother of Zimran. Tangustela, the concubine of Danius, reminds us of the Etruscan Tanaquil or Caia Cæcilia, the wife of a Tarquin. But before the time of Kimarus appears Maddan, a Midian-like name. He was the father of Mempricius and Malim, who respectively recall Mamre and Mahalah. Among the children of Ebraucus (an Ophrah), the son of Mempricius, we find such names as Sisilius, Kambreda, Stadud, Assarach, Edra, Egron, Methahel, Gaul, Gloigni and Darden. This may indicate simply the Zimrite origin of those among whom the corresponding names appear.[160] According to some ancient historians, the Cymri of Wales were the descendants of Briotan Maol, whose language was the original Irish.[161] Maol is the important part of this name, and probably denotes Mahalah. He, as the Celtic Mars, should be the primitive Mile, the Latin Miles, a soldier. Fionn Macumhal, perhaps the same as Macuill, was the first to embody the famous Irish militia. His daughter, Sammir, bore a Zimrite name.[162] But in Malachi, who won from the Dane Tomor the collar of gold, we discover, as I have already indicated, Manlius Torquatus, and in the collar the necklace of Eriphyle.[163] Tristram

158 Davies' Celtic Researches, 191. Bryant, in his Analysis v. 201, deals with the subject of Amber stones, which he finds in many parts of the world, and with the word Amber as denoting sacredness, which he finds in Greece and Egypt.

159 Six Old English Chronicles, 192.

160 Ib. 132, 111, 113

161 Keating's General History of Ireland, 129.

162 Ib. 284, 297.

Besides Tomor the Dane, from whom Malachi won the collar, who bears a name analagous to Cimber, we find in Irish history a Danish Earl of Tomair, a Turgesius and three other Danes Amelanus or Amhlaoib, Cyracus and Imorus, with a Humphrey, recalling the Kempery men of old English traditions: Keating, 425, 412, 434, &c. The Danes are called Gauls: Keating, 413.

163 Keating, 475.

of British story, the son of Meliodas, may possibly be Darda of Mahalah.[164] The latter hero might also be the namer of the mistletoe, so intimately connected with the oaks of his son Darda. In the British and Irish traditions equally, a migration along the African coast of the Mediterranean is recorded, agreeing so far with those of the Latins.[165]

In my last paper, I illustrated the wide dispersion of the family of Gilead by well defined traces of its presence in Germany and Scandinavia. Within the same Teutonic area the Zimri may be found. The Istævones may have received their name from Ishod. Among them appear Sicambri and Gambrivii, Segodunum, Adrana, Mediolanium, Ambiatinum, and the Dructeri. Strabo mentions Melon as a leader of the Sicambri, and Segestes as chief of an allied tribe.[166] The Hermiones furnish Setovia, the Sudeti mountains, Setuacatum, the Mugilones, Meliodunum, Medoslanium, the Omanni, Galægia and the Teracotriæ. The Chætuori may have been a German tribe of Katoorah, and the Diduni, descendants of Dedan the son of Midian. Above the Hermiones and south of the Baltic, between the Elbe and Sarmatia, we meet with Æstii, Setidava, Susudata, Obotrites, the modern name Mecklenburg, and the Calucones. The Teutones reproduce the Diduni and Dedan. The Cimbric Chersonesus introduces us to Scandinavia and to another Amalchian sea. The Wagri of Holstein seem to indicate that Ezer's family was in the ascendant there; and the Sitones, with Sigtuna of Sweden, that the descendants of Ishod had peopled that country.[167] The Danes themselves I believe to have been the posterity of Dedan. The Asiatic origin of the Germans and Scandinavians is so undoubted as to require no comment.[168] The river Tanaquisl, whence the latter are said to have come, bears a suspicious resemblance to Tanaquil and Tangustela, Etruscan and British names.[169] The giant Ymir, who was the ancestor of the Teutonic family in their mytho-

164 Cox & Jones, Popular Romances of the Middle Ages

165 Six Old English Chronicles, 101-2, 390; Keating, 110, &c; The Scottish Chronicle.

166 Strab vii. 1, 4

167 Latham's Ethnology of Europe, 202. The Cimbri and Æstiones are said to have spoken Celtic. Buchanan, Hist Scot, ii. 14

168 Mallet's Northern Antiquities, Bohn, 83, 516. The presence of Runic, Etruscan and Irish Ogham characters in Arabia is the most natural thing in the world. Baldwin's Prehistoric Nations, 87.

169 Ib. 84.

logy, and another famous giant Gymir, must represent Zimran. The latter married Aurboda, a kind of Arriphe or Eriphyle, and had a daughter Gerda, the Critheis of the Homeric legends.[170] Still another Zimrite name appears in Hymir the fisherman, who should rather have been Jokshan the brother of Zimran, seeing that his name means "the nets," and is the original, in as far as Hebrew is an original language in etymology, of the Greek Diktuon, meaning the same thing.[171] Miolnir, a name of Thor, may possibly connect with Mahalah. I do not know whether Tuisto, father of the German Mannus, designates Ishod or not. Heman the son of Mahalah, or, better still, Meonothai son of Abiezer, may represent Mannus. Mimir, who deprived Odin of his eye, I have already associated through the legends of Cocles and others representing Eshcol, with Mamre, the uncle of Zimran.[172] Oxylus, one of these one-eyed heroes, exhibits his Gileadite relationships in being called the son of Mars and Protogenia, the daughter of *Calydon*.[173] Similarly Zimran, as Imbrius, is the son of Ægyptus and *Caliande*, and, as Ampheres, of Neptune and *Clito*. The Scandinavian Gladsheimer was in all probability a reminiscence of a Gileadite or Celtic region. Fortunately for the reception of the fact of a Germanic connection of Gileadites and Cymri, the character of the Cimmerians, as either distinctively Celtic or Germanic, has never been settled.[174] The explanation of this uncertainty is found in the Germanic education of a portion of the Cymric stock which entered Europe from Asia. We may naturally expect these Asiatic Zimri to reproduce in their mythology and language some of the features characteristic of Greek culture and tradition; while the African Zimri of Spain, Gaul and Britain, should possess elements in common with the Latins and other Italian peoples.

Besides the three Cymric tides which overflowed Europe, two of which came from Africa and one from Asia, there were at least two others that spread over parts of Asia and Africa respectively. One of these we have traced through Persia and India to the borders of China, and the other we left in Ethiopia. Both of these might

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170 Mallet's Northern Antiquities, Bohn, 403, 428.
171 Ib 444.
172 Ib 411.
173 He is also called the son of Hæmon, who must be Heman.
174 Rawlinson's Herodotus, App. Book iv., Essay 1. Mallet's Antiquities, 68 note.

easily have been carried farther. The Asiatic, entering China, sent a stream doubtless into the New World from the east, which met with the corresponding stream that flowed from Western Africa or Spain into the Gulf of Mexico and the Caribbean Sea. The African made its way slowly into the centre of the continent, where Djebel Komri, Bornou, with its traditions of Himyaritic occupation, and, in the west, the Cameroons, retained the memory of Zimran.[175] This wide dispersion of a single family, and that not a primitive family of mankind, is surprising. Zimran himself must have lived about nineteen centuries before the Christian era, and not more than four generations of historic men can have preceded him. For these four generations we find ample materials in the Bible, by the aid of which history may be restored up to the very dawn of national existence. I am as yet but a pioneer in the unbroken tract and tangled forest of ancient tradition. Other writers will yet make plain and smooth the highway of the nations from their eastern dwelling place, and, reducing to order and harmony the fragments of mosaic which it has been my labour of love to disinter at every stage in their progress, will present a picture of the far off past that shall be the delight and instructor of future ages.

The following tables exhibit the results obtained, as these have been set forth in the paper. I once more deem it necessary to state that I do not vouch for all the connections set forth, nor do I consider that the proof is vitiated by what may be found an unnecessary and in some cases an erroneous fulness of illustration.[176]

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175 Baldwin's Prehistoric Nations, 329.

176 As I have already indicated that Ezer or Abiezer, the second son of Zimran and Hammoleketh, had a son Meonothai and a grandson Ophrah, I have thought it desirable to add a table of their geographical connections, which will be found closely to relate to those of Zimran's family already mentioned. Meon, or, with the power of the *ayin*, Megon, is the important part of Meonothai's name; and that of Ophrah, which, commencing with *ayin* may appear as Gophrah, &c., is found in the Bible as Leophrah or Beth Leophrah.

Persia.—Mandagora, Caberasa, Gabris and Sabris of Media. Gabra of Persis, Sipphare of Aria, and Masin of Gedrosia.

India.—Magon, Massani, Masicani, Mæandrus. Supphara, Sabaræ, Sippara, Sabara, Abraganus.

Bab. & Ass.—Mesene, Mesene, Mennis, Mygdonia. Abara, Sipphara, Chaboras, Caprius, Labbara..

Arabia.—Mæceni, Labris, Obraca, Spharitæ.

Africa.—Macomades, Macanitæ. Gaphara, Eperos, Aubereum, Sabrata, Tillabari.

Syria.—Cappareæ.

Asia Minor.—Mosynœci, Messena, Moson, Mygdones, Mosyne, Myndus, Mæander, Magnesia, Mæonia, Myonnesus. Sibora, Labranda.

Thrace—Mosynopolis, Apri, Euporia.

Macedonia.—Mygdones.

Greece.—Magnesia, Cyphara and Sperchius of Thessaly; Mæandria of *Epirus;* Macynia of Ætolia; Myonia of Locris; Cyparissus of Phocis; Eupyridæ of Attica; Mecone of Sicyon; Mycenæ of Argolis; Messene, Hyperesia and Laphria of Achaia; Ephyra and Lepreum of Elis; Mantinea, Cyparissia and Aliphera of Arcadia; Cyparissia of *Messenia;* and Cyparissia of Laconia.

Islands.—Mesine of *Cyprus;* Myconos; Myonessus; Hippuris; Ephyra; Sybarita of Crete; Leucophrys of Tenedos; and Caphareus of Eubœa.

Mœsia, &c.—Appiaria of Mœsia; Monetum, Liburnia and Alporio of Illyria; Mogentianæ, Sabara, Sabaria and Labores of Pannonia; and Savaria of Noricum.

Italy.—Mantua, Eporedix and Libero of Gallia Cisalpina; Monœci Pontus and Libarna of Liguria; Liburnus of Samnium; Misenum, Eburi and Avernus of Campania; Caprasia, Sybaris, Sibarena, Aprustum and Leucopetra of Bruttium; Messana and Hypparis of Sicily; Mantinorum opp. of Corsica; and Lipara.

Spain—Massienus, Mantua, Mundus, Mentesia, Menesthei; Epora, Ebora, Eburobritium, Sibaris; Æbura, Libora or Talabrica; Lavara, Lacobriga.

Gaul.—Monesii, Moguntiacum, Nantuates, Nemetes, Namnetum; Avara, Avaricum, Eburones, Eburovices, Eburodunum, Eburobriga, Gabris.

Britain, &c.—Magnatum or Limerick, Monaoida; Eboracum, Gabrosenum, Laberus.

Germany.—Munitium, Mœnus, Misnia, Nuithones; Eburum, Eburodunum, Lupphurdum, Tuliphurdum.

Many of these names are intimately associated with the records of Ezer. Thus in India, Supphara and Sippara are near Muziris and Magaris respectively, and Abraganes near Aggeres and Thagora. In Mesopotamia, Labbara, which lies in the north of Messene, is not far from Hatris; and the Chaboras divides Mygdonia from Osrœne Labris of Arabia is in the territory of the Gerræ, and Obraca in that of the Agræi. Sabrata and Assaria of Africa are near to each other In Syria, Cappareæ has Megara to the north and Sizara to the south-west. Sibora of Pontus is among the Agrianes; and Apri of Thrace is found among a people of the same name. The Mygdones of Macedonia connect with Assurus. Hyperesia in Achaia bore also the name Ægira. Appiaria of Mœsia was near Tigra and the Iatrus. Sibarena of Bruttium lay between the Neæthus and the Æsarus. Ebora of Tarraconensis was also called Ixar. Eburobriga of Gallia Lugdunensis was not very far from Segessera; and Eboracum of Britain was still nearer to Isurium Many similar associations of names tend to prove the correctness of the connections of Meonothai and Ophrah with the family of Ezer.

Before dismissing this family there is a remarkable Bible reference to Ezer himself which cannot be allowed to pass without comment. In Jeremiah xlviii. 32, we read of the sea of Jazer, the name of which is identical with that of the region in Gilead called after Ezer. The children of Moab are there spoken of as passing the sea, and their settlements as reaching as far as the sea of Jazer. I cannot doubt that sea of Jazer is the Adriatic, and that Atria and Edro of Venetia, Adria of the Vestini, with Iadera of Illyria, and other similar names upon its shores, are memorials of Ezer. It is interesting to find a legend that Sorrento was founded by Hadarezer of Syria, who fled before the arms of David. He may have been confounded with an earlier Ezer. Early Travels in Palestine, Bohn, 6, 9. At Atria in Venetia we find the Fossiones Philistinæ. It will not be a difficult task to find the descendants of Moab in the neighbourhood of this sea. Messapia doubtless was one of their colonies. There Ar appears as Uria or Hyria. They may also have passed into Etruria, and given to its river Arnus the name of their Arnon. The Mopsopians of Greece and Asia Minor mark the Moabite track westward.

I.—GEOGRAPHICAL CONNECTIONS.

	Zimri or Zimran.	Ishod.	Ezer or Abiezer.	Mahalah and Hammoleketh.	Heman.	Chalcol.	Darda.
Persia—							
1. Media	Amarieæ		Azara Tachasara Tigrana	Amul Maltai	Amana	Acola	Dariausa Derusiæi
2. Susiana			Agra	Melitena			Deera
3. Persis	Gombroon	Systa Soxotæ					Daritæ
4. Hyrcania	Samariane Tambrax Amarusa Asmura	Astaceni Socande					
5. Parthia	Ambrodax	Issatis Astacana Tastache	Gadar				Dordomana
6. Carmania	Semiramides	Isatichæ			Omœnus		Dara
7. Sogdiana	Comari Samarcand	Basistis					
8. Bactria	Amares Chomara	Astacana	Icarus				Dargidus
9. Aria and Margiana	Ambrodax Zimyra	Asta Astauda Astaveni Sacastene	Cassirotæ		Dammana		
10. Gedrosia	Tamorus	Asthaea	Agris Bagasira	Malana	Nommana	Coeala	Troesi
India—							
1. Northern	Camboricum	Astaceni Soastus Suatene	Abissares Agra Nagara	Malli Miyulu	Aminachæ Jomanes	Glaucæ Cocala	Dardæ Tirhut Dyardanes
2. Central and Southern	Amara Ambra Comaria Tamra Limyrica	Astacapra	Hippocuria Agara	Mesolia	Semne	Caliguris	
3. Farther India	Sammarade Kammeren		Pagrasa Acadra Thagora	Malaya Malacca Maleucolon		Calligicum	Tharra
4. Serica	Asmyræa	Issedones	Aggeres				
Chaldea.	Camarina		Abu Shahrein				Teredon or Diridotis

BABYLONIA	Thamara	Issedea Sittace	Otris	Malcha			Teredata Dorista
ASSYRIA	Sumere Samaran Gomara	Saccada	Aturia	Meso Pylæ, or Mosul		Calchas Calachene	Dartha Dura
MESOPOTAMIA	Himeria Ombiæ Semiramides	Saccada	Auxaris Hatris	Mallii		Achaiakala Cæcilium	Dura Dadura Daradax
ARABIA	Zamareni Camareni Sambracata Smyrnophoros Chamara Shammar Thamar Homeritæ Hamirei Amara Omran	Sata Asateni Ascitæ Sacatia	Agræi or Gerrhæi Ausara Ausaritæ Agra Nagara	Mela Mamala Massala Masthala Malichæ Malichi	Omana Omanitæ Amanitæ Minæi	Acila Ocelis Chaulasii	Darræ Thuris
ETHIOPIA	Sembritæ Amhara	Tasitia	Agrii Esar	Mossylon	Eumenes	Acila	Darada Deire
EGYPT		Schædia	Taposiris	Milukhi Metelis Menelaus		Glaucus	Deirut Tarichœa
N. AFRICA— 1. Libya	Semeros	Auschitæ Nausida	Aziris	Masadalis Menelaus Ampelus Ampeliotæ	Ammonii	Augilæ	Diarroas
2. Africa and Numidia	Zamora	Sidetani Pisida	Azarath Sizaia Sizar or Usar	Machlyes Mascula Misulani Amuncla Maxula	Damensii	Culcua Culucitanæ Igilgilis	Durga Tarychiæ Tritonis
3. Mauretania	Tumarra Thamarita Camarata Emporicus	Usceta Sigatha Sitisi	Asarth Tigisis Tasagora	Molochath Massæsylii Malliana Amilos Ampelusia Tremuli	Mina Jomnium	Chalcorychii Aquila	Durdus Dryitæ Daradæ Dracones
PALESTINE	Zemaraim Samaria		Abiezer Jaazer	Abel Meholah			
PHŒNICIA AND SYRIA	Dummar Tamyrus	Aswad	Azar Gerra	Mahallib Ampelœssa	Amana Haminea		Trachones Tiieres Daradax

ARMENIA	Zimara	Astacana Testis	Azora	Molchia		Acilicene	
CAUCASUS	Seumara	Sioda Vasæda	Absorus	Mechlessus		Glaucus Cilici	Tarsura
ASIA MINOR—							
1. Pontus and Cappadocia.	Imbarus Sinoria	Scydisces	Aziris Cizaii	Pimolisa Megalopolis Melas Melitene	Eumeis	Collucia Gaolasera	Dracones
2. Cilicia.	Commoris	Pisidæum		Mylæ Mallus Melania	Amanides Homonada		
3. Paphlagonia and Galatia		Vasada	Gazora	Timoleum	Amnias Domanitis Timonitis	Callichorus	
4. Bithynia	Thymbrius Smyrdiana	Astacus Astacenus Posidæum			Aminias	Callica	
5. Phrygia and Lycaonia	Thymbrium Amorium		Isauria Achara	Melissa Nacoleia Philomelium	Eumenia	Glaucus Cillexuga	Trogotis Tyriæum
6. Pisidia and Pamphylia	Thymbrius	Side Pisidia	Agrioteri	Melas Amblada Pamphylia	Homona		Darsa
7. Lycia	Chimæra Limyras	Isionda		Milyas Termilyæ		Glaucus	
8. Caria	Thymbris	Pystus Posidium		Mylasa			Doridis
9. Lydia	Smyrna Samornia Thymbræ	Saittæ	Geræ	Melas Tmolus Malæna Mycale Ampelus	Myonnesus Mæonia		
10. Mysia	Cimmeris Thymbris Thymbrium	Assus	Nacrasa	Mallus		Callicolona	Troas Tragasæ
THRACE	Ismarus Himærium Tempyia	Sestos Satiæ Astica	Abdera Agora Agrianes	Melas Naulochus Ampelus	Limnæ		Dorsæi Treres Doriscus Drys Tyrizis Tyrodiza

MACEDONIA	Combræa	Satis Schiate Ægestea Pissantani	Abderites Agrianes		Æmonia		Derrhi
GREECE—							
1. Thessaly	Amyrus Ambrysus Chimærium	Hestiæotis Sciathus Phæstus	Azorus	Melia Melas Milæ Mallæa Homolium	Æmonia Limnæa	Iolcos Œchalia	Tricca Dyras Dryopes Titarus Titaresius
2. Epirus	Chimærium Comarus Tomarus Ambracia	Posidium	Issoria	Molossi Omphalium	Amyntæ		
3. Ætolia and Acarnania		Astacus Thestia	Agræi Acræ	Amphilochia	Dymæi Limnæa	Œchalia	
4. Phocis and Locris	Ambrysus	Phæstus	Tegyra	Amphiclea Hyampolis		Callichorus	Tritæa Tritia
5. Bœotia	Amphiaraus		Agra	Mycalessus	Hæmon	Ocalca	
6. Attica	Amphiaraus Lampræa		Agræ Acharæ	Amphiale Melænæ	Limnæ		Thria Thoreæ Thoricus Deriades Derus
7. Isthmus	Amphiaraus	Ægosthene	Icaria	Molychium	Minon		
8. Argos	Limera	Sythæ	Epidaurus	Umbilicus			Thyrea
9. Achaia			Ægira	Melas Megalopolis Ameilichus		Glaucus	Tritæa
10. Arcadia		Sciathus Asæatis Acidas	Agra	Amilus Malæa Malæna Molossus Megalopolis	Æmonia Aminias	Œchalia Calliæ	Trachys Thyreum
11. Elis		Pisatis Acidon		Omphalium Amphidoli		Scollis	Dorium
12. Messenia			Koros		Limnæ	Œchalia	Dorium Thria
13. Laconia	Limera	Scotitas	Epidaurus Acriæ	Mesola Malæa Menelaium Amyclæ	Limnæ	Œchalia Ægila	Derrhium Thyrides

ISLANDS—							
1 Cyprus					Limenia	Golgoi	Treta
2. Crete	Cimarus Camara	Phæstus	Aptera	Metallum Amyclæum Omphalia Ampelus Amphimalla	Minoa		Tarrha Tityrus
3. Eubœa	Amarynthus	Hestiæa			Tamynæ	Œchalia	Trycha
4. Others	Imbros Imbrasus Camirus			Moschylus Naulochus Melos Malea Ampelus Amphilissus	Lemnos		Thera
MŒSIA AND DACIA		Sugidava	Agarus Iatrus	Naulochus Meldia	Hammeno		Tiriscum Turres Drista Dorticum
SARMATIA	Cimmerii Temerinda Tamyraca Samara	Sagastene Sittaceni	Agri Acria Apaturium	Amalehium	Tuman Ambenus	Chalca	Treres Tauri
ILLYRIA		Dæsitiates	Absorus Epicaria Iadera or Zara	Metulum Dimallum	Æmonia Amantes	Clausula Cylices	Derrii Daorisi Turres
PANNONIA	Comare Komorn Sumerein	Segeste Segedunum	Abieta or Agria		Æmona Amanteni		
NORICUM, VINDELICIA AND RHÆTIA	Ambre Ambidrani		Isarus	Ambilici Maletum	Ambisontii	Cuculle Oscela	Trigisumum
ITALY—							
1. Venetia and Istria			Atria	Motila Malum		Aquilegia	Tergeste
2. Gallia Cisalpina	Umbranum Insubres Lambrus	Sessites Testona	Isara Acerræ Edrum	Mediolanum Mutilum Æmilia Cameliomagus		Colicaria Ocelum	Duria Duriæ Tarus
3. Liguria		Asta Sestiæ Segeste		Ampelus Monilia			
4. Etruria	Umbro Amerinum	Hasta Pisatæ	Pistoria Ausar	Magliana, or Manliana	Minio	Agylla Igilium	Tauri

5. Umbria and Picenum	Ameria Umbria Camerte Camerinum Cumerium	Asitia Suasa	Pisaurum	Matilica Meuaniola		Gallicana Clusiolum	Tuder Tria Tetricus
6. Latium	Semurium Sembruinæ	Setia Festi		Amyclæ	Laminæ		Trerus
7 Sabinum	Simbruinæ	Vestini	Adria	Mesula Mandala Meles		Cucullum	
8 Samnium	Imbrivium	Histonium				Aquilonis Eculanum	
9. Campania	Cimmeris	Sestia Setium	Acerræ	Nola Megalia	Aminea	Gallicanus Callicula	Tirata
10. Apulia, Lucania and Bruttium		Basta Pæstum	Aciris Æsarus	Mateola Malleæ		Calela	Drium Turum Taras Thurii
11. Sicily	Himera Camarina Damyrias Thymbris	Ægeste Acithis	Acræ Imachara	Milichie Mylæ Macella Mascalis Naulochus Monalus	Menæ Amenanus	Callicum	Torus Terios Tiracia
SPAIN—							
1. Bætica		Asta Asito Segida Setia Setida Bastia Bastitani	Abdera Hactara	Malaca			Turdetani
2. Lusitania	Tomar Ambracia Emerita	Egitanea	Gerea	Metallina Turmuli	Æminium	Cæcilium	Durius
3. Tarraconensis	Tamaria Sambroca Ampuriæ	Cesada Ausetani Cosetani Vescitani	Agiria Nucaria	Amphilochia Melsus Massilia Amallobriga	Amænum	Calagurris	Turia Tritium Dertosa
GAUL—							
1. Narbonensis	Comaria Ambrun Ambrussum Sambracitanus	Segustero Setius	Badera	Massilia Mantala		Calagorris Salsulæ	Tarasco

2. Aquitania		Vasates Sociatum Segodunum Acitodunum	Atures Segora	Meduli Mediolanum	Limonium Tamnum		
3. Lugdunensis	Semuren Ambarri	Segustani	Segessera	Meldi Melodunum Mediolanum		Salioclita	Tricasses Turones Druidæ or Durocasses
4 Belgica	Samara Samarobriva Camaracum Cambresis Ambrones Sambre Kemerland	Suessiones	Isara	Mosella Medialænum Mechlin	Ambiani Amicus	Galusiacum	Turicum Duroicoregum Dort
BRITAIN—							
1. Secunda	Cambria	Seteia	Ystrad	Machynleth Mediolanum	Mona		Druidgen
2 Prima	Cimbri Tamar Tamara Somerset Ambrius Ambresbury	Isca Seaton	Ocrinum	Michael, Mt. Termolus	Damnonii Lemanæ	Calcua Uxella Ischalis	Durius or Dart Truro Dorset Durotriges
3 Flav Cæs.	Camborium Combretonium			Mediolanum			Durocina Durocobrivæ
4. Max Cæs.	Humber Cumberland	Segedunum Sistuntii	Isurium	Maglove Amboglana		Galacum Oxellum Calcaria Uxellum	Deur, or Deira
5 Caledonia	Dumbriton			Malua	Damnii		
6 Hibernia	Comaina Samer Limerick		Auterii	Macolicum Moynealta	Limnis Damnii		Dur Derry
GERMANY—							
1. Istævones	Sicambri Gambrivii	Segodunum	Adrana	Mediolanium	Ambiatinum		Dructeri
2. Hermiones		Setovia Sudete Setuacatum		Mugilones Meliodunum Medoslanium	Omanni	Galægia	Teracatriæ
3. Vindili		Æstii Setidava Susudata	Obotrites	Mecklenberg		Calucones	
SCANDINAVIA	Cimbric Chersonesus	Sigtuna Sitones	Wagri	Amalchium	Umea		Trondheim

II.—HISTORICAL, MYTHOLOGICAL AND PHILOLOGICAL CONNECTIONS.

	ZIMRAN.	ISHOD.	ABIEZER.	HAMMOLEKETH AND MAHALAH.	HEMAN.	CHALCOL.	DARDA.
Persia	Bible Zimri Kaiomers Tahmouras STONEHENGE	Pischdad	Apusorus	Mahaleel			Zaratus *Dur,* *a pearl.*
India	Timbara Sambara Sumuri	Ajasat Chetiya Sacti	Upachara	Mallika Muchala Mahali Mekhali			Tirttakas.
Babylonia and Assyria	Smirm Zmarus Cambirus Semiramis	Ascatades Gatiya Usati	Ephecheres	Molis, or Mylitta Milisihu Mancaleus Mamylus Amelon Enyalius Musallimu	Amyntes Amenon	Khalkhalla	
Arabia	Homeritæ of Keturah; Himyar; Shammir; STONEHENGE		Ashar	Amelah			
Palestine and Phœnicia	*Zimran,* *a song.* Demaroon STONEHENGE	*Shachad,* *a gift.* Adodus	*Abiezer,* *father of help.*	*Hammoleketh,* *the Queen.* *Mahol, song.* Melcartus			*Darda,* *pearl of wisdom.*
Cilicia Galatia Pamphylia	Galati of Gomer			Amphilochus at Mallus with Calchas, and founders of Pamphylia.			
Lydia	Omyretis Smyrna Homer Homeridæ	Atys Hesiod		Meles Menapolus Eumeles Tmolus Amphilochus at Claros with Calchas.	Mæon		

Mysia	Thymbræus	Æsyetes		Molion			
Thrace	Thamyris			Zamolxis *Melos, song*			
4 Thessaly Epirus Ætolia				Pamphyli and Dymanes Meliadæ Eumeles Amphilochus Meleager Milo Meilanion		at or	Doris Dryades Torgus Thireus
Locris Phocis Bœotia	Amphiaraus	Schedius		Theoi Meilichioi			Tiresias
Attica and Ægina	Amphiaraus	Pisidice	Actor Hippocrates	Zeus Meilichios Megacles		Echeclus	Draco
Argos	Amphiaraus			Amphilochus Zeus Meilichios		Calchas	
Achaia		Astacus Hicetaon	Agrius	Melampus			Tritia
Arcadia			*Epikouros,* *the helper*		Euæmon		
Laconia		Ægisthus		Amyclas Menelaus Enyalius Eumelus		Cleocharis Zaleucus	Deritus Therita Tyrtæus
Cyprus Crete Rhodes	Tamyrads Camirus			Melisseus Amalthæa			
Eubœa Imbros Samos	Imbramus Tembrion			Amphiclus			
Etruria	Demaratus						Tarchon

Latium and Sabinum	Thymber Tmarus Cimber Ambarvia	Vesta	*Ajutor, the helper*	Metellus Manlius Æmilia Amulius Enyalius		Cæcilius	Thurius Torquatus
Magna Græcia and Sicily.		Acestes		Myscellus Milo Menecolus			
Gaul and Spain.	Celts from Gomer			Amphilochus in Spain Wood of Massilia			Druids
Britain	Emrys, or Ambrosius; Ambrose Merlin; Kimarus; STONEHENGE[177]			Malim Meliodas *Moli, sing* *Mawlganu, chant*			Druids Tristram
Ireland	Tomor Tomair Imorus Humphrey *Amhran, song.*	*Asccadh, gift*	Cyracus[178]	Amelanus *Mile, soldier* *Mal, poet*			Turgesius *Darag, oak*
Germany and Scandinavia	Ymir Gymir Hymir *Hamar, hammer*	Tuisto	Ægir	Miolnir *Mal, song*	Mannus		Thor of Thrudvang

177 I have already (note 158) mentioned the word *amber* in its connection with Zimran, the Cymri and sacred stones. The word amber is Celtic, and appears in most modern languages. Had we any doubt that Zimran is its original, it would be removed by the Greek word Electron. Electra I hold to be the name of Keturah, with the prefix of the Arabic article An Electra is made the mother of Medon, a Midian. Electra in Messenia connects with the story of Thamyris, and Ithome near recalls Etam. Paus. iv. 33. Electryone was the sister of the Rhodian Heliades, among whom Ochime, Cercaphus and Camirus appear. The name Keturah, as denoting incense, may easily be associated with amber or ambergris The Sclavonic languages probably retained her name as the term for this substance in jantar, gintaras and sihters, all of which may be corruptions of Keturah I have, however, proved pretty definitely the connection of Keturah with Eshcol and Mamre Sacal is the Egyptian word for amber, and is doubtless the same as Eshcol. When we pass beyond the region of the language of necessity into that of luxury, art and science, historical etymology must be our guide As *tantalize, damask* and *cabal* carry us into mythology, geography and history respectively, so we shall find that a large proportion of the words of any language can only be explained by searching for them in similar fields. Mythology is not so much a disease of language as language is an embodiment of ancient facts of which what we are pleased to call mythology retains the only memorial I do not know precisely why Liguria, a western Locris and early home of the Celtic Lœgrians, should give a name to amber It was however a Zimrite region

178 It is more probable that Cyracus denotes Zerach the second husband of Keturah, who is referred to in note 98 He is, as I have there stated, Zerach son of Achumai, Harka of Khem, Cherucheres of Amenemes and Cercestes of Ægyptus, who derived his name from Chemi or Coptos. He is also Cercyon the son of Agamedes. It seems that he married before Keturah a daughter of Chareph, the son of Ashtari or the great Sesostris, Xisuthrus, &c., and by this marriage had two sons, Ethan and Jobab This explains the association of Cerberus and Cercyon; of Agamedes, his father, and Trophonius, of the union of Cercaphus with Cyrbie, Crius with Eurybia, Charaxus with Rhodope, Khem and Harka with Thriphis, and the descent of Cherucheres from Usecheres II Triopas and other similar names associated with unmistakable traces of Zerach, set forth the same fact. I am thus able to add to previous genealogies the following:

```
                              Shobal
                                |
          ----------------------|
          |                     |
Manahath  Ashchur             Reaiah
   |         |                  |
daughter=Ashtari              Jachath
      |                         |
      Chareph                 Achumai
         |                      |
      daughter       =        Zerach        =        Keturah=Abraham
                 |                                        |
      ---------------------------                         |
      |                         |                         |
    Ethan                     Jobab                   Zimran, &c.
      |                      who ruled
   Azariah                   in Edom
                               Or,
                               Seb
                                |
      ---------------------------
      |                         |
   Month    Usecheres           Ra
      |         |               |
   Ritho = Sesostris         Achthoes
                |               |
   Harphre or Cerpheres    Khem or Amenemes
                |               |
          Thriphis    =     Cherucheres      =      Atari
```

Cercasorus, opposite the Athribite nome, is a record of Zerach in connection with his wife Thriphis. His family is Sabellian, Hellenic, Dorian, Achæmenian. Edomite monarchy, or rather the monarchy which arose upon the borders of Palestine, Arabia and Egypt, dates from but one generation before the time of Zerach's son Jobab, Bela the son of Beor being his predecessor and its founder. This Bela was in all probability the King of Zoar in the days of Abraham, and the Egyptian Belus who is said to have fled from Salatis into Arabia. Herophile, whom I have already identified with Eriphyle, is made a daughter of Lamia (Lechem), and is said to have been born at Corycus (Zerach). Paus. x. 12.

A CALIFORNIA BORAX DEPOSIT.

BY W. HODGSON ELLIS, M.B.

Read before the Canadian Institute, February 19th, 1876.

The borax of commerce has long been derived almost exclusively from the boracic acid of the Tuscan *soffioni;* the discovery in California of a large deposit of native borax or "*tincal*" bids fair to modify in some measure the trade supply of this article.

In San Bernardino County, California, is the bed of a dry lake, which is covered with a dirty gray deposit, consisting of borate of soda mixed with sulphate and carbonate of soda and chloride of sodium. In some places native borax or *tincal* is found nearly pure in large crystals.

Through the kindness of Mr. John Ledyard, formerly of Toronto, who has been employed at the works, I have received specimens of the crude borax and also of the purified products. To him I am also indebted for the following particulars :—

The crude material is carted to the works, dissolved in water, and boiled down till the liquid has attained a density of 1·16. It is then run from the boiler into "settlers," where it is left for about eight hours. At the end of this time the clear liquid is run off and allowed to crystallize, either in tanks or in long, narrow, shallow vessels, called *flumes.* The product of this operation is called "concentrated borax," and sells at seven cents per pound. "Refined borax" is made by re-dissolving the "concentrated" borax and re-crystallizing it in the tanks. It sells for nine cents per pound.

An analysis of Californian refined borax, given in the *Chemical News*, December 17th, 1875, is as follows :—

Crystallized biborate of soda...........................	99·75
Chloride of sodium	0·25
	100 00

Mr. Ledyard's sample yielded to my analysis :—

Crystallized biborate of soda	99 70
Chloride of sodium	0·30

An analysis of the crude borax gave me the following results :—

Sodium biborate	39·23
Sodium sulphate	8·46
Sodium carbonate	2·77
Sodium chloride	14·23
Calcium carbonate	3 57
Alumina and ferric oxide	0·33
Silica and sand	23·34
Water	8·07
	100·00

AN ADDITIONAL NOTE ON THE FUNCTION OF SALT IN SEA WATER.

BY E. J. CHAPMAN, PH.D,

Professor of Mineralogy and Geology in University College, Toronto.

More than twenty years ago, the author submitted to the CANADIAN INSTITUTE an original view respecting the function of the saline components of the sea. This view was to the effect that the essential function of the salinity of the sea is to regulate evaporation. Fresh water, it was shewn, evaporates far more rapidly than salt water; and, as regards the latter, the stronger the salinity the slower the evaporation—other conditions, of course, being equal.

In the natural evaporation of the waters of the sea, two antagonistic forces are at work: the absorbing power of the air, and the resisting power of the sea. If one of these powers increase or diminish in intensity, the intensity of the other increases or diminishes also.

If the absorbing power of the air (by increase of temperature or other cause) increase in strength, the effects of this increase become controlled and rapidly neutralized by the stronger resisting power imparted to the water by its increased degree of saltness. If, on the other hand, the absorbent power of the air become weakened (by excess of rainfall, diminution of temperature, &c.), evaporation becomes assisted by the weaker resistance of the water. These compensating effects, it is contended, are due essentially to the presence of saline matters in the waters of the sea.

The original experiments published on this subject in 1855—although sufficiently exact to establish the striking difference which the evaporation of fresh water exhibits as compared with that of sea water—contained a source of error arising from the form of the vessels employed, and partly from the evaporating surface of the liquids not having been kept constantly at the same level. As the surface of the fresh water soon occupied a lower level than that of the other liquid, it necessarily became protected to a greater degree from the action of the atmosphere: and thus the evaporation from it (although always greater than the evaporation from the salt water) was somewhat less than it should have been. Experiments of this kind can scarcely be rendered absolutely faultless, but in after trials these sources of error were remedied as far as possible. The annexed results are from one of these trials extending over seven comparatively warm days:—

Periods of 24 hours	Distilled Water. Loss per cent	Sea Water Loss per cent	Differences
1	14·52	13·96	0·56
2	13·64	13·05	0·59
3	11·86	11·22	0·64
4	15.43	14·71	0·72
5	15·78	14·97	0·81
6	13·93	13·03	0·90
7	13·55	12·54	1·01

The function of regulating evaporation, thus attributed to the saline condition of sea water, may not seem at first thought to be a very important one; but, in its results, it is probably the most important of all the natural phenomena of which the ocean is the stage. The moisture of the earth, it is well known, comes essentially from the sea. The salt-free vapour, taken up by evaporation from the surface of the sea, is wafted sooner or later to the land; and there becoming condensed by contact with the cold of mountain chains, by tree-covered districts, and other recognized agencies, it falls in the form of rain, &c.; and, finally, after fulfilling its manifold functions, it becomes returned, for the greater part, by the natural drainage-channels of the earth—the brooks and streams and brimming rivers—to the sea from whence it came. If any prolonged cause of disturbance, therefore, affected the process of evaporation as carried on betwixt the air and sea, the earth throughout broad areas, if not throughout its whole extent, would necessarily suffer by the reaction—either from a want of rain, or a deficiency of moisture in the atmosphere; or from unripened harvests and inundations of the land occasioned by excess of rainfall. The saline condition of the sea evidently serves as the main controlling power to disturbances of this character.

Teleology is terribly out of fashion, nowadays, in scientific thought. The author should perhaps apologize, therefore, for attempting to recall attention to a subject of this kind. But without being in any way an opponent of "advanced views" generally, one may still hesitate to regard the wonderful balance of natural forces, seen almost everywhere in the cosmic infinity around us, as nothing more than merely a fortuitous result.

SOME CANADIAN NOMS-DE-PLUME IDENTIFIED:
WITH SAMPLES OF THE WRITINGS TO WHICH THEY ARE APPENDED.

BY HENRY SCADDING, D.D.

(Continued from page 276.)

We now come to our political *noms-de-plume.*

Canada, both in its French and its English portions, has had a troubled history. With a very mixed population, teeming with a variety of clashing prejudices, brought with them or inherited from the Old World, governors sent out by the parent state to guide their destinies, to amalgamate them into one mass, to mould their character into a national consistency, have found, especially in years bygone, that their task was not an easy or a trifling one; and whatever their line of conduct, they were sure to be criticized with severity by one coterie or another in the community. Here, as elsewhere, the newspapers and other local periodicals have been vents for the spleen of individuals; and as at early periods in Canada, Upper and Lower, men in power held it to be proper to stand on their dignity more punctiliously than they do now, it was not quite safe for writers to come out with their strictures *in propriâ personâ.* Consequently, the local periodicals of the day abound with objurgatory communications under the fictitious signatures usually adopted in the newspapers and periodicals of the same period in Great Britain and Ireland. And when I say in former days men in power were specially touchy, I include in the expression the Houses of Assembly themselves, which were very ready to summon offenders before them for verbal breaches of privilege. Thus Mr. Cary, editor of the *Quebec Mercury,* was sent for by the Lower Canadian House, in 1813, for publishing a communication signed "Juniolus Canadensis," an invective, in the style of Junius, against Mr. Stuart, a member of the House. Mr. Cary absented himself from the city during the remainder of the Session, and so eluded the search of the Serjeant-at-Arms. But the day after the prorogation the following Card appeared in the *Mercury:* "The Editor's respects to a majority of the House of Assembly. Being just arrived from a tour of business, he learns that the House had evinced much anxiety to see him during his absence. Unfortunately, his return has taken place a day too late for him to have the honour of waiting on the House. He is, however, rather at a loss to conceive how his presence could be in any manner useful in assisting them in their vocation of framing laws."

It would be, of course, an endless and unprofitable undertaking to trace the authorship of the great bulk of pseudonymous productions in early Canadian journals on political subjects. But one *nom-de-plume* which appeared in the columns of the *Montreal Herald*, in the years 1813-15, presents exceptional claims to consideration. The signature of VERITAS has become historical. Moreover, it possessed for a time an additional degree of interest from the slight mystery and uncertainty which attached to it, the author having taken some pains, as I suppose, to maintain an incognito. As all persons concerned have long passed off the scene, no harm will be done now if I remove the veil, as I shall do presently, and for the first time since an uncertainty on the subject sprang up.

Sir George Prevost was the Governor-General of Canada and Commander-in-Chief of the Forces in 1812, when the war broke out between Great Britain and the United States, and the letters of Veritas are devoted to an adverse criticism of Sir George's military tactics throughout the unnatural contest. In many of the subsequent accounts of the war of 1812, Veritas is quoted as an authority, but I do not observe anywhere that the real name of the writer is mentioned. It became, in fact, as we shall see, almost irretrievably lost. So late as 1855, after all reason for secrecy had passed away, Auchinleck, in his "History of the War, '12, '13, '14," defends Sir George Prevost against the strictures of the shadowy Veritas. "Veritas observes," he says, "that it is the acme of assurance to insinuate that the [British] Ministry were to blame for the insufficiency [of force in the two Provinces at the outbreak of the war], especially as they could only have a knowledge of our wants through Sir George's information. Now, how in justice," Auchinleck asks, "can Sir George be blamed for not informing Ministers of his requirements for a war which he was instructed [by that Ministry] by all the means in his power to avoid the promotion of? In his anxiety to attack the movers of the address [to Sir George, on his departure from Quebec] in reference to the war, Veritas has suffered himself to go to the verge of injustice." Again, in Col. W. F. Coffin's admirable and eloquent work, entitled "1812; or the War and its Moral: a Canadian Chronicle," it is observed, "If York (Toronto) had been left defenceless and unprotected; if a ship of war in the hands of the shipwright had been recklessly exposed to destruction, the fault was not with Sheaffe nor with his direct superior, Sir George Prevost, as charged by Veritas, but with the authorities in England, who trifled with the emergency until too late, and then spent treasures in life and money to repair an irreparable error."

In Tupper's "Life and Letters of Major-General Sir Isaac Brock," Veritas is also largely quoted, but in the same abstract way. The author of an article in the *Quarterly Review* of July, 1822, headed "Campaigns in the Canadas," evidently knew who Veritas was; but he refrains from naming him. "The Letters of Veritas," the writer says, "were originally printed in a weekly paper published at Montreal, in Lower Canada, and subsequently collected in the little volume before us. Within a small compass," the reviewer continues, "these unpretending letters contain a greater body of useful information upon the campaigns in the Canadas than is anywhere else to be found. They are, we believe, the production of a gentleman in Montreal of known respectability. Though not a military man, he enjoyed the best opportunities for acquaintance with the circumstances of the war; and as these letters, which excited great attention in the Canadas, appeared in successive papers while Montreal was filled with almost all the officers of rank who had served in the country, it may reasonably be presumed that his errors, had he committed any, would not have escaped without censure; yet no reply was ever attempted to his statements—no doubt ever expressed in the provinces of the correctness of his assertions." My curiosity, a few years since, having become aroused as to the identity of Veritas, it came to be with me, for a time, a kind of Junius-question which I sought to solve: for a long time, but not, finally, without success. I searched in vain in the useful works of Mr. H. J. Morgan, of Ottawa, the compiler of "Sketches of Celebrated Canadians," and the *Bibliotheca Canadensis;* but I found no clue. I interrogated the late Rev. Dr. Richardson on the subject (he, in his younger days, lost an arm while actively serving in a naval capacity in one of the expeditions ordered by Sir George Prevost). I addressed notes to several gentlemen who had interested themselves in early Canadian history, but without result. Amongst them, especially, I applied to Col. Coffin, above-named, but after inquiry instituted, he could afford me no help. Inquiries were also made for me of the present proprietors and publishers of the *Montreal Herald.* I thought that possibly among the traditions of the office of that paper the name of its now historical contributor might be preserved. Mr. Penny, the present editor of the *Herald,* kindly endeavoured to get the desired information from Mr. Archibald Ferguson, a gentleman now aged more than ninety years, formerly proprietor of *Herald.* Mr. Ferguson's reply, however, now lying before me, was as follows:—"In answer to your note of the 17th instant, I beg to inform you that I do not know who wrote the articles signed Veritas and Nerva, in 1815. They were published nine years before I purchased the *Herald* establishment, and the two former proprietors were dead before I purchased." (I had coupled my query about Veritas with one about a writer styling himself Nerva, also in the *Herald;* but Nerva I discovered afterwards by accident, while looking through the articles in Mr. Morgan's *Bibliotheca Canadensis.*) How I came at length to recover the all but totally forgotten authorship of the Veritas letters, I will detail concisely after I have given a sample or two of the productions themselves. I add the reflection: if in so short a period an uncertainty so decided could spring up in regard to writings whose authorship was probably notorious to contemporaries, how easy it must have been, in the days when printing was unknown, and when of many an important record no duplicate existed, for ambiguities to arise on such points; how easy it must have been, at the dictate of policy or ambition, to falsify and substitute, with small chance of explicit detection at the hands of posterity.

Veritas, throughout his letters, inveighs against Sir George Prevost for an apparent lack of energy, decision, and dash. But we must bear in mind what Auchinleck has said, as quoted just now, that Sir George was probably under restraint from the instructions which he had received from the Ministry at home, who had no relish for the contest in which they found themselves engaged. "Towards spring, 1814, so inveterate," Veritas says, "was Sir George's rage for armistices, notwithstanding the injurious consequences of the former to the military service, that a negotiation for another was set on foot, and defeated solely from the refusal of our admiral on the American Station to concur in it. The Americans gave out that the proposition came from Sir George, which I believe, because otherwise he would have met it at once by a direct negative that would have ended all discussion on the subject. In January, 1814, whilst the Legislature was sitting at Quebec, Sir George made a trip to Montreal, from no military motive that has ever been discovered or assigned, during which the then Assembly were active in preparing mischief. That Session was a stormy one, and ending in March, the Head-Quarters were retransferred to Montreal. * * * * Soon after the navigation opened upon Lake Champlain, Capt. Pring, in the naval command there, sailed from Isle aux Noix with our flotilla, then superior to that of the enemy, which had wintered in Otter Creek, where they had a ship-yard employed in constructing a force intended to surpass ours. Capt. Pring, in consequence, applied to Sir George for some troops to accompany him, with a view of attempting to destroy this establishment and the vessels in that creek, whether afloat or upon the stocks, which, next to Sackett's Harbour, was an object worth a trial at some risk. As usual, the application was refused. When Capt. Pring returned from his cruise up that creek, he reported to Sir George what might have been done by a joint attack, and then he was offered assistance, but the Captain replied that it was then too late, as the enemy had taken alarm and prepared accordingly. Sir George had the extraordinary fatality of either never attempting an active operation, or of thinking of it only when the time for practical execution was past."

Here is a passage which, for style, may remind us of Kinglake or Sir William Napier; the incidents referred to will also probably interest us. "As the season for action advanced," Veritas says, "to the astonishment of everyone, there was formed at Chambly what is called a Camp of Instruction, comprising the greater part of the force above enumerated, and from which might and ought to have been detached a force for the attack of Sackett's Harbour, or for the reinforcement of the Niagara frontier, seriously threatened as it then was (1814) with invasion, in the opinion of every person who had eyes to see or ears to hear. Had the first-mentioned object been attained, the enemy would not have ventured to cross into Upper Canada; or if Sir George was obstinately bent on letting Sackett's Harbour alone, the reinforcement of the Niagara frontier became the more imperiously necessary to secure it against the enemy's accumulating force, which had been even seen by some of our officers in returning from captivity, but whose reports thereon were utterly disregarded. Thus the Camp above-said furnished the means of instruction to the enemy upon the said frontier, by allowing them to practise against our very inferior force; but of destruction to our troops there employed, who were thereby doomed to combat against fearful odds, as will be seen hereafter, which is quite inexcusable, seeing we had the means of prevention in our power; for so infatuated was Sir George that not a man was sent from Lower Canada to their aid until the 12th July, after our first disaster at Chippewa was known. * * * From the end of May, reinforcements from Great Britain, Ireland and the West Indies came in; but the accursed Camp of Instruction continued; when to our astonishment, in June and July, such a numerous body of troops arrived from Bordeaux that it became evident Sir George was quite bewildered thereby. Piecemeal reinforcements were now despatched to Upper Canada, and a very large force kept below to do something—but what it was remained doubtful, although a bustle of preparation began across the river, which was continued for months at infinite expense." I add one more passage: an indignant, Junius-like denunciation of certain speeches in the House of Commons, notably one by Mr. Whitbread, on the subject of the destruction of the public buildings at Washington by a British force, in which speeches more feeling was apparently shown for the loss experienced by the United States Government than for the sufferings of British subjects when violently deprived of their homes and property at York and Niagara, a few months previously, by an invading United States army. "Now, is it possible to conceive," Veritas asks, "that all these and former acts of conflagration and pillage could have happened without orders from the American Government? And yet if we had retaliated upon this principle in the Chesapeake, or elsewhere (which was completely in our power to have done), what an outcry would have been raised by Mr. Madison, and re-echoed by the Opposition in the Imperial Parliament, who, on finding themselves beat from their grounds of censure against our Government and officers for the destruction of the public buildings at Washington, when proved to have been merely retaliatory, then took up a new position equally untenable, viz., that it would have been magnanimous not to have followed the example of the Americans in their conduct at York and Newark. Now, in common sense, what does such doctrine mean? Do these mock-patriots reserve all their sympathies for the enemies of their country, and regard with callous indifference the sufferings of their fellow-subjects? Are the latter not entitled to protection and consideration; and as means of that protection, was it not incumbent upon our officers, and a point of justice, to turn against the enemy their own weapons, and thereby make them feel the consequences of their own enormity of conduct, with a view to prevent their repeating the like in future? It is very magnanimous, to be sure, to speak with cold-blooded indifference about the infliction of ruin upon friends, at the distance of 3,000 miles, by fire and devastation in the most aggravated shapes; but I will venture to say that if Mr. Whitbread's brewery and his princely mansion, with all their contents, had been at York or Newark, and shared the fate of the buildings there consigned to the flames by the enemy, we should never have heard of his lecture upon the virtue of magnanimity."

It was by the aid of Sir Francis Hincks, now resident in Montreal, that my curiosity in regard to Veritas was at length gratified. Sir Francis took much interest in the inquiry, when it chanced to be proposed to him; and he kindly applied for me to the present authorities of the *Herald* office, with the result already mentioned. When now I supposed nothing further would come of the investigation, I unexpectedly received from Sir Francis the following communication, which sets the question at rest. The note is dated Montreal, 15th July, 1873. "By a very singular accident," Sir Francis writes, "I obtained a few moments ago the information which you wanted a few weeks since. Coming into town this morning, I met Mr. J. S. McKenzie, one of our oldest and wealthiest citizens, lately a Director of the Bank of Montreal, and senior partner of one of our principal firms. He was talking of his age, and as having served in the war of 1812. It immediately occurred to me that he might know who Veritas was; but at the moment I had forgotten this signature, and was only able to ask if he recollected a criticism on Sir George Prevost's operations. 'Certainly,' he said, 'it was signed VERITAS, and was written by the Hon. John Richardson, with whom I was a clerk in the old house of Forsyth, Richardson & Co.' Mr. Richardson was a very likely man to have written such an article," Sir Francis adds, "and Mr. McKenzie was quite clear on the point. I think, therefore, you may be satisfied. I had overlooked Mr. McKenzie, who is one of our octogenarians."

The most concise way in which I can explain who Mr. Richardson, the writer of the letters signed "Veritas" was, will be to copy the inscription on a marble tablet on the outer wall of the "Richardson Wing" of the General Hospital at Montreal. It reads as follows:— "This building was erected A.D. 1852, to commemorate the public and private virtues of the Hon. John Richardson, a distinguished merchant of this City, and Member of the Executive and Legislative Councils of the Province. He was the first President of this Hospital, and a liberal contributor to its foundation and support. He was born at Portsoy, North Britain, and died 18th May, 1831, aged 76 years."

Veritas closes his series of letters with this paragraph: "It was my intention to have given also a sketch of Sir George's civil administration; but reflecting that it has been already so ably depicted by NERVA, in his admirably written allegory, I shall for the present not prosecute that intention." The "allegory" of Nerva was contained in a series of letters, professedly on Irish affairs, addressed to the *Herald*, in which Canada was adumbrated by Ireland, Sir George Prevost by Earl Fitzwilliam, and Sir George's predecessor, Sir James Craig, by Lord Westmoreland. Sir George's marked policy of conciliation as a civil governor is therein roundly condemned, but evidently from the point of view of a narrow conservatism: a policy, it must be remembered, enjoined by Sir George's masters in England, with distinct reference to the immediate crisis, when Canada was about to be exposed to an invasion, and required for its safety a people, so far as possible, united. "Between two systems of government proposed for adoption," Nerva observes, "theorists may often find it difficult to determine the claims to preference; because the peculiar defects of each may be compensated by peculiar advantages; but where a system of government is already established, there are certain rules for its exercise from which the experience of practical politicians will pronounce all deviation to be improper and hazardous. Of these rules, the most universally admitted is, that all changes should be gradual, not abrupt; should be necessary, not experimental. But Earl Fitzwilliam began his innovations upon his entrance into office, without waiting to ascertain whether Lord Westmoreland's measures were adapted to the situation of the country; without indeed knowing what the situation of the country required, or whether a sudden change, even from what might originally have been improper, would not produce greater evil than that which it should be intended to correct. His proper path had indeed been marked out for him, and every obstruction and difficulty removed by Lord Westmoreland, whose labours, had they been turned to advantage, would have enabled his successor to pursue, with perfect ease and safety, a course at once consistent with his own honour and with the dignity of his government. Yet these advantages were overlooked or despised by the Earl, who, like some rulers in whom vanity has predominated over judgment, disdained to govern in any respect according to the prescription or example of another. In consequence, he was speedily surrounded by men of principles avowedly inimical to the just and long-established prerogatives of the Crown, who were the objects of his peculiar notice, and most graciously received at his table and his court. Situations of trust and power were accumulated upon individuals unknown before in departments of State, and incapable as well as regardless of the performance of their official duties; while their rapacity was so insatiable as to force from the unwilling Viceroy himself the observation, that if England and Ireland were given to them as estates, they would ask for the Isle of Man as a kitchen garden. A viceroy, with the assistance of associates, dependants and companions of so unusual a cast, it would be natural to expect would differ in principle and in action from most representatives of royalty. And the event fully justified the expectation. The conciliation of the worthless became his primary object; and concession was considered the principal means."

Nerva, whose letters, like those of Veritas, were re-published in a collected form, after their appearance in the *Herald*, was Mr. Justice Gale, who died at Montreal in 1865. These productions thus acquired a more than temporary circulation and influence. In regard to the strictures of Veritas, we read among the miscellaneous editorial matter of the *Herald* of August 12th, 1815, the following item: "Persons living at a distance are informed that the whole of the impressions of 'VERITAS Letters' are sold. We give this notice in order to save correspondents the expense of postage. We understand an edition is now printing at Halifax. Veritas was uncommonly well received in that city."

The editor and printer of the *Herald* were both prosecuted by the Government. In the number of that journal for March 11, 1815, we have the announcement that "On Monday last [this would be March 5] the Grand Jury for this District found a bill of indictment against the printer of this paper for a libel on the Commander-in-Chief. On Wednesday [this would be the 7th], *two* bills were found against the Editor for the *same offences*. To all the charges contained in the indictments the defendants pleaded *Not Guilty*. They readily found security to appear in another term for trial." We have no notice given us in subsequent journals of the issue of the prosecution. It may have been dropped in consequence of the death of Sir George Prevost in January, 1816.

Mr. Mungo Kay, the editor, and Mr. W. Gray, the printer, did not betray the confidence placed in them by the pseudonymous writers in their journal, except in one instance. It happened that Mr. Sewell, the Solicitor-General, whose duty it became to conduct the proceedings against the alleged libellers, had himself on two occasions, under the nom-de-plume of Colonist, contributed articles to the *Herald* which could be interpreted as censure on the Commander-in-Chief. As, in the opinion of the editor and printer, Mr. Sewell exhibited an over-zeal in pressing the case against them, by summoning the employés of the printing office to give evidence, they considered themselves at liberty to disclose to Sir George Prevost the authorship of the particular articles referred to, and this led to the removal of Mr. Sewell from the Solicitor-Generalship. The result of the prosecution was thus probably more serious to him than to any one else; his official advancement receiving on the occasion a fatal check.

Contemporary with Veritas and Nerva in the volumes of the *Herald* was a writer who signed himself *Le Bon Vieux Temps*. He was an exponent of the views of the loyally-disposed French Canadians in regard to the politics of the day. I have not been able to trace satisfactorily the authorship of the letters thus subscribed. They have been attributed to a Viger and a Quesnel.

In 1843 Sir Charles Metcalfe succeeded Sir Charles Bagot in the Governor-Generalship of Canada. Responsible Government had not long been conceded; and the Governors themselves had not yet quite cordially come into the system. Their view of their own responsibility to the Crown and people of England conflicted in some degree with the theory of Responsible Government as understood by Canadians. Sir Charles Metcalfe, though nominally accepting Responsible

Government, found himself in antagonism with its warmest supporters. Possessed of a strong will, he wished to rule as well as reign; and, probably, could he have had, consistently with the new theory, his own way in the management of public affairs, the common weal would not have suffered; for he was a highly-gifted, excellent, and most benevolent-minded man. But the *amour propre* of Canadian statesmen, just beginning to rejoice in the newly-acquired right of self-government, was quickly offended by Sir Charles' too frequent interposition of his own individual judgment.

Legion's letters were a sharp attack upon Sir Charles Metcalfe's mode of administering the Canadian government, and a vindication of the view taken of the reformed Canadian constitution by the Liberal party. Nominally they were a reply to a series of letters by Dr. Egerton Ryerson, in defence of Sir Charles Metcalfe's ideas; and it was during the course of this discussion that Legion fastened on his opponent the curious soubriquet of Leonidas; not, as I have seen it alleged, because his antagonist had adopted that name as a *nom-de-plume*, but simply because, when rushing to the protection of the Governor-General, he chanced to liken himself to the Spartan hero * I need not go further into the particulars of this renowned encounter. I will simply give a specimen or two of Legion's flowing, oratorical style. I first quote a short passage, which disposes of the *nom-de-plume* theory of the origin of "Leonidas" as a soubriquet, and also explains why Legion himself adopted the obviously objectionable signature which appears at the close of his letters: "Had he [his opponent] signed himself the Doctor, or Leonidas, or Three Hundred Spartans, or Wesley, or Fletcher, or Robert Hall, or Chalmers, I should have been spared the necessity for this letter," Legion says; "but he [his opponent] has placed his name and his former conduct before the public as bearing upon the matter at issue, and as adding weight to his arguments. I could not, therefore, as he says, pass it

* The passage referred to occurs at p iv of the Introductory Notice, dated Cobourg, May 27, 1844, prefixed to "Sir Charles Medcalfe Defended against the Attacks of his late Counsellors." "Mr Ryerson has not thought proper, under present circumstances, to accept the office of Superintendent of Education, nor has any political office ever been offered to him. And he is ready to relinquish any situation which he now fills rather than not accomplish this imperative undertaking For if a Leonidas and three hundred Spartans could throw themselves into the Thermopylæ of death for the salvation of their country, it would ill become one humble Canadian to hesitate at any sacrifice, or shrink from any responsibility, or even danger, in order to prevent his own countrymen from rushing into a vortex which, he is most certainly persuaded, will involve many of them in calamities more serious than those which followed the events of 1837."

over; nor would it have been courteous to treat his name and his inducements as nothing. I think it a piece of misjudged egotism to mix the name of a public writer up with his arguments; it always is calculated to mislead, and at the best is loss of time and of printing materials, which now bid fair to be too much in request to be wasted. The above are my sentiments, Sir," the writer says to the editor of the *Examiner*, the journal in which the letters first appeared, "but as they are also the opinion of hundreds of thousands as good loyal Canadians, I have no right to the monopoly. I therefore, Sir, with all deference to your readers, subscribe myself your and their humble servant, LEGION—for We are Many." I now quote an elaborate discrimination between despotism and constitutional government, with an ironical statement of the merits of the former under certain circumstances, and a repudiation of the doctrine that rulers in free countries can proceed safely and satisfactorily without having regard to public opinion and considerations of party. "A party may be defined for our present purpose," Legion observes, "as a number of persons professing an opinion or opinions in which they agree; opposite parties, as two parties each respectively agreeing amongst its own members, and opposing the opinion or opinions of the other party. As the whole of a community is rarely of one opinion, the opinion of the majority, or of those forming the largest party, is, for the purpose of government, said to be public opinion; at least it is the opinion which for all practical purposes must be taken to be public opinion. What is just, and right, and good," Legion goes on to say, "may be the object of a despotic as well as of a free government. No one dreams of alleging that absolute power in the ruler is inconsistent with good government. All I need maintain is, that absolute power in the ruler is inconsistent with all our notions of free institutions. An absolute ruler may, with the best intentions, look within his own breast for the rules of right and wrong—to his own reason for his policy; and if his mind be better constituted, and his means of information greater than that of all others, his government may be better and wiser than any government influenced by popular opinion. To such a potentate, it is true praise to say of him that he possessed an inflexible determination to administer his government without regard to party, because the opinions which make parties are beneath his consideration. He judges, he thinks, he rules for himself; he puts down public opinion, for it is but an impediment in his way; and he rules irrespective of party, because to him public opinion is as nothing. But just in proportion as the form of a government is removed from a despotism, disregard of public opinion becomes a crime in a ruler, and ceases to be a subject for eulogy. And he who administers a Government free and popular in its form, without regard to public opinion or to party opinions, call it which we please, is a violator of the constitution he is bound to uphold, and insincere in his professions of attachment to that constitution. Swift, in ridiculing party divisions, describes the kingdom of Lilliput as divided into two parties, one of whom wore low heels to their shoes, the other high heels; and if Sir Charles Metcalfe had been made Governor of Lilliput, he might have governed its diminutive inhabitants without regard to their heels, and have chosen his councillors from both parties indifferently, caring nothing for their disputes, and despising their party differences; but who would allege that he was influenced by public opinion, or that he was administering Responsible Government? It is, however, just as a pigmy people that Sir Charles has always regarded Canadians, and it is with this view that he takes to himself the praise of inflexible determination; but the inflexible determination of a ruler under the British Constitution is national determination; and personal determination which opposes this, is despotism. The threat to employ whatever force may be necessary to enforce it, is tyranny; and the pretence that it is consistent with Responsible Government is hypocrisy." On Sir Charles' alleged resolve to act officially without the concurrence of his Executive Council, Legion thus remarks: "Charity may once have ascribed his invasion of the Constitution of this country to ignorance of British constitutional usage; but time has removed the veil, and he must now be considered either as the originator, or the instrument of a design to defeat and put down Responsible Government in Canada. If Canadians value Responsible Government, they cannot give way. They must use every constitutional means of asserting their rights, till they obtain them fully. If they do not value British freedom, or if Dr. Ryerson has been able to frighten them with his bugbear of "Royal Proclamations and Military Provisions," let them kneel down and ask pardon for the presumption of their Parliament, and let the reign of favouritism and intrigue continue. If Canadians have not the spirit of British subjects, let them be the servants of servants they deserve to be; but if they have any wish for peace and quietness as the fruit of ignominious vassalage, let them petition for the abolition of the Provincial Parliament, which cannot exist without constantly reminding them of their degradation. There may be something noble in political slavery; but political slavery with the forms of freedom is, to all intents and purposes, wretched and utterly despicable."

The letters of Legion were from the pen of Robert Baldwin Sullivan, afterwards one of the judges of the Queen's Bench, and previously a member of successive Governments before and after the union of the Canadas. The author of the letters of Legion was wont in his younger days to contribute papers of a humorous and playful character to the literary periodicals of the day. In Sibbald's *Canadian Magazine*, published at York (Toronto) in 1833, are to be seen communications of his under the *nom-de-plume* of "Cinna." I select a passage from an amusing "Essay on Roads," by Cinna.* "This being an introductory essay," the writer says, "it is fit that I explain that my remarks will not be confined to mere terrestrial roads; they will, indeed, be principally directed to those mental highways along which the glorious march of intellect is conducted, or rather driven with such steam-engine impetuosity. The schoolmaster is abroad, they say; and, indeed, for any use he is of, may so remain; learning is acquired nowadays without his assistance. The road to the temple of Fame has been levelled and macadamized; and there are rumours of a railway and a canal. This last, to be sure, is opposed by some old sober-sided fools, who think that the ancient institutions at the top of the hill, and which have been erected with so much labour, will slide into the deep cut which would be necessary to bring the canal down to ditch-water level; but suppose they do, who cares? Is it not better to go on a *tow*-path over their ruins, than be threatened with a *hempen* one, into the other world, for trying to undermine them? When I was a little boy, my grandmother thought me a youth of talents rare when I learned my letters; and to say the truth, my talons were often made to look as rare as an Abyssinian beefsteak before I acquired so much learning. I then stuck so long in orthography, that one would think I was spellbound. Oh! if I had only waited till now, when grown up gentlemen and ladies are taught writing in six short lessons. I might in a

* Of a later date is the "Cinna" of *Barker's Canadian Magazine* and the Kingston *British Whig*, understood to have been W. B. Wells, Esq., now County Judge of Kent.

week have been a literate person, and so branded by Act of Parliament. I might then, indeed, have *served* my friends, who now say I am a burden to them, with writs of *ca-re* and fiery faces, like Mr. Underhill; or perhaps I might have been an attorney and then my clients would give me instructions, and pay besides; and no one could say my education would not be finished some time or other, unless, indeed, it is possible that my aforesaid instructions might happen to be never dun! which is, it must be acknowledged, very unlikely." In the same *Canadian Magazine* are some poetic pieces from the hand of Cinna, humorous and serious, which I shall presently notice. He explains in the following manner, in one of his papers, how he first came to send the editor a communication in prose:—"I was sitting," he says, "one evening with my friend 'Sae Bald' (so the editor Sibbald resolved his name on the covers of the Magazine), who everybody knows to be the proprietor of the Magazine, and I was reciting to him, as I thought most beautifully, some cantos of my great epic poem, in which I flatter myself I have excelled most poets in making the sound agree with the sense. The canto contained a sublime and musical description of the baying of a kennel full of hounds by moonlight; and of course the verse seemed to echo the voices of the interesting animals who thus sang in concert with the music of the spheres. The passage I was reading, notwithstanding the splendour of the lunar orb, was a dark one; and I was indulging myself in the hope that I had excelled even my companion 'Sae Bald' in the obscurity of his style, when I was awakened from my pleasing dream by his suddenly interrupting me. Laying down his glass, 'Cinna, mon,' says he, 'will ye just hand me the nutmeg?' This spicy gale quite shipwrecked the bark of my dogs, and oh! how that cinnamon and nutmeg grated on my feelings? But think not, reader, that my friend does not understand and feel poetry, particularly such as mine. The truth was, I had chosen my time badly. The printer's imp stood behind his chair. 'Cinna,' said Sae Bald, 'what for do ye no gie us some prose for the Mogazeen? Yon deevil of a printer is in an unco hurry for matter, an' he says, nae matter how I get it, it maun be furnishet directly.' 'And I suppose,' said I, snappishly, 'you cannot furnish it directly if your materials are inverse.'" I close Cinna's prose with two anecdotes which he contrives to bring in. (The "Red Lion" is still in being in Yorkville; it used to be known, from the name of the well-known proprietor and manager, as Tiers' Tavern. It should have been mentioned above that the Underhill there named was a well-known local bailiff.) "An old acquaintance of mine," Cinna writes, "the landlord of the Red Lion, who was a jolly fellow, although his name was Tiers (what his wife's was before marriage is now forgotten, for Tiers dropped upon the word and—blotted it out for ever!), puzzled a gentleman sorely in my presence, by telling him that he, Tiers, was tired of *public life*, and must retire from the *bar*. And I myself," Cinna adds, "was once canvassing for a seat in Parliament, and applied to an Irish friend to let me have some wild land, *that* being considered the only qualification necessary in a member. I began by telling my friend, in the elevated and patriotic style which the election time produces, that I was desirous of having a *stake* in the country. 'Then,' says he, 'you had better go to old Ireland for that same, for the never a *steak* you'll get in this country fit to ait, for love or money.'" Outrageous puns, it will be observed, form the staple of these papers. Some playful verses from the same hand, in the manner of Hood, and similarly characterized, are to be seen also in Sibbald's Magazine. As a specimen, I give a few lines from a ballad of thirty-two stanzas. Tom Scalpel, a medical student, abstracts from a dissecting-room the head and arms of a dead body. The deed is thus described:—

"Says Tom, although the sky don't fall
  I think I'll have a lark;
This kind of lark, they fly by night;
  So Tom got out of bed,
And took his steel and stole two arms,
  And bagged the subject's head;
Like other folks that take *to* arms,
  He took to legs and run,
Although he heard no shot, ere half
  His heavy task was done."

The grotesque consequences of the action are then detailed at length, in language ingeniously tortured. I observe also some graceful songs by Cinna, in the Haynes Bayly style. I select one verse:—

"The worm the rose's petals fold,
  Gnaws at its inmost core;
And love that never must be told
  Consumes the heart the more."

To these extracts I subjoin one passage, in which the writer of the Letters of Legion, and of the productions subscribed "Cinna," speaks in his own proper person. It is from an "Address on Immigration and Colonization," delivered in the Mechanics' Institute, Toronto, 1847. It will be seen that in 1847 he had a very clear view of the capabilities of the then almost wholly undeveloped North-West. "I dare say by this time," Mr. Sullivan said, in the course of his address, "I have established my character for being visionary and over-ardent, and impatient; but I have to lead you yet farther. Just take the map of Canada—but no! that will not do; take the map of North America, and look to the westward of that glorious inland sea, Lake Superior. I say nothing of the mineral treasures of its northern shores, or those of our own Lake Huron, but I ask you to go with me to the head of Lake Superior, to the boundary line. You will say it is a cold journey; but I tell you the climate still improves as you go westward. At the head of Lake Superior we surmount a height of land, and then descend into the real garden of the British possessions, of which so few know anything. Books tell you little of the country, and what they do say will deceive and mislead you. I tell you what I have heard directly from your townsman, Mr. Angus Bethune, and indirectly from Mr. Ermatinger, very lately from that country:—A little to the westward of Lake Superior is Lake Winnipeg, and into Lake Winnipeg runs the Saskatchewan River. It takes its rise in the Rocky Mountains, and the Lake Winnipeg discharges its waters towards and into Hudson's Bay. This river runs from west to east fifteen hundred miles without an obstruction; it is navigable for boats carrying ten or twelve tons. It runs through a country diversified with prairie, rich grass, clumps of forest, and on one of the branches of the river are coal-beds, out of which coal can be obtained by any one with a spade in his hand or, without; and the plains are covered with the wild buffalo of America. I am told that you may drive a waggon from one end to the other of the country of the Saskatchewan; and I am told, moreover, that it is superior in soil and equal in climate to any part of Canada, and that it produces wheat, barley, oats, potatoes—in short, all the crops of temperate climates—in abundance." Now that Manitoba has been organized, and a beneficent civilization is beginning to spread itself thence far out over the broad Saskatchewan valleys, destined soon to meet influences of a similar kind emanating from British Columbia, the forecasts of a thoughtful, ardent mind in regard to these regions some thirty years ago are interesting to read; and they may help us to realize and measure the progress—material, social, and moral—which has been made in that interval of time.

SYNOPSIS OF THE FLORA OF THE VALLEY OF THE ST. LAWRENCE AND GREAT LAKES,

WITH DESCRIPTIONS OF THE RARER PLANTS.

BY JOHN MACOUN, M A., *Botanist to the Geological Survey.*

AND

JOHN GIBSON,* B A., F.G S., F.B S E.

(*Continued from page 176*)

GERANIACEÆ.

GERANIUM, L. Cranesbill.

G. maculatum, L. Wild Cranesbill.

Indigenous. Open woods and fields. Vicinity of Prescott (Billings). County Lanark (Gibson). Common in Central Canada (Macoun). Hamilton, Ont. (Logie). Near London, Ont. (Saunders). Western Ontario, on Lake Huron; Chippawa and Malden, Ont. (Maclagan). New Brunswick (Dr. Fowler). West of the Saskatchewan? (Bourgeau).

G. Carolinianum, L. Carolina Cranesbill.

Indigenous. Barren soil and waste places. Prescott (Billings). Quebec and Saguenay (Brunet). On gneiss rocks, River Rouge (D'Urban). Western Ontario, on Lake Huron (Gibson). Saskatchewan plains (Bourgeau). Owen Sound; Thunder Bay; Islands in Lake of the Woods; Fort Edmonton, on the Saskatchewan; Peace River, Dunvegan; Telegraph Trail, Upper British Columbia; Vancouver Island (Macoun). New Brunswick (Dr. Fowler).

G. Robertianum, L. Herb Robert.

Indigenous. Moist woods and shaded rocky ravines. New Brunswick (G. F. Mathews). Isle aux Hurons, Quebec (Holmes' Herb. McGill College). Chippawa, Malden (Maclagan). Common in Central Canada (Macoun). Mountain near Hamilton (Logie). Western Ontario (Saunders, Gibson). Whiskey and Cockburn Islands and Bruce Mines, Lake Huron (Dr. Bell). Head of Goulais Bay, Lake Superior (Prof. Bell). Prince Arthur's Landing; Islands, Lake of the Woods (Macoun).

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* It is with great regret that we have to state that, since the above was in type, the death of Mr Gibson has been announced. In a botanizing excursion on the north shore of Lake Superior, during the vacation season of 1876, Mr Gibson unhappily contracted rheumatic fever, which afterwards terminated fatally at Montreal At the time of his decease, Mr. Gibson was Science Master in the Normal School at Ottawa He was born at Bayfield, in the County of Huron, and graduated at the University of Toronto in 1872 The valuable contribution to Canadian Botanical Science, of which Mr Gibson, conjointly with Professor Macoun, was the author, will be continued in these pages by the latter gentleman.

Erodium, L'Her. Storksbill.

E. cicutarium, L'Her. Annual Storksbill.

Introduced from Europe. Escaped from gardens. Lake Lemab, Hastings County, Ont. (Macoun). Vicinity of Hamilton, Ont. (Logie). Vancouver Island (Macoun).

Flœrkea, Willd. False Mermaid.

F. proserpinacoides, Willd. False Mermaid.

Indigenous. Marshes and river banks. Amherstburg, Ont. (Maclagan).

Impatiens, L. Balsam. Jewel-weed.

I. pallida, Nutt. Pale Touch-me-not.

Indigenous. Cedar swamps, along rills, and by springs. Niagara Falls (Macoun). Burlington Bay (Logie). St. Catharines, Ont. (Maclagan). Western Ontario, on Lake Huron (Gibson). Montreal Mountain (Dr. Holmes). Plains of the Saskatchewan? (Bourgeau). St. John's, Peace River (Macoun).

I. fulva, Nutt. Spotted Touch-me-not.

Indigenous Cedar swamps, along rills, and by streams. New Brunswick (Dr. Fowler.) Quebec, St. Joachim (Brunet). Montreal Island (Dr. Holmes). Nicolet, Montreal, Chippawa, Niagara, Malden (Maclagan). Rivière du Loup (Dr. Thomas). River Rouge (D'Urban). Common in Central and Western Ontario (Macoun, Gibson, Logie, Saunders). Kaministiquia River, Lake Superior; Dawson Route; Edmonton, Saskatchewan River; Fort Assinaboine on the Athabasca (Macoun). Saskatchewan Plains (Bourgeau). British America, lat. 66° and Newfoundland (Hooker).

Oxalis, L. Wood-sorrel.

O. acetosella, L. Common Wood-sorrel.

Indigenous. Deep cold woods. New Brunswick (G. F. Mathews). Montreal, Port St. Francis (Maclagan). Rivière du Loup (Dr. Thomas). River Rouge (D'Urban). Quebec and Island of Anticosti (Brunet). Woods near Montreal; Portages of Black River, Three Rivers (Dr. Holmes). Northern portions of Central Canada, and Owen Sound (Macoun). Grand Island, Lake Superior (Prof. Bell). North-east coast of Lake Superior (Macoun). Maline River, Dawson Route (Macoun).

O stricta, L. Yellow Wood-sorrel.

Indigenous. Copses, cultivated grounds, and river banks. New Brunswick (Dr. Fowler). Vicinity of Quebec (Brunet). River Rouge (D'Urban). Common in Central Canada (Macoun). Common in Western Ontario (Logie, Saunders, Gibson). Lake of the Woods (Macoun).

O. coaniculata, L.

Indigenous. In cultivated grounds. Is distinguished from *O. stricta* by the presence of stipules at the base of the petioles, and its *pubescent* leaflets and sepals. Vicinity of Montreal (Brunet). Lake Huron (Dr. Todd, *vide* Hooker).

RUTACEÆ.

Zanthoxylum, Colden. Prickly Ash.

Z. Americanum, Mill. Northern Prickly Ash.

Indigenous. Water-courses, shores and low rich woodlands. Vicinity of Montreal; Isle aux Noix (Brunet). Vicinity of Ottawa (Billings). Common in Central Canada (Macoun). Common in Western Ontario (Gibson, Saunders, Logie). Chippawa, Navy Island, Thorold, Malden (Maclagan).

ANACARDIACEÆ.

RHUS, L. Sumach.

R. typhina, L. Staghorn Sumach.

Indigenous. Hillsides, thickets. New Brunswick (Dr. Fowler). Temiscouta, Quebec, Three Rivers, Canada West (Maclagan). Vicinity of Grenville (D'Urban). Village of Beaupré, Quebec (Brunet). Common in Central Canada and Owen Sound (Macoun). Vicinity of London (Saunders). Hamilton (Logie). County Huron (Gibson). North shore of Lake Huron (Prof. Bell). Cape Smyth, Manitoulin Island; Whiskey, Cockburn and Mississagui Islands, Lake Huron (Dr. Bell).

R. glabra, L. Smooth Sumach.

Indigenous. Barren grounds, rocks. Vicinity of London (Saunders). Amherstburg (Maclagan). Abundant near Belleville, Ont.; Lake Nemikin, Dawson Route (Macoun). Saskatchewan Plains (Bourgeau).

R. copallina, L. Dwarf Sumach.

Indigenous. Rocky places. The Thousand Islands, River St. Lawrence (Rev. J. K. McMorine). Barren places, Canada (Torrey and Gray).

R. Toxicodendron, L. Poison Ivy. Poison Oak.

Indigenous. Thickets and low grounds. New Brunswick (Dr. Fowler). River Rouge, abundant (D'Urban). Quebec, St. Joachim (Brunet). St. Johns, Nicolet; Chippawa, Malden (Maclagan). Abundant in Western Ontario (Logie, Saunders, Gibson). Eastern Ontario (Billings). Abundant north shore of Lake Huron, and east coast of Lake Superior (Prof Bell). Abundant in Central Canada; Owen Sound; Sturgeon Lake, Dawson Route; Fort Edmonton, on the Saskatchewan (Macoun). Saskatchewan Plains (Bourgeau). Cape Smyth, Grand Manitoulin; Whiskey, Cockburn and Mississagui Islands, Lake Huron (Dr. Bell). Montreal Island (Dr. Holmes).

R. aromatica, Ait. Fragrant Sumach.

Indigenous. Dry, rocky soil. Abundant along the Rivers Moira and Trent, Ont. (Macoun). Banks of Niagara and Detroit Rivers (Maclagan). Wolfe Island, opposite Kingston; Whiskey Island, Lake Huron (Dr. Bell). Saskatchewan River (Hooker). Maline River, Dawson Route (Macoun.)

VITACEÆ.

VITIS, Tourn. Grape.

V. cordifolia, Michx. Winter Grape. Frost Grape.

Indigenous. Thickets and river banks. Quebec, Isle of Orleans (Dr Thomas). Lake St. John (Brunet). Nicolet, Quebec; Malden (Maclagan). Common in Eastern Ontario (Billings) Common in Central Canada (Macoun). Common in Western Ontario (Logie, Saunders, Gibson). Island of Montreal (Dr. Holmes). Dufferin, Manitoba (Dawson).

V. cordifolia, Michx. Var. riparia, Gray.

Indigenous. Thickets and river banks. Vicinity of Collingwood, Ont. (Macoun). Vicinity of Hamilton (J. M. Buchan). Rivière aux Sables, Western Ontario (Gibson).

AMPELOPSIS, Michx. Virginian Creeper.

A. quinquefolia, Michx. American Ivy. Woodbine. Virginian Creeper.

Indigenous. Low, rich grounds. Rocks at Gross Isle, Quebec (Brunet). Abundant, River Rouge (D'Urban). Common in Eastern Ontario (Billings). Abundant in Western Ontario (Gibson, Logie, Saunders). Niagara District (Maclagan). Common in Central Canada; Owen Sound; 15 miles up the Kaministiquia, Lake Superior; New Portage, Dawson Route (Macoun). Montreal Island (Dr. Holmes). Lake of the Woods (Dawson).

RHAMNACEÆ.

RHAMNUS, Tourn. Buckthorn.

R. catharticus, L. Common Buckthorn.

Introduced. Cultivated grounds. Castleton, and vicinity of Belleville, Ont. (Macoun).

R. alnifolius, L'Her. Alder-leaved Buckthorn.

Indigenous. Cold swamps and meadows. St. Croix, Quebec (Brunet). New Brunswick (Dr. Fowler). Rivière du Loup (Dr. Thomas). Wolfe Island and Niagara Falls (Maclagan). Common in northern portions of Eastern Ontario (Billings). Frequent in Western Ontario (Logie, Saunders, Gibson). Common in Central Canada; Owen Sound; Woods near Pic River, Lake Superior (Macoun). Cockburn Island, Lake Huron (Dr Bell). Montreal Island (Dr. Holmes). Saskatchewan Plains (Bourgeau). Koolanie Pass (Dawson).

CEANOTHUS, L. New Jersey Tea. Red-root.

C. Americanus, L. New Jersey Tea.

Indigenous. Dry wood lands. Vicinity of Prescott (Billings). Kingston, Niagara, Malden (Maclagan). Abundant near London, Ont. (Saunders). East Flamboro, Ont. (Logie). Dry soils, Hastings and Northumberland Counties (Macoun). Saskatchewan Plains (Bourgeau).

C. ovalis, Bigelow. Oval-leaved Ceanothus.

Indigenous. Dry rocks. Rocky places, Canada (Torrey & Gray). Near Shannonville station, Ont.; St. Norah's Island, Peterborough County; very abundant twenty miles up the Kaministiquia River, Lake Superior; Sturgeon Lake, Dawson Route (Macoun). Gore Bay, Grand Manitoulin Island, Lake Huron (Dr. Bell).

CELASTRACEÆ.

CELASTRUS, L. Staff-Tree. Shrubby Bitter-sweet.

C. scandens, L. Wax-work.

Indigenous. Along streams and thickets. Borders of rivers, Quebec (Brunet). Montreal Island, Chippawa, Malden (Maclagan). Vicinity of London, uncommon (Saunders). Mountain side, Hamilton (Logie). Common near Prescott (Billings). Frequent along rivers and in fields, Central Canada; also at Owen Sound (Macoun). Mamainse, east coast of Lake Superior (Prof. Bell).

Euonymus, Tourn. Spindle-Tree.

E. atropurpureus, Jacq. Burning-Bush. Waahoo.

Indigenous. Shady woods. Upper Canada (Torrey & Gray). Malden, Ont. (Maclagan).

E. Americanus, L. Strawberry Bush.

Indigenous. Wooded river banks. Vicinity of London (Saunders). Hills around Niagara (Maclagan). Banks of Lake St. Clair (Douglas).

E. Americanus, L. Var. obovatus, Torrey & Gray.

Indigenous. Low or wet places. Vicinity of Hamilton, Ont. (Judge Logie.)

SAPINDACEÆ.

Staphylea, L. Bladder-Nut.

S. trifolia, L. American Bladder-Nut.

Indigenous. Thickets, river banks. Vicinity of Prescott (Billings). Local in Central Canada (Macoun). Mountain side, west of Hamilton (Logie). Vicinity of London (Saunders). Wolfe Island, opposite Kingston, and Malden, Ont. (Maclagan).

Æsculus, L. Horse Chestnut. Buckeye.

Æ. Hippocastanum, and Æ. glabra are only found in cultivation.

Acer, Tourn. Maple.

A. Pennsylvanicum, L. Striped Maple. Moose-wood.

Indigenous. Rich, damp woods. New Brunswick (G. F. Mathews). River Rouge (D'Urban). Common in Quebec (Brunet). Common at Rivière du Loup (Dr. Thomas). Nicolet (Maclagan). Common near Prescott (Billings). Abundant in northern parts of Central Canada (Macoun). Island east of Mississagui River, Lake Huron (Prof. Bell). Cockburn Island, Lake Huron (Dr. Bell). Goulais Point, Lake Superior; Red Bay, Lake Huron (Macoun). County Huron, Ont. (Gibson). British America, lat. 51° N. (Torr. & Gray).

A. spicatum, L. Mountain Maple.

Indigenous. Wet woods and cedar swamps. New Brunswick (Dr. Fowler). County of Gaspé (Brunet). Nicolet, Montreal, Bel'œil, Niagara (Maclagan). Common all along the St. Lawrence (Dr. Thomas). Vicinity of Hamilton (Logie). London (Saunders). County Huron, Ont. (Gibson). Common in Central Canada; Owen Sound, Michipicotin Island and Thunder Bay, Lake Superior; Dawson Route (Macoun). Saskatchewan Plains (Bourgeau). Hilton and Cockburn Islands, Lake Huron; west coast of Newfoundland (Dr. Bell). To lat. 51° N. (Torrey & Gray).

A. saccharinum, Wang. Sugar Maple.

Indigenous. Rich woods. Abundant throughout Ontario, Quebec and the Maritime Provinces. South-east coast of Lake Superior, and Thunder Bay (Macoun).

A. saccharinum, Wang. Var. nigrum, Gray. Black Sugar Maple.

Indigenous. Rich woods. Mirivin's woods, near Prescott (Billings). Nicolet (Brunet). Malden, Ont. (Maclagan).

A. dasycarpum, Ehrhart. White or Silver Maple.

Indigenous. River valleys and banks. Common in the valleys of the Trent and Moira Rivers, and Prince Edward County; Mud Portage, Dawson Route (Macoun). Rare along the River St. Francis (Brunet). New Brunswick (G. F. Mathews).

A. rubrum, L. Red or Swamp Maple.

Indigenous. Swamps and wet woods. New Brunswick (Dr. Fowler). Throughout the Province (Maclagan). Rivière du Loup (Thomas). River Rouge (D'Urban). Common in Quebec (Brunet). Common in Eastern Ontario (Billings). Common in Western Ontario (Logie, Saunders, Gibson). Common in Central Canada (Macoun). Goulais Point, Lake Superior; Maline Rapids, Dawson Route (Macoun). Saskatchewan Plains (Bourgeau). West coast of Newfoundland (Dr. Bell). Centre of St. Joseph's Island, Lake Huron (Dr. Bell).

NEGUNDO, Mœnch. Box-Elder.

N. aceroides, Mœnch. Ash-leaved Maple.

Indigenous. River banks. Interior of Canada (Hooker). Eleven miles up the Kaministiquia, Lake Superior (Macoun). Saskatchewan Plains (Bourgeau). Island on Lake of the Woods (Macoun.) Carleton (Macoun).

POLYGALACEÆ.

POLYGALA, Tourn. Milkwort.

P. incarnata, L.

Indigenous. Dry soil. Ontario (Brunet).

P. sanguinea, L.

Indigenous. Barren grounds. Sandwich, Ont. (Maclagan).

P. fastigiata, Nutt.

Indigenous. Dry grounds. Vicinity of Hamilton (Judge Logie).

P. Nuttalii, Torrey & Gray.

Indigenous. Prince's Island, Ont. (Logie).

P. verticillata, L.

Indigenous. Dry soil. Amherstburg, Ont. (Maclagan). Plains of the Saskatchewan (Bourgeau). Boucherville Island, River St. Lawrence (Dr. Holmes).

P. Senega, L. Seneca Snake-root.

Indigenous. Rocky soil and sandy plains. Abundant on sandy plains in Central Canada (Macoun). Frequent in vicinity of London (Saunders). Plains of the River aux Sables, south, Lake Huron (Gibson). Prince's Island (Logie). Kingston, Niagara, Navy Island, and Malden (Maclagan). Drummond Island, Lake Huron (Dr. Bell). Saskatchewan Plains (Bourgeau).

P. polygama, Walt.

Indigenous. Dry sandy soil. Sandy plains, local, Central Canada (Macoun). English's woods, vicinity of London (Saunders). Lake of the Woods (Dawson).

P. paucifolia, Willd.

Indigenous. Light sandy soil and pine barrens. Sandy plains, common, Central Canada (Macoun). Vicinity of Kingston (Maclagan). Near Lake Medad, Ont. (Logie). Near White Fish Point, in sand around red pines (Prof. Bell). Lake Huron (Brunet). Lake Ontario (Michaux). Cockburn Island, Lake Huron (Dr. Bell). Kaministiquia River, Lake Superior (Macoun). Saskatchewan Plains (Bourgeau). Island of Montreal (Dr. Holmes).

LEGUMINOSÆ.

Lupinus, Tourn. Lupine.

L. perennis, L. Wild Lupine.

Indigenous. Sandy soil. Scarce at Castleton, Peterborough Co (Macoun). Very common, G. W. R. track, vicinity of London (Saunders). Plains of the River aux Sables, south, Lake Huron (Gibson). Sandwich, Ont. (Maclagan).

Trifolium, L. Clover. Trefoil.

T. arvense, L. Stone Clover.

Naturalized from Europe. Old fields. Necropolis, Toronto (Macoun). Near Dundurn, Ont. (Logie) Brockville Road, near Conway's Creek (Billings). Common, Rivière du Loup (Dr. Thomas).

T. pratense, L. Red Clover.

Introduced from Europe. Fields and meadows. Common throughout Eastern and Central Canada.

T. reflexum, L. Buffalo Clover.

Indigenous. Light dry grounds. Islands in Detroit River (Maclagan).

T. repens, L. White Clover.

Indigenous. Fields and copses, everywhere. Both indigenous and introduced.

T. agrarium L. Yellow or Hop-Clover.

Introduced. Sandy fields. Between Trenton and the Carrying place, Ont., 1863 (Macoun).

T. procumbens, L. Low Hop Clover.

Introduced. Sandy fields and roadsides. Vicinity of Quebec (Brunet). Fields, Hamilton (Logie). New Brunswick (Dr. Fowler). Kingston (Morden).

T. hybridum, Alsick.

Introduced. Cultivated fields, and along fences. Is being extensively cultivated in the west instead of *T. pratense*.

MELILOTUS, Tourn. Melilot. Sweet Clover.

M. officinalis, Willd. Yellow Melilot.

Introduced. Waste or cultivated grounds. River side, near Belleville, Ont. (Macoun). Near the Citadel, Quebec (Brunet). Montreal (Maclagan). New Brunswick (Dr. Fowler). Toronto (Buchan).

M. alba, Lam. White Melilotus.

Introduced. Waste or cultivated grounds. A weed or flower in gardens, Belleville (Macoun). Bank of the St. Lawrence, near Prescott (Billings). New Brunswick (Dr. Fowler).

MEDICAGO, L. Medick.

M. sativa, L. Lucern.

Introduced. Sandy fields. Northumberland County, rare, and Owen Sound (Macoun.)

M. lupulina, L. Black Medick.

Introduced. Waste places. Abundant in Central Canada. Common in Eastern Ontario (Billings). Frequent in Western Ontario (Logie, Gibson). New Brunswick (Dr. Fowler).

ROBINIA, L. Locust Tree.

R. Pseudacacia, L. Common Locust or False Acacia.

Introduced. Cultivated as an ornamental tree.

R. viscosa, Vent. Clammy Locust.

Introduced. Cultivated as an ornamental tree. Scarce. This is much smaller than the *R. Pseudacacia.*

ASTRAGALUS, L. Milk-Vetch.

A. Canadensis, L. Canadian Milk-Vetch.

Indigenous. River banks. New Brunswick (Dr. Fowler). Borders of rivers near Quebec (Brunet). Montreal Island (Dr. Holmes). Prescott and Brockville (Billings). Rice Lake, Belleville on the Moira, banks of Trent (Macoun). Near Cove, vicinity of London (Saunders). Burlington Heights (Logie). River aux Sables, south, Lake Huron (Gibson). Kingston, Wolfe Island, Goat Island, Navy Island, Malden (Maclagan). Michipicotin Island, Kaministiquia River, and New Portage, Dawson Route (Macoun). Plains of Saskatchewan (Bourgeau).

A. Cooperi, Gray.

Indigenous. Rocky grounds. Meyersburg and vicinity of Marmora Village; Bruce Peninsula, Ont. (Macoun). La Cloche Island and Whiskey Island, Lake Huron (Dr. Bell). Hamilton (Logie). Montreal Island (Maclagan).

A. Robbinsii, Gray.

Indigenous. Rocky ledges. Acadia, valley of the St. Lawrence (G. F. Mathew.)

A. alpinus, L.

Indigenous. Rocks and banks. Northern parts of Canada—*A. secundus*—(Michaux). Labrador coast (Butler). Island of Anticosti (Dr. Thomas). East Greenland (Hooker). Montreal Island (Dr. Holmes, *vide* Torr. & Gray). Near Quebec (Mrs. Percival). Macleod's Lake, Lat. 55° (Macoun).

OXYTROPIS, DC. Oxytropis.

O. campestris, DC.

Indigenous. Dry rocky ground. Isle of Orleans; Coast of Labrador (Brunet). Baffin's Bay (Hooker). Saskatchewan Plains; Peace River Valley (Macoun). This is undoubtedly the *O. Lamberti* reported from Quebec by Mrs. Percival.

O. podocarpa, Gray. *Proc. Am. Acad. 1863.*

Indigenous. On rocky ground. South coast of Labrador (Gray). *O. arctica*, Hook. Fl. Bor.-Am. 1, p. 146, pro parte, non R. Brown. *Astragalus biflorus*, Schweinitz in herb. Nearly stemless, silky; leaflets opposite and alternate, oval-oblong; heads, few flowered, the flowers somewhat umbellate; legumes erect, oblong, acuminate, and clothed with black hairs.

HEDYSARUM, Tourn. Hedysarum.

H. boreale, Nutt. Northern Hedysarum.

Indigenous. Gravelly or rocky soil. Borders of Lake St. John (Brunet). North shore of Lake Superior (Agassiz). Labrador (Butler). From Fort Ellis to Fort Edmonton, on the Saskatchewan; Portage between Little Slave Lake and Peace River; Plains between Dunvegan and St. John's, on Peace River, abundant (Macoun). Northern Canada (Michaux). Arctic Circle (Richardson). Kotzebue's Sound (Beechey). Rocky Mountains, lat. 54° N. (Drummond).

GLYCYRRHIZA, Tourn. Liquorice.

G. lepidota, Nutt.

Indigenous. Sandy banks. Fort Erie, Ont., opposite Buffalo (G. W. Clinton). Mouth of Rainy River, Lake of the Woods, and westward (Macoun). Lake Athabasca (Macoun).

DESMODIUM, DC. Tick-Trefoil.

D. nudiflorum, DC.

Indigenous. Dry woods. Sandy woods, Brighton, Ont.; Oak Hills, Sidney, Ont. (Macoun). Rare in Eastern Ontario (Billings). Niagara River (Maclagan). Vicinity of Hamilton (Logie). Papineau Wood, Montreal (Dr. Holmes).

D. acuminatum, DC.

Indigenous. Rich woods. Common in rich woods, Central Canada (Macoun). Abundant in Eastern Ontario (Billings). Near Dundas, Ont. (Logie). Nicolet; Chippawa, St Catharines, Malden (Maclagan). Rich woods, Bosanquet, Seaforth, Bayfield, Ont. (Gibson). St. Joachim; Foot of Little Cape, common (Brunet). Mountain of Montreal (Dr. Holmes).

D. pauciflorum, DC.

Indigenous. Dry sandy woods. Sandy woods, Castleton, Northumberland County (Macoun). Prescott, rare (Billings). Vicinity of Hamilton (Logie).

D. canescens, DC.

Indigenous. Moist grounds. Malden, Ont. (Maclagan).

D. cuspidatum, Torrey and Gray.

Indigenous. Thickets. Myersburgh, Northumberland County (Macoun). Vicinity of Hamilton (Buchan). Cayuga, St. Catharines and Malden (Maclagan).

D. Dillenii, Darlingt.

Indigenous. Open woodlands. Vicinity of Hamilton (Judge Logie).

D. paniculatum, DC.

Indigenous. Copses. Vicinity of London (Saunders). Hamilton (Logie). St. Catharines, Malden (Maclagan).

D. Canadense, DC.

Indigenous. Dry rich woods. Vicinity of Quebec; River Restigouche (Brunet). Huckleberry Rapids, River Rouge (D'Urban). Eastern Ontario, common (Billings). Nicolet, Niagara, Cayuga, Malden (Maclagan). Common in Central Canada (Macoun). Stanley Township, Lake Huron (Gibson). Island of Montreal (Dr. Holmes).

LESPEDEZA, Michx. Bush Clover.

L. repens, Torr. and Gray.

Indigenous. Dry sandy soil. Upper Canada (Douglas). The Dell, Ancaster, Ont. (Judge Logie).

L. violacea, Pers.

Indigenous. Dry copses and borders of woods. Malden, Ont. (Maclagan). The Dell, Ancaster, Ont. (Judge Logie).

L. hirta, Ell.

Indigenous. Dry hillsides. Oak Hills, Sidney, Ont. (Macoun). Prescott (Billings). Prince's Island, Lake Medad, Ont. (Logie). St. Catharines, Thorold, and Queenston, Ont. (Maclagan).

L. capitata, Michx.

Indigenous. Dry and sandy soil. Rice Lake Plains; Oak Hills, Sidney, Ont. (Macoun). Vicinity of London, common (Saunders). County Huron, Lake Huron (Gibson). Eastern Ontario, along the banks of the St. Lawrence (Billings). Prince's Island, Lake Medad (Logie). Malden, Ont. (Maclagan).

L. capitata, Mx. Var. augustifolia, Gray.

VICIA, Tourn. Vetch. Tare.

V. sativa, L. Common Vetch or Tare.

Introduced. Cultivated fields and waste places. Along G. T. R. track, Belleville (Macoun). Clay banks, east of Prescott (Billings). Vicinity of Quebec (Brunet). New Brunswick (G. F. Mathews). Common at Rivière du Loup (Dr. Thomas). Malden, Ont. (Maclagan).

V. tetrasperma, L.

Introduced. Waste places near the coast. Isle of Orleans (Brunet). Longeuil, Quebec (Maclagan).

V. hirsuta, Koch.

Introduced. Waste places. Quebec (Brunet). Common at Rivière du Loup (Dr. Thomas). Vicinity of Hamilton (Logie).

V. Cracea, L.

Indigenous. Fields and wastes. Rocky field near Belleville (Macoun). Common near Prescott (Billings). Common at Quebec (Brunet). New Brunswick (Dr. Fowler). Montreal Island (Holmes, Maclagan). Common at Rivière du Loup (Dr. Thomas). Fifteen miles up the Kaministiquia, Lake Superior (Macoun). Fort Garry and Fort Carleton, on the Saskatchewan (Macoun).

V. Caroliniana, Walt.

Indigenous. River banks and lake shores, &c. Bay of Quinté, Prince Edward County (Macoun). Chippawa, Navy Island and Malden (Maclagan).

V. Americana, Muhl.

Indigenous. River banks and moist soil. Paris (Logie). Chippawa, Navy Island, Cayuga, and Malden (Maclagan). North shore of Lake Superior (Agassiz). Twenty miles up the Kaministiquia River and on Pie Island, Lake Superior; Shebandewan Lake, Dawson Route. Abundant all the way from Fort Garry westward to Peace River, and through the Rocky Mountains and Upper British Columbia to Quesnelle (Macoun). North to Bear Lake (Hooker).

V. Americana, Muhl. Var. Sylvatica, Mac. & Gib.

Leaflets elliptical-lanceolate, somewhat rigid, strongly reticulated; peduncles 2-5 flowered. Climbing over bushes on the banks of the Kaministiquia, 20 miles from its mouth (Macoun). Saskatchewan and westward (Hooker).

LATHYRUS, L. Vetchling.

L. maritimus, Bigelow.

Indigenous. Lake and river beaches from the Gulf of St. Lawrence to Lake Superior. New Brunswick (Mathews). Rivière du Loup, Anticosti, Labrador (Brunet). West coast of Newfoundland; and Mississagui Island, Lake Huron (Dr. Bell). Presqu'ile Point, Lake Ontario, and very abundant along the shores of Lake Superior (Macoun). Hamilton (Logie). Mouth of the River aux Sables, south (Gibson). Saskatchewan Valley (Bourgeau). Kotzebue's Sound and Arctic America (Richard).

L. venosus, Muhl.

Indigenous. Shady river banks and thickets. Whirlpool, Niagara Falls (Maclagan). Very abundant 15 miles up the Kaministiquia River, and along Rainy River, Lake of the Woods, extending westward to the Athabasca (Macoun). River St. Pierre (Dr. Holmes). West to Pacific (Macoun).

V. ochroleucus, Hook.

Indigenous. Rocky hill sides and thickets. Kingston and Chippawa (Maclagan). Hamilton (Logie). Rocky woods near Belleville; North shore of Lake Superior and Kaministiquia River; abundant on the Dawson Route;

thickets Saskatchewan Plains; and throughout the partially wooded country to Peace River, and west of the Rocky Mountains to the Upper Frazer (Macoun). North to Bear Lake (Rich.)

L. palustris, L.

Indigenous. Marshy meadows and along river banks. Abundant from Labrador and New Brunswick to the head of Lake Superior, and westward to Edmonton on the Saskatchewan (Macoun).

L. palustris, L. Var. myrtifolius, Gray.

Indigenous. Rocky banks of rivers. New Brunswick (Fowler). Lotbiniere (Brunet). Montreal Island (Dr. Holmes). Carol's Point (Logie). Chippawa (Maclagan). Bayfield River (Gibson). Banks of the Rivers Trent and Moira throughout their whole length. Colpoy's Bay, Georgian Bay (Macoun). Cockburn Island, Lake Huron (Dr. Bell).

Apios, Boarhaave. Ground Nut.

A. tuberosa, Mœnch.

Indigenous. Low gravelly banks of rivers. St. Nicholas, and Lotbiniere (Brunet). Montreal Island (Dr. Holmes). Marsh near Prescott (Billings). Heely Falls, River Trent, Northumberland County; near Smithville, on the Moira, Hastings County (Macoun). Vicinity of London (Saunders). Hamilton (Logie). Bayfield River (Gibson).

Phaseolus, L. Kidney Bean.

P. diversifolius, Pers.

Indigenous. Sandy fields and banks. Montreal, Malden (Maclagan).

P. helvolus, L.

Indigenous. Sandy fields and thickets. G. W. R. track one mile east of London (Saunders). Hamilton (Logie).

Amphicarpæa, Ell. Hog Pea Nut.

A. monoica, Nutt.

Indigenous. Rich woodlands and moist thickets. Common at St. Croix and Quebec (Brunet). Along the banks of the Rouge, Quebec (D'Urban) Woods and thickets, Prescott (Billings). Common in Central Canada; 15 miles up the Kaministiquia River, Lake Superior (Macoun). Montreal Island (Dr. Holmes). Owen Sound (Dr. Bell). Prince's Island (Logie). Niagara District, and Malden (Maclagan).

Baptisia, Vent. False Indigo.

B. tinctoria, R. Br. Wild Indigo.

Indigenous. Sandy dry soil. Vicinity of Hamilton (Logie). Colchester, Sandwich, Ont. (Maclagan.)

B. leucantha, Torr. & Gray.

Indigenous. Rich alluvial soil. Province of Ontario, near Lake Erie (Torr. & Gray).

B. alba, R. Br.

Indigenous. Dry soil. Canadian shore of Lake Erie (Goldie).

GYMNOCLADUS, Lam. Kentucky Coffee Tree.

G. Canadensis, Lam.

Introduced. Rich woods along rivers. Cultivated as an ornamental tree, Island of Montreal (Brunet).

GLEDITSCHIA, L. Honey Locust.

G. triacanthos, L. Honey Locust.

Introduced. Rich woods. Cultivated as an ornamental tree. Belleville (Macoun). Island of Montreal (Brunet).

ROSACEÆ.

PRUNUS, Tourn. Plum, Cherry, &c.

P. Americana, Marshall. Wild Yellow or Red Plum.

Indigenous. Woodlands and river banks. Common in Central Canada Macoun). Island of Montreal; along the Ottawa (Brunet). Common in Eastern Ontario (Billings). Common in Western Ontario (Logie, Ellis). Chippawa and Malden (Maclagan). County Huron, Lake Huron (Gibson). Opposite Gros Cap, Lake Superior (Prof. Bell). Whiskey Island, Lake Huron (Dr. Bell). Owen Sound; woods at Kakabeka Falls, Kaministiquia River; Island Portage, Dawson Route (Macoun). Saskatchewan Plains (Bourgeau).

P. maritima, Wang. Peach Plum.

Indigenous. Sandy barrens in the vicinity of the sea coast. Quebec (Brunet).

P. pumila, L. Dwarf Cherry.

Indigenous. Sandy barrens. New Brunswick (Mathews). Isle of Orleans, Restigouche, River Mistassini (Brunet). River Rouge (D'Urban). Montreal, Point du Lac (Maclagan). Sandy flats of the River aux Sables, south, Lake Huron (Gibson). Rice Lake Plains; Wellington Beach, Lake Ontario; Red Bay, Lake Huron; beaches around Lake Superior; Bruillé Portage, Dawson Route (Macoun). Whiskey and Cockburn Islands, Lake Huron (Dr. Bell). Saskatchewan Valley (Bourgeau). Lake Athabasca (Macoun).

P. Pennsylvanica, L. Wild Red Cherry.

Indigenous. Rocky woods and thickets. New Brunswick (Mathews). River Rouge (D'Urban). Vicinity of Quebec; Lake Mistassini (Brunet). Rivière du Loup (Dr. Thomas). Common in Eastern Ontario (Billings). Common in Western Ontario (Logie, Saunders, Gibson, Ellis). Nicolet, Navy Island (Maclagan). Common in Central Canada; Thunder Bay, Lake Superior; St. Ignace Island, Lake Superior; Dawson Route, and west to Little Slave Lake (Macoun). Montreal Island (Dr. Holmes). West coast Newfoundland (Dr. Bell).

P. Virginiana, L. Choke Cherry.

Indigenous. River banks and thickets. New Brunswick (Dr. Fowler). Sparingly at River Rouge (D'Urban). Quebec and Charlesburgh (Brunet).

Not common, Rivière du Loup (Dr. Thomas). Common in Eastern Ontario (Billings). Common in Western Ontario (Logie, Saunders, Gibson, Ellis). Chippawa and Malden, Ont. (Maclagan). Central Canada; Kaministiquia River, Lake Superior; Mud Portage, Dawson Route; Fort Edmonton, Fort Assinaboine, Little Slave Lake, Dunvegan on Peace River (Macoun). To the Arctic Circle (Hooker). Islands in Lake Huron; Newfoundland (Dr. Bell).

P. serotina, Ehrhart. Wild Black Cherry.

Indigenous. Woods. New Brunswick (Dr. Fowler). Island of Montreal (Dr. Holmes). Eastern Townships (Brunet). Prescott (Billings). Hamilton (Logie). London (Saunders). Niagara, Malden (Maclagan). Bayfield River, Lake Huron (Gibson). Central Canada; Owen Sound; Kaministiquia River; Lake Superior (Macoun). Hudson's Bay; Great Slave Lake (Richardson).

SPIRÆA, L. Meadow Sweet.

S. opulifolia, L. Nine Bark

Indigenous. Rocky river banks. Common near Quebec (Brunet). Island of Orleans (Dr. Thomas). Island of Montreal (Dr. Holmes). St. Thomas (Miss Crooks). Rather rare, London (Saunders). Niagara, Malden (Maclagan). Stanley Township, Lake Huron (Gibson). Owen Sound and Red Bay, Lake Huron; abundant around Lake Superior, and 30 miles up the Kaministiquia River (Macoun). Islands in Lake Huron (Dr. Bell) Red River (Richardson). Rainy River, Dawson Route (Macoun). Thousand Islands (Macoun).

S. salicifolia, L. Common Meadow Sweet.

Indigenous. Wet or low grounds. Widely diffused through Eastern and Central Canada, the Western Peninsula, and westward to Fort Edmonton on the Saskatchewan.

S. tomentosa, L. Hardhack. Steeple Bush.

Indigenous. Low grounds. New Brunswick (Dr. Fowler). Three Rivers, Nicolet and Montreal Island (Maclagan). River Rouge (D'Urban). Common, Prescott (Billings). Lakes Partridge and Hooper, Hastings County; Addington County (Macoun).

GILLENIA, Mœnch. Indian Physic.

G. trifoliata, Mœnch. Bowman's Root.

Indigenous. Rich woods. Prince's Island, Lake Medad, Ont. (Judge Logie).

POTERIUM, L. Burnet.

P. Canadense, Gray. Canadian Burnet.

Indigenous. Bogs and wet meadows. Cacouna (Prof. Ellis.) Labrador (Butler). West coast of Newfoundland (Dr. Bell). Island of Montreal (Dr. Holmes.) Watersheds between Pacific and Arctic Oceans (Macoun).

ALCHEMILLA, Tourn. Lady's Mantle.

A. vulgaris, L.

Indigenous. Leaves radical, reniform, 7-9 lobed to about $\frac{1}{3}$ their depth; the lobes somewhat semiorbicular, serrate throughout; flowers in terminal dichotomous corymbs.—Torrey & Gray. Labrador, S. coast (Butler).

AGRIMONIA, Tourn. Agrimony.

E. Eupatoria, L. Common Agrimony.

Indigenous. Borders of woods. New Brunswick (Mathews). Common at River Rouge (D'Urban). Common in Quebec (Brunet). Rivière du Loup (Dr. Thomas). Island of Montreal (Dr. Holmes). Common in Eastern Ontario (Billings). Common in Central Canada; Owen Sound; Kaministiquia River, Lake Superior to Fort Edmonton on the Saskatchewan (Macoun). Whiskey Island, Lake Huron (Dr. Bell). North shore of Lake Superior (Agassiz). Oaklands, Ont. (Logie). Central Ontario (Prof. Ellis).

A. parviflora, Ait. Small-flowered Agrimony.

Indigenous. Woods and glades. Common near London, Ont. (Saunders). Malden, Ont. (Maclagan).

DRYAS, L. Dryas.

D. Drummondii, Hook.

Leaves elliptical, slightly attenuated at the base, crenate-serrate, clothed beneath, as well as the prominent veins, with a white tomentum; sepals ovate; flowers yellow. Indigenous. Gravelly beds of rivers and lake margins. Island of Anticosti (Pursh). Gaspé Peninsula (Dr. Bell). Slate Islands, Lake Superior (Prof. Ellis). Sand bars along Peace River within the Rocky Mountains, and westward to the West Road River (Macoun). In the woody country from lat. 54° to 64°, and about Slave Lake to the Arctic Sea in lat. 68° (Richardson). Rocky Mountains, lat. 52° N. (Bourgeau).

D. integrifolia, Vahl.

Indigenous. Rocky banks along streams. Labrador (Butler). Island of Anticosti (Pursh). Mount Selwyn, Peace River Pass (Macoun).

D. octopetela, Linn.

Leaves oblong-ovate, coarsely crenate-toothed, obtuse at each end, clothed with a white tomentum beneath, the veins prominent; sepals linear; flowers white. Indigenous. Rocky ground along rivers. Labrador (Butler). Arctic America, and Greenland to Behring's Straits (Hooker). Rocky Mountains, lat. 52° N. (Bourgeau). Stewert's Lake Mountains, B.C. (Macoun).

GEUM, L. Avens.

G. album, Gmelin.

Indigenous. Borders of woods in rich soil. New Brunswick (Fowler). Vicinity of Quebec; Charlesbourg (Brunet). Rivière du Loup (Thomas) Valley of the Rouge (D'Urban). Abundant throughout Ontario, from the extreme east to Owen Sound.

Geum Virginianum, L.

Indigenous. Borders of fields in rich soil. Rare. Along the Grand Trunk Railway, at a culvert three miles east of Belleville (Macoun). Hamilton (Logie). Chippawa, Malden (Maclagan).

G. macrophyllum, Willd.

Indigenous. Cold rocky woods. New Brunswick, common (Fowler) Rivière du Loup (Thomas). North-east shore of Lake Superior, between the

Pic and Otter Head. American Portage, Dawson Route (Macoun). Unalaska, Sitcha, and North-west Coast (Tolmie) Saskatchewan River, near Fort Pitt, Fort Assinaboine, on the Athabasca (Macoun).

G. strictum, Ait.

Indigenous. Borders of fields and in moist thickets. New Brunswick (Fowler). Near the General Hospital, Quebec (Brunet). Common at Prescott (Billings). Common in Central Canada; woods Owen Sound; up the Kaministiquia River; also at Fort Francis, and west through the Rocky Mountains down to Vancouver Island (Macoun). Hamilton (Logie). Western Peninsula, common (Gibson and Saunders). Whiskey and Cockburn Islands, Lake Huron (Dr. Bell).

G. vernum, Torr. & Gray.

Indigenous. Thickets and borders of woods. Malden (Maclagan).

G. rivale, L.

Indigenous. About springs in wet woods. New Brunswick (Fowler). Vicinity of Quebec (Brunet). St Foy, Quebec (Thomas). Scarce at Prescott (Billings). Rather scarce in Central Canada; about springs Owen Sound; Kakabeka Falls, Kaministiquia River; Lake Shebandowan, Dawson Route, Fort Assinaboine, Athabasca River (Macoun). Sault Ste Marie (Prof. Bell) Common at London (Saunders). Montreal (Maclagan). Labrador (Butler) West coast of Newfoundland (Dr. Bell). Extends to the Arctic Circle (Hooker). West to Stewert's Lake, B.C. (Macoun).

G. geniculatum, Michx.

Indigenous. Canada (Michaux).

G. triflorum, Pursh.

Indigenous. Rocky ground. Rocks at Trenton Station, west of the cutting; abundant at Shannonville (Macoun). Vicinity of London (Saunders). From Fort Garry, west to Edmonton, and from Smoky River, along Peace River, to the Rocky Mountains (Macoun). Saskatchewan Plains (Bourgeau).

Waldsteinia, Willd.

W. fragarioides, Tratt. Barren Strawberry.

Indigenous. Wooded hillsides. Common in Central Canada (Macoun). Common in Eastern Ontario (Billings). Common in Western Ontario (Logie, Ellis, Saunders, Gibson). Cockburn Island, Lake Huron (Dr. Bell).

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THE PRESIDENT'S ADDRESS.

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In accepting the honour you have done me in electing me to preside over the meetings of the Canadian Institute, I have thought it would be in keeping with the present occasion that I should devote my remarks to some question which would serve to indicate the objects of our Association. For this purpose, the subject of the Advancement of Science, although perhaps the most difficult, seemed to me the most appropriate. I have accordingly endeavoured, though in a crude and imperfect manner, to treat this comprehensive question from such points of view as were calculated to indicate to us our true position with regard to Science.

It is a prominent feature of our modern civilization, and one indicative of its very advanced stage, that increasing efforts are being made to extend the boundaries of Science in every direction. Unsatisfied by the present range of knowledge, the human mind still strives after universal empire, and in divers ways we still see manifested that restless spirit which prompts men to new ventures, and revives the recollection of the mythical stories of the heroic age. With regard to Science, it is in many respects the beginning of a golden age, wherein the glory of advancing knowledge shall not only be the fond dream of the philosopher, but the proud boast of nations. It is an age, indeed, wherein has already appeared a large measure of the lofty spirit that pervaded the ancient Greek philosophy, and gained for the race, even in a conquered state, the respect and admiration of their masters. It is not the spirit of the ancient Romans. With them universal rule was the object of the national ambition, and in the attainment of that end military and political considerations completely absorbed the energy of the State. Even at the height of Rome's civilization her sweetest bard sang:

> Tu regere imperio populos Romane, memento.
> Hæ tibi erunt artes : pacisque imponere mores,
> Parcere subjectis, et debellare superbos.

Fortunately for the interests of humanity, the foremost nations of the present day have a more lofty ambition. Turning to the most aggressive of these, we behold a people, long engrossed in a political idea, attain to national unity by a rapid series of unparalleled military successes; and yet at the same time the Germans are so occupied with the pursuit of the Arts and Sciences, that their fatherland is looked upon by foreigners as much in the light of a vast university as an immense camp. It is, in fact, to the intellectual prominence of the Germans and their devotion to Science that the recent extension of their boundaries and their political unification are largely due. Such, at any rate, is the opinion of an eminent French physicist, who even goes the length of ascribing the loss of his country's military prestige entirely to the neglect, on the part of the French Government, of scientific development. In an article of great power, Pasteur uses the following language: "The public powers of France have long misapprehended this law of correlation between theoretic Science and the life of nations. Victim, no doubt, to her political instability, modern France has done nothing to maintain, propagate, and develop scientific activity. She has been content with receiving an impulse already received; she has lived on her past, believing herself always great in discovery, because she owes to it her material prosperity. But she has not perceived that her sources have been imprudently permitted to run dry. Neighbouring nations, on the contrary, excited by the stimulus given by France, have turned it to their profit, rendering it fruitful by labours and by sacrifices sagely combined. While Germany multiplied her Universities and established among them the most salutary emulation; while she surrounded her masters and her doctors with honours and with consideration, creating vast laboratories endowed with thousands of instruments for the prosecution of research, France, weakened by her revolutions, always occupied in the barren search after the best form of government, gave only a distracted attention to her establishments of superior instruction." Such a picture is in striking contrast to that presented by France in the days of Lagrange and Laplace. Those were the times, not only of her great scientific superiority, but of her great military successes. The fact that the relative positions of France and her powerful neighbour have been thus changed is calculated to inspire the former, not only to retrieve her military renown, but to regain her old position in the scientific world, wherein she was once *facile princeps*. Where the German has reaped so abundantly, the French will not be slow to cultivate. No political boundaries separate them in the domain of Science, and there, let us hope, they may long contend for the glory of advancing the interests of a higher civilization. A more special interest attends our theme when we consider the attitude of our mother-land towards the question of the encouragement of scientific research. No country in the world owes so much to Science as Britain does. By it her wealth and commerce have been built up; her strength has been developed at home, and her power extended abroad. To it is due her industrial progress. It has created work for her teeming millions. It has developed the skill of her artizans, quickened the intelligence of her people, improved their habits, and multiplied their comforts. It is to the honour of England, and to the credit of her intelligence, that, amidst all her commercial and political successes, she is not unmindful of the original sources of her material strength. The great debt she owes to Science is acknowledged, and out of her abundant store she is ever ready to aid in extending the bounds of knowledge. Her liberality in this direction is unquestioned, and only requires some well considered scheme to guide it in the way of more certain and speedy success. To the departments of Astronomical and Geographical Science more especially has she lent substantial aid. The expeditions of the *Challenger*, and of the *Alert* and the *Discovery*, are the most recent examples of what the Government is willing to do; whilst the readiness with which men are found to undertake such expeditions, is a proof that the spirit which animated Franklin and Livingstone still flourishes on English soil. When we turn to the United States of America, this larger spirit of earnestness in the work of extending Science does not appear to be manifested by the national Government; but such a manifestation is hardly to be expected in so young a country, compelled, in the first instance, to devote its energies to the running of the great political engine, and to the development of the country's agriculture and industries. The aid, however, which the national Government has failed to supply is being bestowed by private liberality; and to such an extent has this been the case, so large and numerous have the bequests to Science been, that the impulse thus developed may fairly be treated as a national one. The restless energy of the people, their character for independent thought, their well known inventive powers, together with their wealth and liberality, all constitute the main essentials for scientific progress. In such soil, Science, if earnestly pursued, is sure to flourish. The work already performed in connection with their museums and astronomical observatories is an indication that "the good seed has not fallen on stony ground."

That the ambition of the foremost nations of the earth should be thus partly in the direction of scientific advancement is an omen of good promise, and an indication that the claims of the investigator shall receive that recognition of his services which has so often been denied him in the past. Unlike the author, he has no property in his discoveries; he seeks no patent to protect them. No man is more truly the servant of posterity. From his labours the practical genius derives his inspiration. Amongst his researches are to be found the germs of future inventions; and yet, even though his discoveries have frequently proved the means of developing untold wealth for the nation, this self-denying genius would often gladly have received in his lifetime such crumbs as his heirs let fall from their tables. In the interests of the investigator, then, it is a subject of congratulation that national governments are taking an increasing interest in the work of advancing Science. One consequence of this is that scientific labour is now more generally esteemed, and it is seldom that the searcher after truth is made rudely acquainted with the "uses of adversity." Notwithstanding his more favourable surroundings, however, it is not to be expected that he will travel in future along a royal road to progress. On the contrary, real advancement is probably now more difficult than ever, so much progress has already been made in every branch of Science. What is of special importance, however, is that the achievements of the investigator are now more immediately recognized and accepted. The discoveries of Faraday were known in the scientific world almost as soon as made; the same may be said of the labours of Kirchoff and Bunsen; and at the present day the news of such successes is transmitted throughout the scientific world with the regularity and dispatch of the newspaper. Even great laws of nature of a new and startling kind are now most rapidly assimilated and absorbed into the body of Science. The principle of the conservation of energy was most readily apprehended and received, and the theory of the evolution of organic forms not less so, by a large part of the scientific world. This adaptability to new ideas is in striking contrast to the struggles and strifes which characterized the early history of Science. Bacon and Newton have long since displaced Aristotle and the schoolmen, and the scientific world has happily emerged from a state of gross darkness and superstition. As in Religion and Politics, so also in Science, there have been a reformation and a revolution; more happy, however, in their results; for the intolerance and passion of the past have almost entirely disappeared, and given place to an earnest desire to work towards one common end. Moreover, the means of carrying on the work have greatly improved. Scientific associations have been largely multiplied, and now form the medium in which intellectual energy is sustained and increased, and through which discoveries are propagated throughout the scientific world. In the transactions of such associations is to be traced the progress of Science for the last two centuries. Even as early as the Restoration in England the necessity for some such organization was felt. At that tine the new fields of discovery were rapidly enlarging, and the cultivators of the new philosophy soon perceived that a union of their forces was the best means of strengthening their position and advancing their cause. It was at this period that the Royal Society of London was founded. Although started under the happiest auspices—a very Hercules in its infancy, whose labours were destined to exert a far-reaching influence on the material and intellectual progress of mankind—yet its earliest years were years of bitterness and strife. The new organization was maligned and ridiculed in the most merciless manner. The old scholastic philosophy had not yet been dethroned—the State had just passed through the fires of the Revolution, and within the sphere of Politics and Religion men's minds were still warm and easily disturbed. Under these circumstances the new philosophy was not only viewed with suspicion, but it was openly insinuated that its object was the subversion of the Christian religion, and the Royal Society itself a conspiracy against the political and religious freedom of England. Coarse and violent attacks were made on its members, and most persistent efforts expended by writers of undoubted ability to ridicule and discredit its transactions. Vigorous as these onslaughts were, however, their influence in checking the steady progress of the Society was imperceptible. Whilst the names of her critics were soon forgotten, the subject of their attacks grew in the favour of the nation, and established her reputation at home and abroad. To-day the Royal Society stands in no need of defenders; its historian need not now descend to the task of proving that it was designed neither for the extinction of the Universities nor of the Christian religion. On the contrary, to trace the history of the Royal Society is to describe the rise and progress of scientific discovery in England. The era of its inception saw the birth of many new sciences. The first National Observatory was built at Greenwich, and modern Astronomy incurred the great debt it owes to the immortal Flamsteed. Experimental Chemistry, Mineralogy, Zoology and Botany may be said to have been founded at this time. In the development of these and kindred sciences the Royal Society has played an important part, as a few names from its long roll will amply prove. Amongst these we find Newton, Young and Faraday; Boyle, Dalton and Davy; Brewster, the two Herschels, and scores of others worthy of honourable mention; and in our own day the Society embraces numbers of men like Joule, Thomson and Darwin, whose labours are destined still further to promote its progress and to enrich Science. The example thus furnished by so splendid a record has not been without its influence on other parts of the empire. In Edinburgh, Dublin, and most of the large cities, similar associations have long since been established, and have shared largely in the labours and honours of the pioneer society. The important position thus occupied by the Royal Society and its allies with respect to the advancement of science, has its counterparts in the history of other countries. On the continent there is a similar confederation of scientific societies, at the head of which stands the French Academy. In the number of its illustrious names, in the multiplicity of its labours, and in the splendour of its achievements, this association surpasses all others. Founded about the same time as the Royal Society, it has continued to command the attention and to engross the intellectual activity of the nation. Amongst all the triumphs of the Gaul, the achievements of the philosopher stand pre-eminent; the Institute still holds the sceptre of thought, and commands the loyalty of the fickle Frenchman. The numbers of such associations in other countries it would be impossible to estimate, so numerous are the localities in which they have been established, and so varied the special objects to which they are devoted. Even in the New World their numbers are respectable, and their successes considerable. Washington, Philadelphia, and other American cities can boast of their scientific associations, which are permanently established and actively engaged in continuing the publication of memoirs of acknowledged reputation.

So large a number of societies, the presence of so many workers on the uncertain boundaries of Science, to the uninitiated must appear to involve an immense amount of misspent labour, and the effort may appear disproportionate to the work performed. In a new country such notions are sure to prevail, and therefore it is well to remind those who entertain these opinions, that without such work further progress is impossible. Labour thus spent is not lost, for the greater part of it becomes a store of future energy, destined to benefit posterity in the way that our ancestors have profited us. Moreover, it should be borne in mind that the further extension of Science necessitates an increasing division of labour. The history of scientific progress is no longer the history of an individual, as it once was. No Aristotle now dreams of attaining to universal knowledge. This is an age of special research, and he who wishes to explore new fields of knowledge or to acquire an exact acquaintance with the old, must restrict his labours within a very confined area. The age in this respect contrasts strongly with the past. Up to the time of Newton it is easy to specify the whole ground gained by the new philosophy. Copernicus, Tycho Brahe, Kepler, Descartes, and Huyghens, are names suggestive of laws which the most ordinary intelligence now accepts. When first stated, however, these laws were great discoveries, and were scarcely apprehended by any minds save those which originated them. Familiar as these discoveries are now, they constituted the foundation of Mechanical and Astronomical Science, and led up to that great generalization of Newton whereby an endless and complex series of facts were proved to follow one simple law, and theory and fact were reconciled in a way that has not been exemplified in any other department of Science either before or since.

Concurrently the department of Mathematics received an immense impetus from the invention of the Differential Calculus. The impulse thus acquired was communicated in time to the other branches of Physical Science, as Light, Sound, Electricity, and Magnetism; but in tracing the course of the sciences henceforward, so vast is the area covered by them, so numerous are those who contributed to this expansion, that the historian is obliged to adopt a classification of the sciences, and to treat them as if they were separate and independent developments. In addition to the divisions already mentioned, the Physical Sciences now embrace two others, which have risen into positions of the first importance. The old metaphysical elements—fire, water, air, and earth—have been displaced by the sixty-five simple bodies of the chemist, who traces his elements and observes the laws of their combination and decomposition throughout all the varied transformations of nature. Aided by the telescope and prism, he has successfully essayed to peer into the depths of space, and to search for traces of his elements even in the distant stars. The rapid progress which has characterized the Physical Sciences generally has also been well exemplified in the Science of Heat. In this department, during the last thirty years, a new theory has been developed which has entirely exploded the old notions, and done much towards establishing the identity of all natural action. The brilliant discoveries that have characterized the progress of the Physical Sciences, together with the practical results that have flowed from them, have long since established their reputation. Their influence, moreover, has been felt in every branch of learning, and a corresponding impulse has thus been given to the expansion of the entire system of knowledge. More especially has this influence been exemplified in the case of the Natural Sciences. Even the youngest of us is sensible of the rapid development of this group of sciences during the last quarter of a century, and of the wide range now covered by such departments as Botany and Zoology, Physiology and Comparative Anatomy, Geology and Palæontology. The study of Natural History no longer consists in the description of a few external characteristics of living forms; a comprehensive classification of all animals, living and extinct, is the work to which the student in this department now devotes himself. The botanist is obliged to distinguish several hundred thousand varieties of plants; the various forms of animal life with which the zoologist deals amounts to some two millions; the longest life may be spent in examining the enormous mass of phenomena presented by the fossils in the crust of the earth. Again, the study of Anatomy is no longer confined to the description of the human form, but has branched out into the comprehensive subjects of Comparative Anatomy and Microscopic Anatomy. A like change has taken place in other departments of the Natural Sciences, so that fields which but lately were barren wastes, now yield a bountiful harvest, and afford work to inquiring minds. Nor has the germ of all this activity been without an influence in other fields of knowledge remote from these. The scientific method has been introduced with success into the study of Language; it has penetrated into the departments of Comparative Philology, History, and Archæology; and even mental and social phenomena are measured by its standard guage, and subjected to its searching treatment.

Having thus glanced briefly at some of the main divisions on the map of science, it is well not to leave this part of the subject without guarding against the supposition that the various departments are unconnected and independent of each other. Distinctly bounded they may be, as also remote from one another, and apparently without connection. Still they have many interests in common; and their advancement largely depends on alliances and concerted action amongst them all. In certain cases this mutual dependence is immediately apparent. In the Physical Sciences, for instance, laws of great generality connect the several branches; and in the establishment of the various groups of principles embodied in the several classes, each department derives assistance from the other, and all are indebted to Mathematics. A corresponding relation exists among the various divisions of the Natural Sciences. Moreover, between departments of science apparently unconnected there are points of contact where each acts to the advantage of the other. The history of Science is filled with examples of this inter-connection. Even such divergent subjects as Physiology and Comparative Philology have experienced the advantages of union; so also have Comparative Philology and History, Physiology and Psychology; whilst from the combined discoveries of Physiology and Optics, the department of Opthalmic Medicine has been enabled to advance during the last twenty-five years in a manner that is unparalleled in the progress of the healing art. That the inter-dependence in question is generally recognized by scientific men the world over, the continued existence of scientific associations amply proves. In the circumstances of this country, it is especially important that the existence of such a connection should not be overlooked, and I would therefore seek to give additional prominence to this relationship by appealing to a high authority. In treating of the genesis of Science, Herbert Spencer says: "Perhaps the clearest comprehension of the inter-connected growth of the Sciences may be obtained by contemplating that of the Arts, to which it is strictly analogous, and with which it is inseparably bound up. Most intelligent persons must have been, at one time or other, struck with the vast array of antecedents presupposed by one of our processes of manufacture. Let him trace the production of a printed cotton, and consider all that is implied by it. There are the many successive improvements through which the power-looms reached their present perfection; there is the steam-engine that drives them, having its long history from Papin downwards; there are the lathes in which its cylinder was bored, and the string of ancestral lathes from which those lathes proceeded; there is the steam hammer under which its crank shaft was welded; there are the puddling furnaces, the blast furnaces, the coal mines and the iron mines needful for producing the raw material; there are the slowly-improved appliances by which the factory was built, and lighted, and ventilated; there are the printing engine, and the dye house, and the colour laboratory with its stock of materials from all parts of the world, implying cochineal culture, log-wood cutting, indigo-growing; there are the implements used by the producers of cotton, the gins by which it is cleaned, the elaborate machines by which it is spun; there are the vessels in which cotton is imported, with the building slips, the rope-yards, the sail-cloth factories, the anchor-forges, needful for making them; and besides all these directly necessary antecedents, each of them involving many others, there are the institutions which have developed the requisite intelligence, the printing and publishing arrangements which have spread the necessary information, the social organization which has rendered possible such a complex co-operation of agencies. Further analysis would show that the many arts thus concerned in the economical production of a child's frock, have each of them been brought to its present efficiency by slow steps which the other arts have aided; and that from the beginning this reciprocity has been ever on the increase. It needs but, on the one hand, to consider how utterly impossible it is for the savage, even with ore and coal ready, to produce so simple a thing as an iron hatchet, and then to consider, on the other hand, that it would have been impracticable among ourselves, even a century ago, to raise the tubes of the Britannia Bridge from lack of the hydraulic press, to at once see how mutually dependent are the arts, and how all must advance that each may advance. Well, the sciences are involved with each other in just the same manner. They are, in fact, inextricably woven into this same complex web of the arts; and are only conventionally independent of it. Originally the two were one. How to fix the religious festivals, when to sow, how to weigh commodities, and in what manner to measure ground, were the purely practical questions out of which arose Astronomy, Mechanics, Geometry. Since then there has been a perpetual inosculation of the sciences and the arts. Science has been supplying Art with truer generalizations and more completely quantitative previsions; Art has been supplying Science with better materials and more perfect instruments. And all along the inter-dependence has been growing closer, not only between Art and Science, but among the arts themselves and among the sciences themselves." Such a *consensus* explains and justifies the existence of scientific associations. A combination of energies, an interchange of ideas, a comparison of results, are all essential instruments in the work of advancing knowledge. It is in connection with such societies that the means of attaining to this end are provided. By the aid of their machinery labourers in different fields of research and remote quarters of the globe are enabled to communicate with each other. By mutual intercourse the cultivators of different branches are taught to look beyond the narrow limits within which they are wont to work, and to feel that there are other fields of labour equally fruitful, and other intellects equally active. By association of different intellectual energies are maintained a healthy equilibrium and a profitable connection among the various sciences. The most important function, however, performed by an association for the advancement of Science consists in the publication of its transactions. Without such publication investigators would to a large extent be working in the dark, and in many cases would be exhausting their energies on problems already solved. By announcing the work performed such a waste of energy is avoided; one discovery leads to another, and what is not immediately productive may contain the germs of future progress. No better example of the importance of publication can be adduced than that which is furnished by the history of the progress of Astronomy. During the last thirty years there have sprung up, mushroom like, in Europe and America, innumerable observatories, both public and private; but most of these have had a very brief existence, or have contributed nothing to the progress of Astronomy, because their Observations have not been published. The published Observations of astronomers, on the other hand, have not only constituted the foundation of the science and led to its rapid development, but much that is being now done at the great observatories is for the purpose of providing materials for the use of future investigators. What has thus been found essential to the efficiency of observatories is equally so in the case of scientific associations, and any society which neglects this, the main end of its existence, cannot long survive such a state of inanition.

Important as it is that the true aim of such associations should be clearly apprehended, it is even more essential that the common duty of all to aid in compassing these ends should be generally recognized. This duty pertains not only to members of scientific societies, but it devolves on the State, and extends to such academic bodies as are enabled by their wealth to offer appropriate rewards. The question how best to bestow such encouragement is an embarrassing one, and its practical solution is beset, especially in England and America, with many difficulties. Everywhere the tide of man's ambition runs too strongly in unpropitious channels; the age is intensely utilitarian; the industrial applications of Science are all engrossing; the service of the State is more attractive than the pursuit of Science. In the Universities most of the energy is consumed in the work of tuition; whilst the rewards offered to distinguished graduates to continue special studies are not sufficient to retain them permanently. It is under such circumstances as these that the Government and the Universities have been urged in England to devise some comprehensive scheme for the encouragement of research. Without attempting the solution of such an involved problem as this, it seems to me, from general considerations, that the direction in which to search for a satisfactory answer is indicated by an examination of the German University system. Except in a few cases, to the Universities we must look to carry out any scheme; in such institutions are, or ought to be, found the elements essential to the success of any feasible plan—well filled libraries, rich museums, ample laboratories, and abundance of physical apparatus. Even where these advantages exist, however, rapid progress cannot be attained until there is a large increase in the number of teachers, accompanied by a corresponding division of labour. This is the distinguishing feature of the German Universities. In them the teacher is not relieved from the duties of the lecture-room or the work of the laboratory, but his subject lies within narrow limits, and he is thus not only enabled to teach but to devote a lifetime to his special subject. Teaching must ever be the main business of the University, and the original investigator makes the best teacher. By contracting the sphere of his labours you enable him not only to teach, but to discover. In fact, nearly all the great discoveries in Science have been made by teachers, and at the present time the most successful workers are teachers who are devoting themselves to very special branches. Before the German plan, however, can be generally pursued anywhere an enormous revenue must be available; there must be a small standing army of professors, and a highly trained body of recruits. At the great English Universities a plan embracing this peculiar feature of the German system may possibly be some day attempted; but in its operations we should probably miss some excellent characteristics that distinguish the British system. Moreover, notwithstanding all that has been written in favour of radical changes in the English University system, it must not be forgotten that it has not only maintained a high state of culture in the nation, but has contributed largely to the service of the State. Nay, more, from the British Universities theoretical Science has derived very material assistance in the past; and from the liberal interest they now display in every question affecting the progress of knowledge, the most favourable results may be predicted. In addition to their great libraries, museums and laboratories have been provided at immense cost; whilst the labours of such men as Max Müller, Stokes, Cayley, Thomson, Tait, and others, show that they at any rate have not been overburdened by the routine of teaching.

Having thus glanced briefly at the growth of Science and the general conditions of its advancement, it remains for me to say something with regard to its prospects in connection with the Association to which we all are attached. In this Province of Ontario the Canadian Institute has remained in quiet and undisturbed possession of the field for the last quarter of a century, and during that time its Journal has regularly appeared and been exchanged with a large number of similar publications known only in the literature of Science. Our true aims, though never questioned, have been understood by but few. We have not had the misfortune to be attacked as the

Royal Society was at its inception; but, on the other hand, we have missed the notoriety which is frequently sought after for the benefit of new undertakings. Notwithstanding the absence of such adventitious aid, however, we have not only lived, but prospered. We possess not only a "local habitation," but, I venture to say, "a name"—a fact which is perhaps better known abroad than at home. That a comparatively small number of contributors should be thus able to keep alive a purely scientific journal for such a length of time is a proof, not only that our active members were moved by high aims persistently pursued, but that their example has not been without its influence in creating and fostering the self-denying spirit so essential to research. To those older members who thus "cast their bread upon the waters," a debt is due that cannot be repaid. We can only express the wish that those who still remain may long be spared to continue the work thus begun, and to enjoy the satisfaction of seeing that their example has not been set in vain. The work thus commenced by the pioneers of Science in Canada it is our mission and privilege to carry out. The main functions of the Institute are now, as formerly, the publication of its Journal and the holding of meetings for scientific disquisitions. For these purposes there is comparatively a small number on whom to draw, most of our contributors being engaged in academical duties, the performance of which leaves but little time to be devoted to the work of research. Moreover, the prospect of increasing this number is not encouraging, for not only are there but few positions in this country favourable to this kind of work, but with those who are professionally engaged in its pursuit the principle of the division of labour obtains to a very small extent. In this New World the University professor is obliged to profess and teach a range of subjects which in a German University engage the attention of half a dozen professors. In Leipsic there are one hundred and eighty-seven professors. The animated picture presented by such a group contains a wealth of colour and a richness in detail which are in striking contrast to the stereotyped tameness so familiar in the New World. Such a condition as ours is, however, incidental to the growth of every young country, whose first objects are education and the development of its trade and commerce. When more wealth has been gained, and the industrial arts flourish, increased attention will no doubt be devoted to theoretic Science, and more avenues opened up for its advancement. To create such channels is one of the chief obligations of every enlightened community, whilst the neglect on the part of any government to bestow such aid as it can afford in this direction is a sure indication of the existence of a rude and stationary form of civilization. The growth of Science in Canada, though progressive, is still in a rudimentary state, and stands in want of increased stimulus, both from public and private sources. We have yet to see developed the large and liberal spirit that prompts private citizens to devote their fortunes to the endowment of seats of learning and the foundation of museums, observatories, and free public libraries. When such munificence shall be displayed in Canada, it is to be hoped that the bountiful donors will bear in mind that bequests, whether public or private, should be for the general good, and that in the intellectual as in the social world, an indiscriminate liberality may, whilst relieving poverty, beget indolence, and fail to promote progress. The applause attendant on such acts largely depends on the profit that accrues to posterity, in whose interest the broadest liberality will be displayed in creating new forms of energy, favourable to a more abundant husbandry and the cultivation of fresh fields of labour. It is therefore to be hoped that no misplaced liberality will perpetuate the miserable system, so common on this continent, of multiplying seats of learning and increasing the university family by scores of feeble and needy children to whom time can bring neither strength nor prosperity. Such a plan not only fritters away material and intellectual wealth, but is calculated to produce a barren and mediocre uniformity. In this connection the experience of the United States is particularly suggestive, and clearly indicates that our future efforts should be directed to improving the efficiency of existing institutions, and rendering them genuine seats of learning, the home alike of the student and the teacher, of the scholar and the investigator. Whilst thus avoiding the errors into which our neighbours have fallen, we should not be slow to imitate them in such matters as the foundation of great public libraries and the establishment of museums. It is also to be hoped that their efforts on behalf of Astronomy will not be lost on us, and that the time is not far distant when the immortal science shall be enriched by the labours of a Canadian Observatory. How near that time is, how far we are still from the most fruitful sources of modern civilization, is to a large extent indicated by the present condition of this Institute. Its position is the surest index of the extent to which the intellectual resources of the country have been developed.

With regard to our future prospects, it is of course premature to speak with confidence. I think, however, that I see indications of increasing activity amongst our members, several of whom, from different parts of the Dominion, continue to send us the fruits of their labours. I take it also as a favourable sign that our membership is being largely extended; and in this connection it is a promising feature that the additions are being derived not only from those who are professionally engaged in the pursuit of Science, but also from those who, though employed in other occupations, seek relaxation in cultivating some particular branch of knowledge. I may be permitted to express the hope that we may continue to derive an increasing support from the cultivated classes of the community. Even the sympathy of such men is not without its value to us; and, moreover, amongst them are to be found many of high culture and great influence who are peculiarly fitted to discuss philosophical questions of general interest. It is with a view to enlist such support as this that it has been proposed to institute before long popular courses of scientific lectures entirely distinct from the disquisitions which characterize our ordinary meetings. In initiating such a scheme, however, the Institute does not in the least contemplate a departure from her proper objects, which, as I have endeavoured to point out, should continue to command our increasing attention. On the contrary, the Council are of opinion that the institution of such lectures and the enlargement of our library would have the effect not only of spreading a knowledge of Science, but of creating in certain instances a taste which may assist in advancing the higher aims of the Institute. The promotion of Science and the cultivation of an independent spirit of research must continue to be our aim in the future as it has been in the past. The new home within whose walls we are now assembled for the first time, whilst it is a fit subject for present congratulations, should remind us that the work of building up Science has but commenced in this country. The position which this Society has already won may serve as the foundation. For the building up of the superstructure it is to be hoped that neither material means shall be wanting, nor ample stores of intellectual strength and persevering effort. Under such conditions in the future, our seats of learning will prove true foci of illumination, from which shall emanate an active intelligence and a spirit of inquiry worthy of the most enlightened age.

SKETCH OF THE GEOLOGY OF THE ROUTE OF THE INTERCOLONIAL RAILWAY.

BY ROBERT BELL, C.E., F.G.S.,
Of the Geological Survey of Canada.

(READ BEFORE THE CANADIAN INSTITUTE, FEBRUARY 10TH, 1877.)

The following article was written nearly a year ago, at the request of Mr. Sandford Fleming, Chief Engineer of the Intercolonial Railway, and was used by him for reference in preparing the historical sketch of this national undertaking, published last spring. It epitomizes the more recent views of the late Sir W. E. Logan in regard to the "Quebec group" of rocks, and may be found of interest to those who wish for a mere cursory knowledge of these formations, or of the geology generally of the region traversed by this railway. Dr. Dawson is followed in regard to New Brunswick and Nova Scotia. A separate short account is given of the geology of each of the four sections into which Mr. Fleming has divided the railway.

1. *The St. Lawrence District—from Rivière du Loup to the southern end of Lake Matapedia.*

The rocks along this section of the railway belong almost entirely to the Quebec group. The geological position of this series is about the middle of the Lower Silurian system. In the province of Quebec it forms a belt, extending from the northern boundary of Vermont north-eastward to Cape Rosier in Gaspé. Along the south-east side of this belt, especially towards Vermont, the rocks are more or less metamorphosed, and they are supposed by some to be of older date than the fossiliferous portion of the strata within the area indicated, such as that in the neighbourhood of Point Levis.

The Quebec group has been separated into (1) the Lower or Levis division, (2) the Middle or Lauzon division, and (3) the Upper or Sillery division. The bulk of the Levis division consists of limestones and limestone-conglomerates, which are mostly magnesian. A black or dark colour prevails throughout the formation. It is well developed in the neighbourhood of Phillipsburgh on Lake Champlain, where a section of the beds, 4,860 feet in thickness, has been measured. The lowermost 1,285 feet of the strata exposed on the Island of Orleans, belong to this division. They consist generally of grey argillaceous shales with bands of grey dolomitic conglomerates, and are supposed to overlie the rocks of the Phillipsburgh section. The known thickness of this division would therefore be 6,145 feet. The rocks of the Levis division have afforded nearly 200 species of fossils, the majority of which have not been discovered elsewhere. These indicate that the geological age of the division is about equivalent to that of the Chazy formation of Ontario. Throughout the Middle or Lauzon division, the rocks are principally shales, with some sandstones and occasionally small beds of conglomerate and limestone. Their prevailing colour is greenish; but red, purple and grey, and mixed red and green strata also occur. On the Island of Orleans and around Point Levis the lowermost 700 feet of this division is overlaid by 400 feet of greenish arenaceous shale studded with grains of glauconite, but rock of this kind has not been found elsewhere in the Quebec group. On Orleans Island the Lauzon division has a thickness of 3,740 feet; but according to Mr. Richardson, it varies in other localities from 100 up to 4,000 feet. In the Upper or Sillery division, the prevailing rocks are greenish sandstones, passing into fine conglomerates. Red and green shales are also met with towards the base. The total thickness is estimated at about 2,000 feet. The known thickness of the strata of the whole group is therefore 11,885 feet, or more than two miles. The numerous deposits of copper ore in the rocks of the Quebec group belong to two horizons, one at the bottom and the other at the top of the Middle or Lauzon division.

The rocks of the St. Lawrence District of the Intercolonial Railway belong principally to the Lauzon division; their general strike is parallel to the shore of the St. Lawrence, and consequently to the course of the railway. Between Rimouski and the Great Metis river the railway curves inland, and crosses obliquely a small basin of the Sillery sandstones. North-eastward of Metis, in the continuation of the strike of the Quebec group, the Lower or Levis division takes the place of the Lauzon, and is largely developed at a short distance back from the St. Lawrence, all the way to Cape Rosier; while to the south-westward of Rivière du Loup, the Lauzon division, which is only seven miles wide at Rimouski, expands in breadth as it runs up the St. Lawrence, until, opposite St. Thomas, it occupies a belt of country forty miles in width. In this distance, besides small outliers of the Sillery sandstone, two large basins of it rest upon the Lauzon shales. The more eastern of these begins opposite Green Island village and extends south thirty miles, and the other, commencing at St. Roch, runs south-west fifty miles. One of the Sillery outliers referred to occurs on the shore of the St. Lawrence, about two miles below Rivière du Loup, and another includes Cacouna Island and runs to Green Island River.

At Trois Pistoles, Bic and Great Metis, grey sandstones or quartzites and coarse limestone-conglomerates are interstratified with the shales of the Lauzon division. These conglomerates consist of a sandy matrix, with small pebbles of white quartz and masses of limestone and diorite of all sizes. Some of the limestone boulders are very large, one at Metis having been estimated to weigh over twenty-five tons, after a considerable part of it had been removed. On the north-east side of Lake Matapedia a similar conglomerate, associated with dark shales, is met with about two miles from the upper end. In the central portion of this shore of the lake the rocks consist of greenish sandstones, apparently of the Sillery division, interstratified with red shales and cut by trap dykes; while the lower three miles are occupied by a peculiar concretionary diorite containing much epidote. These rocks are overlaid unconformably by the Gaspé series, which occur along the south-west side of the lake. The lower member of the latter group, which occupies this shore of the lake except the uppermost four miles, consists of a whitish and pinkish sandstone, sixty or seventy feet in thickness, dipping westward at a low angle. The rocks in the four miles nearest the head of the lake consist of dark brownish-grey, somewhat arenaceous, limestones, enclosing nodules of a purer character. The surfaces of the beds are uneven, and under the weather become of a lighter grey than the freshly broken rock.

2. *The Restigouche District—from the southern extremity of Lake Matapedia to the Nipisiguit River.*

With the exception of some small sections which will be presently described, the Intercolonial Railway in this district passes over rock of the Gaspé Limestone series. These rocks spread over an immense area in the adjacent parts of the Province of Quebec and New Brunswick. The whole area drained by the Restigouche River may be said to be occupied by them, and they run out in belts to the extremity of the Gaspé peninsula. They consist of dark greyish limestones (which are mostly impure), grey and blackish shales and greyish argillites, and their greatest thickness is upwards of 3,000 feet. They are of Upper Silurian age, and may be considered as representing all the strata, from the Clinton to the Lower Helderberg inclusive. On the Matapedia River, they consist mostly of dark grey calcareous shales and slaty strata, with some limestone bands. Just below the "Devil's Elbow" are certain greenish-grey sandstones and argillaceous and arenaceous slates and shales, which are supposed to represent the overlying Gaspé sandstones. Between this point and Lake Matapedia we would therefore have the whole thickness of the Gaspé limestone, since, as we have seen, the base of this formation is met with along its south-western shore.

The mouth of the Restigouche River lies in a basin of Lower Carboniferous rocks, surrounded by the Gaspé Limestone series, which forms the higher ground on both sides. These Lower Carboniferous rocks consist principally of red sandstones and conglomerates, and form part of the Bonaventure formation. Between them and the flank of the high ground on either side there is a belt of amygdaloidal and other trappean rocks, which frequently form conspicuous conical hills. At Dalhousie, the limestones and shales are interstratified with beds of trap and volcanic ash. In 1858, Mr. Richardson and the writer here collected a considerable variety of fossils, which proved the strata to be of the age of the Niagara formation. From Dalhousie to the west side of Nipisiguit Bay the same formation continues, and affords good limestone in several places. A belt of rocks of the Quebec group, and apparently belonging to the Lauzon division, which extends from the State of Maine through New Brunswick, is supposed to come as far as the south-west side of Nipisiguit Bay. Grey granite is exposed at Middle River, close to Bathurst Harbour, and again at Rough Waters on the Nipisiguit, three miles from Bathurst. It is composed of opaque white felspar, colourless translucent quartz and black mica, and resembles some of the granite of the Eastern Townships. The exposures near Bathurst are supposed to be the termination of a long granitic range, which runs north-eastward from Penobscot Bay on the Atlantic coast through Maine and New Brunswick.

3. *The Miramichi District—from the Nipisiguit River to Moncton.*

The most conspicuous feature of the geological map of New Brunswick is the great triangular basin of carboniferous rocks, which occupies about one-third of the whole area of the province. The western shore of the Gulf of St. Lawrence, from the Bay of Chaleur to the Nova Scotia line, may be considered as the base of this triangle; while the apex lies beyond Oromocto Lake, in the south-western part of the province. Bathurst is situated on one side of this area and Moncton near the other, so that the above section of the railway exactly spans this geological region. With the exception of a narrow and irregular border of Lower Carboniferous rocks, the strata within this area belong to the Middle Coal formation or perhaps to the Millstone Grit, and consist principally of greyish and reddish sandstones, interstratified with shales and conglomerates. Notwithstanding their great geographical extent, they appear to be spread almost horizontally over an even floor of older rocks, and have no great thickness, the more ancient strata cropping up through them in numerous places. Only a few thin seams of coal have yet been discovered among these Carboniferous rocks. One of them, occurring on the north-west side of Grand Lake (and which does not average two feet in thickness), is worked along its outcrop in a primitive fashion by the inhabitants. On the south side of the Bay of Chaleur, between Cranberry Cape and Point Dumai, two coal seams, measuring six and eight inches respectively, have been observed among the greenish grey sandstones which form cliffs all along the shore between these points, and have a thickness of about 400 feet. The roof of the uppermost of these seams consists of flaggy bluish-grey shale, containing many ferns and other plants in a beautiful state of preservation. Other small coal seams have been reported as occurring near the Richibucto and Buctouche Rivers.

The horizontal strata around Bathurst belong to the Bonaventure formation, which, as already mentioned, constitutes a part of the Lower Carboniferous series. They consist of about sixty feet of reddish shales and red and white sandstone conglomerates, with a layer of bluish-grey shale about the middle. This layer averages about two feet in thickness, and crops out on the west side of the

Nipisiguit river, about a mile above Bathurst. Some of the plant-remains which it contains are replaced by the vitreous sulphide of copper, which also occurs in small nodules in the same bed. An attempt to work this deposit for copper was made about the year 1843.

4. *The Nova Scotia District—from Moncton to Truro.*

From Moncton to the northern flank of the Cobequid Mountains the general course of the railway crosses obliquely three belts of Lower Carboniferous rocks and one belonging to the productive Coal formation, one of the former being at either extremity of the distance while the higher rocks occupy an intermediate position. The Lower Carboniferous rocks of Nova Scotia have been separated by Dr. Dawson into a Lower Carboniferous marine formation and the Lower Coal measures. The first of these consists usually of thick beds of reddish sandstone, clay and marl, enclosing beds of gypsum and limestone, but in some localities it is represented almost entirely by conglomerates. It is largely developed in different areas throughout the eastern half of Nova Scotia proper and in Cape Breton, and affords all the gypsum exported from Nova Scotia and New Brunswick. The Lower Coal measures, in some localities, consist of grey sandstone and dark shales with thick beds of conglomerates and coarse sandstones toward the base; while in others they present a great thickness of peculiar bituminous and calcareous shales. The most interesting exposures of this division occur in the south-eastern part of New Brunswick. Near Hillsborough, in this region, a vein cutting these shales is filled with the remarkable mineral Albertite, which is so valuable for gas-making. The coal measures proper in Nova Scotia are characterized by the prevalence of grey sandstones and darkly-coloured shales, and by the comparative scarcity of conglomerates. The coal-field of Cumberland county is situated on the belt or trough of this formation, which has been referred to as crossed by the railway section under consideration; and the Pictou coal-field appears to belong to an eastward continuation of the same trough.

The Cobequid Mountains are flanked on both sides by rocks which are partially metamorphosed in some places, but on the north side, in the vicinity of the railway, Dr. Honeyman has found fossils by which their age has been determined to be Upper Silurian. On the south side, the strata consist of greyish quartzites and olive-coloured shales. These are cut at a small angle to the stratification and cleavage by a large irregular vein, which crosses the railway with an east and west bearing, and which has been traced for a long distance on either side. Smaller and nearly parallel veins have also been found near the principal one. They are all filled with carbonates and oxides of iron, and constitute the Acadia Iron Mines of Londonderry, which are at present worked by the Steel Company of Canada. This company is now engaged in erecting two large improved blast furnaces, capable of producing upwards of 1,000 tons of metal per week, which is at the rate of more than five times the whole consumption of pig iron in the Lower Provinces. The construction of this section of the railway and of the Pictou Branch will now enable the company to obtain coal for smelting purposes, either from Springhill or New Glasgow, which are nearly equally distant from the iron works. These mines were examined and reported upon by Mr. Selwyn in 1872.

The centres of the highest parts of the Cobequid Mountains are occupied principally by a hard reddish rock, supposed by Dr. Honeyman to be Laurentian gneiss. Examples of this rock are met with on the railway, between Folly Lake and Wentworth.

Between the southern base of the Cobequid Mountains and the neighbourhood of Truro the railway traverses obliquely a trough of Lower Carboniferous rocks.

Cobequid Bay is excavated from a narrow basin of soft bright red sandstone, of Triassic age, which overlies the Carboniferous rocks unconformably. The remains, or the more or less broken margin of this basin, are found all around the shores of the bay, and also extending eastward from Truro, at its head, a distance of four miles up the Salmon River, where the two sides of the narrow basin come to a point.

THE GLACIAL AND INTERGLACIAL STRATA OF SCARBORO' HEIGHTS,

AND

OTHER LOCALITIES NEAR TORONTO, ONTARIO.

(WITH A PLATE.)

BY MR. GEORGE JENNINGS HINDE, F.G.S.

(Read before the Canadian Institute, February 3rd, 1877.)

There is perhaps no other portion of the great inland basin of North America where the strata, showing the different changes which have occurred from the commencement of the Glacial period up to the present, are better displayed than along the shores of Lake Ontario and the country bordering on it. The south shore of the lake in the State of New York is described by Professor Hall as one continuous section; at Niagara the interest attached to the Falls has caused the superficial strata to be closely studied, not only by American geologists, but by such men as Lyell and Ramsay; and a late article by Mr. Thos. Belt, F.G.S.,* shows that their entire history is not yet satisfactorily determined. Between Niagara and Dundas, Ontario, at the western extremity of the lake, the southern shores present glacial beds of great interest, but which have not yet been fully described. On its northern shores, from the commencement of the channel of the St. Lawrence at the Thousand Isles, westwards as far as Scarboro', Ontario, the banks of the lake are generally low and without features of importance, and beyond Scarboro' the shores are again low to the western extremity.

This general deficiency in conspicuous sections along the north shore is more than compensated by the display, perhaps unequalled anywhere round the lake, of glacial strata at the Scarboro' Cliff. This cliff, generally known by the name of the Scarboro' Heights, commences near Port Union, about fifteen miles east of Toronto, and from thence extends along the lake shore, in a general south-westerly direction, for about nine and a half miles. It is low at its easterly end, but gradually

* Quarterly Journal of Science, April, 1875.

rises to an elevation of 170 to 190 feet above the lake, at which elevation it continues till approaching the westerly end, where it again slopes to the lake level. A second terrace, about 100 feet in height, runs for some distance nearly parallel with the lowest or lake terrace, and about a quarter of a mile behind it; but at one place this upper terrace approaches the lower one sufficiently close to form, for a short distance, a continuous section with it. At this place the entire height of the section is about 290 feet above the lake level. The waves of the lake wash the base of the section for the whole distance, and are constantly eroding it; their action is much increased by the undermining influences of the springs which jut out between the layers of the clay and sandy strata, and cause large landslips. As fast, however, as the materials fall to the base of the cliff they are removed by the waves of the lake, and thus, from the summit to the base of the cliff for the greater part of the section, every stratum of the soft beds of clay, sand and gravel of which it is formed, can be traced in a manner rarely met with. The readiness with which the usually soft strata of the Glacial period yield to denuding atmospheric influences, renders good exposures unusual, and then only for short distances; and as generally these beds have been partially eroded at various periods since they were formed, and even entirely removed in certain places, there is great difficulty in deciphering their true history. On this account a section so extended and complete as that at Scarboro' presents most unusual facilities for gaining a knowledge of the succession of the events of the Glacial era in this portion of the continent. As, however, the Scarboro' section does not show the lower portion of the series of the glacial deposits immediately resting on the Palæozoic rocks, it will be necessary, in order to trace the complete succession from below upwards, to refer first to a section facing the lake, where these old rocks are exposed. They may be seen in the low cliffs at the Garrison Common and Humber Bay, west of Toronto, and about twelve miles distant from the Scarboro' Heights.

As far as I am able to ascertain, the geological structure of the Scarboro' Cliff has never been described in a detailed manner. The cliff itself, in reference to its influence on the formation of the island bounding Toronto harbour, formed the subject of two memoirs by Sandford Fleming, Esq., C.E., and Prof. H. Y. Hind.*

It is very curious that Sir Charles Lyell,† who was attracted to

* Canadian Journal (First Series), Vol. II., April, 1854.

† Travels in North America, 1841-2, chap. xx.

Toronto to examine the well-defined terraces between Toronto and Lake Simcoe, should not have searched the lowest and most important of these terraces at Scarboro'; it may be due to the fact that the base of the cliff is only accessible when the lake level is low and the weather fine.

Professor A. C. Ramsay, in his description of the glacial beds of Canada,* mentions the bold cliff of sand, gravel, and clay partly white, with boulders at Scarboro' Heights.

There is no special reference made to this cliff in the "Geology of Canada," by Sir W. Logan (1863), but the superficial strata at Scarboro' and near Toronto † are stated to belong to his Erie and Saugeen divisions.

In order to understand the conclusions which may be drawn from the character of the pebbles and boulders found in the till or boulder clay of these cliffs, it will be desirable to give a preliminary sketch of the underlying strata, which form the floor on which the glacial beds rest, on the north shore of the lake.

Commencing at its eastern extremity and proceeding westwards, there are—

1st. *The Ridge of Laurentian Rocks*, forming part of the spur connecting the main range of these rocks in Canada, with that of the Adirondack region of New York. From the Thousand Isles, the range in Canada extends nearly due west to the shores of the Georgian Bay. The crystalline gneissoid character of these rocks readily distinguishes them from those of the succeeding divisions.

2nd. *Potsdam Sandstone.*—A hard gray sandstone and conglomerate, of which there is a small area north of Kingston. It also forms some of the islands at the entrance to the channel of the St. Lawrence, and extends south for a short distance in the State of New York.

3rd. *Trenton Limestone* (including the Black River and Bird's-Eye divisions).—For the most part, a blue fossiliferous limestone, the lower beds thick and massive, the upper with some intervening shales. These limestone beds underlie the greater portion of the area between the lake shore and the outcrop of the Laurentian range to the north, and they extend on the lake shore from Kingston westwards as far as the township of Whitby, a distance of one hundred and thirty miles.

* Quarterly Journal of the Geological Society, 1859, p. 203.

† Geology of Canada, p. 904.

4th. *Utica Shale.*—A black bituminous shale filled with fossils. From Whitby, where this shale band rests on the Trenton limestone, the outcrop of this rock reaches on the shore to the vicinity of Port Union, a distance of about fifteen miles.

5th. *Hudson River Group.* — Principally bluish arenaceous flagstones and shales, with a few thin beds of limestone. From Port Union, this group of rocks extends nearly as far as Oakville, or about forty miles, along the lake shore.

6th. *Medina Sandstones and Shales.*—Beds of a deep red colour, with a few thin bands of a greenish tint. These rocks form the lake shore between Oakville and the western extremity, a distance of about eighteen miles.

7th. *Niagara Limestone.*—A very hard magnesian limestone of a gray tint, which forms the summit of the prominent escarpment near the west end of the lake.

These groups of strata, with the exception of the Laurentian, belong to the Cambrian, Cambro-Silurian and Silurian divisions of the Palæozoic age. The strata are nearly horizontal, but have a slight dip to the south-west, and the various beds are apparently all conformable. On account of their extremely regular arrangement, in passing over this area from east to west, or from north-east to south-west, there is the following succession of lithological characters in the underlying strata: first, crystalline gneissoid rock, then a *gray* sandstone, followed by *blue* limestone, *black* shales, *blue* flags, *red* sandstones, and *gray* dolomite. This variation, independent of the fossils which they contain, allows the rock-fragments in the till to be referred without difficulty to their respective sources; and taken in connection with the striæ on the rocks, enables the direction in which the ice moved to be ascertained with certainty. These Palæozoic rocks in this portion of Canada are oftentimes concealed for long distances by the overlying glacial strata; thus, north of Toronto they are hidden for more than forty miles, and a still greater distance may be travelled west from Peterboro', Ontario, without meeting with them. Exposures generally occur along the lake shore or in the lower reaches of the streams which empty into the lake.

The Palæozoic rocks underlying the Scarboro' Cliff belong to the Hudson River group of bluish flags and shales; but at this place, for about twenty miles along the lake shore, they have been eroded to a lower level than the lake; at the Garrison Common and Humber Bay they are again visible.

I propose to describe, first, the lowest glacial beds, or those immediately resting on the Palæozoic strata, and then trace the various changes in ascending order.

Placed in a tabular form, the order of the strata is as below :—

Succession of Strata at Scarboro' Heights, Garrison Common and Humber Bay, East and West of Toronto.

	Garrison Common and Humber Bay	Scarboro' Heights
7. Stratified sand and gravel, Post-Glacial	15 feet	50 feet.
6. Till or boulder clay, No. 3..................	Absent	30 feet.
5. Laminated clay and sand, Interglacial........	Absent	90 feet.
4. Till or boulder clay, No. 2..................	Absent	70 feet.
3. Interglacial fossiliferous sand..............	Absent	40 feet.
2. Interglacial fossiliferous clay	20 feet.	100 feet.
1. Till or boulder clay, No. 1	25 feet	Below Lake level.
Palæozoic flags and shales	5 feet exposed	

Palæozoic Rocks.—At the Garrison Common, and indeed for the entire distance between that place and Burlington, Ontario, thirty-two miles to the west, these rocks may be seen, with the exception of a few intervals, along the lake shore. Their upper surfaces have been broken up by the glacial ice in a very uneven manner, and seldom maintain the same level for many yards in succession. The flaggy sandstones forming these rocks do not receive or retain well the glacial markings, and I am not aware that any striæ have been previously noted at this place or anywhere near it. On account of the lake having been at a higher level than usual this last summer, the waves made greater inroads on the cliff, and washed away the till from the surface of the rock beneath, and on this I was fortunate enough to find glacial striæ in several places. The direction of these striæ varied between N. 28° W. and N. 86° W., and the average of nine observations was N. 66° W. Following the extension of these striæ, it will be seen that the glacier must have traversed the basin of Lake Ontario, and its course westwards was up the slope of the country, in the direction of the elevated Silurian plateau of the peninsula of Ontario. That this, and not the opposite, was its true course is shown by the materials of the till, to be presently described. I am unable to find any record of glacial striæ to the west of this place, nearer than the townships of Flamboro' and Beverley, from thirty to forty miles distant; the majority of the observations at these places, recorded in the "Geology of Canada," shows that the path of the glacier was still in the same direction, that is, to the west, varying a few degrees north and south of it. As these townships are situated on the Silurian plateau, the glacier must have overflowed the escarpment bounding it to the east, which is at an elevation of four hundred feet above the lake.

Till, or Boulder Clay, No. 1.—The beds immediately resting on this uneven striated floor of Palæozoic rocks are of "till"* of a typical character. (*Fig.* 2, *b.*) The matrix is a sticky, bluish, calcareous clay, which on exposure frequently turns to a brownish or yellowish tint; it is entirely unstratified. This clay is filled with slabs of rock, stones and boulders. The slabs are portions of the underlying flags which have been torn up by the ice; some of them have a surface three feet square and are a foot in thickness; their edges have, as a rule, not suffered from abrasion. Many of these slabs stand on their edges in the clay, conclusively showing that they had not been dropped in their present places by an iceberg, or they would not have settled in an upright position; their uninjured edges also show that they have travelled but short distances. Most of the *stones* in the clay are not more than one or two inches in diameter; they are blunt edged, polished and scratched. Though some may have been formed out of the thin bands of limestone which occasionally occur in the underlying Hudson River strata, the greater part resemble more closely the blue Trenton limestone. Mingled with these are many fragments of the black Utica shale, which, though much softer than the limestone pebbles, yet retain the ice-markings very plainly. The presence of these shales in the till bears witness that the path of the glacier, under whose mass they were brought to this place, was from the east, as there are no rocks of this material in the opposite direction. The absence of fragments of the red sandstone or the gray dolomite which crop out to the west of this place, furnishes negative testimony to the same effect.

There are but few large boulders in the lower till at this place; occasionally a large block of Trenton limestone covered with scratches, and a few of Laurentian gneiss. The gneissoid boulders, where they occur, are generally grouped within a short distance of one place;

* I use the term "till" in the same sense as Mr Jas. Geikie in the second edition of the "Great Ice Age," as synonymous with the "boulder clay." No distinction can be maintained here between the non-stratified clays with striated stones and with or without boulders, resting on the Palæozoic rocks and those of a later date, covering Interglacial deposits. I prefer the term "till;" its use avoids the anomaly of styling beds "boulder clays," in which frequently no boulders are present.

they are mostly two to three feet in diameter, and very often have one portion of their surface smoothed and deeply striated, an ornamentation but rarely seen on the boulders of this rock scattered over the surface of the country. Guided by the direction of the striæ on the rocks beneath, it seems probable that these gneissoid boulders may have been transported across the lake from the Adirondack Mountains of New York, more than one hundred and eighty miles distant.

There is a fine example of the rare (or rarely noticed) phenomenon of "Striated Pavement" in the till at the Garrison Common. I am not aware that it has been previously noted in Canada, but it has been described as occurring in till in the Miami Valley, Ohio. The stones, slabs and boulders which are elsewhere irregularly scattered through the mass of the till, have been here arranged side by side in a nearly level stratum in the clay, forming a sort of mosaic pavement or floor, the pieces of which are of various sizes and shapes. (*Fig.* 2, *p.*) These pieces are fixed in the blue clayey matrix, and the same material covers the pavement for nearly 20 feet in thickness. The projecting edges of the fragments seen in the cliff section have exactly the appearance of a horizontal layer of stratified rock. In some portions the pavement is formed of but a single layer of stones; in other places the stones are two or three deep; and there are indications for a short distance of a second pavement about two feet below the first. This peculiar floor extends for nearly 800 yards along the cliff; it is not exactly level, but slopes from two to three feet in that distance. In addition to this even, nearly level arrangement, the upper surfaces of the stones and boulders are also covered with striæ running in a uniform direction, similarly to those on the underlying rock, showing that the pavement must have been the floor of a glacier. Some of the stones have also their under surfaces striated, probably resulting from glacial action before they became fixed in the pavement. From compass observations in eleven different places, I found that the striæ on the pavement varied between N. 56° W. and N. 70° W.; the average direction is N. 67° W., which is, within one degree, the average direction of the striæ on the underlying rocks to the east of this place. Though only the jutting edges and small portions of the upper surface of the pavement were exposed in the face of the cliff, yet, where the overlying till had been removed in some small gullies, the pavement could be traced for a short distance inland. From the striæ, it can be seen that these stones had been pressed into the clay below by the weight of a glacier passing over them; but unless some stream of water previously washed the stones out of a bed of till, it is difficult to see how any amount of pressure could have effected the arrangement in which they are now found. There does not appear, however, any evidence of water action, neither in the till above or below the pavement.

I have also discovered a pavement in till similar in all respects to that above mentioned, in the cliff facing the lake between Oakville and Bronté, Ontario, about twenty-three miles to the west of the Garrison Common.

I could not detect any difference in the character of the till above and that below these pavements, beyond that the till underneath contained larger slabs and stones than that above; this difference however existed in those portions of the cliff where the pavement was absent. Dr. Croll believes that similar pavements* indicate an intervening period between the formation of the beds of till above and below; but the striking uniformity in the course of the striæ on the pavement and on the Palæozoic rocks, points to the probability that they were effected by the same glacier in this case.

2. *Interglacial Fossiliferous Clay.*—Next above this lower till there are seen in the cliff to the west of the Humber Bay beds of stratified clay, with some vegetable remains in them. (*Fig.* 3, *c.*) These stratified clays form the most important part of the section at Scarboro' Heights, and I purpose describing them as they occur at that place. My object in mentioning this small patch at the Humber Bay is to show their true position in the series, resting unconformably on the lower till; for at Scarboro' these clays extend beneath the lake level, and they might have been deemed of Pre-Glacial instead of Interglacial age. If a boring were made at Scarboro', it is highly probable that beneath the clays there would be found a till and then the Palæozoic rocks, in the same manner as at the Humber Bay.

The extent to which the present configuration of this country is due to the ordinary forces of denudation previous to the Glacial period, and the degree it is owing to the ice action during that period, is very difficult to determine, and the data for a satisfactory solution are yet wanting. I do not think that the effects of the glacial ice in forming the present features of the country, can be exaggerated; and it

* Climate and Time. American Edition, p. 255.

appears to me doubtful if there are now visible any prominent physical features of Pre-Glacial age in the region of Western Canada underlaid by the Palæozoic rocks. Doubts are yet expressed in some quarters as to the capacity of glaciers to excavate our large lakes, as Lakes Ontario, Erie, Huron and Michigan; and though rock-basins, eroded out of undisturbed Palæozoic strata, their formation is put down by some to a depression of the earth's surface. If the earlier glacier was massive enough to overflow mountains 3,000 and 4,000 feet in height, as is known to have been the case in New England, it ought to have been a comparatively easy task for such a mass to plough out the hollows of our inland lakes to depths of only 300 or 400 feet below the sea level.

I will give a very striking instance of glacial action on the shores of Lake Ontario, which seems to me to furnish strong proof of the basin of this lake at least having been scooped out by the ice. At its easterly end, where the channel of the St. Lawrence commences, I have traced the deep glacial striæ and furrows on one of the islands of Potsdam sandstone from 100 feet above the water's level down to the water's edge, until they disappeared beneath the lake. These striæ, like the generality of those abundantly seen in this district, run towards the south-west. From thence I have crossed the lake to its south-western shores, about one hundred and eighty miles distant from the place where the striæ entered the water. The rocks immediately next the lake here are too soft to retain striæ, but on going back two or three miles to the elevated escarpment of limestone 400 feet above the lake, the rock surface is seen to be covered with striæ running in nearly the same direction as at the easterly end, or S. 35° W. Standing on the edge of this escarpment and looking towards the north-east, whence the ice came, it can be seen at a glance that it must have crossed the basin of the lake; and still further to complete the proof, in the bed of till on the summit of the escarpment there are plenty of striated fragments of the Cambro-Silurian strata (Hudson River) which, from the course of the striæ, must have been brought from the outcrop of these beds in the bottom of the lake. When the path of the glacier can be thus traced following the axis of the lake from north-east to south-west, and masses of till which have been eroded from the rocks outcropping in the area of the lake are met with, heaped up on the banks at its south-westerly end, the only conclusion which can be drawn is that the lake basin is due to the powerful eroding influence of a glacier.

The present basins of the lakes, however, by no means represent all the hollows made in the old rocks by the glacial ice; many of these have been filled up by till and stratified deposits, and until borings are made, remain unknown. Thus Dr. Sterry Hunt has shown that the Palæozoic rocks on the shores of Lake Erie are covered with glacial and stratified clays to a thickness of 100 to 200 feet beneath the lake level; whereas the lake itself in most places is not more than 70 feet in depth. There is, however, to be considered the fact that the present depth of the lakes is probably very much less than their originally excavated depth by the glacier; for stratified deposits of clay and silt brought down by the rivers, &c., have been gradually accumulating in their basins since the time when the glaciers which filled them were dissolved.

At the Scarboro' Heights there is one of these filled-up glacial hollows. The Palæozoic rocks were eroded by the first glacier deeper than the present lake level; without a boring it is impossible to say how deep the hollow may have been. With the exception of a short distance at both ends of the section and a space in the central portion, the basal beds of the Scarboro' Cliff are composed of beds of stratified clay. (*Fig.* 1, *c.*) Their maximum thickness above the lake is about 100 feet; how far they extend below is unknown. They are bluish and ash-gray in colour, and contain more or less of lime and sand in their composition. The beds appear to be entirely free from pebbles, stones or boulders of any kind. There is considerable variation in the thickness of the different strata; whilst some beds are two or three feet in thickness, in others there are over twenty layers in the space of an inch. In the greater part of the section the beds are horizontal; but at either extremity and in the central part, where the clay has been extensively eroded by the succeeding glacier, the lower remaining beds are contorted and twisted in a most remarkable manner. The layers are bent and folded over each other in inextricable confusion, and are also faulted on a small scale. The outlier of this same clay at the Humber Bay is also corrugated in a similar manner. (*Fig.* 4, *c.*)

3. *Interglacial Fossiliferous Sand.*—Before describing the fossils contained in the clay beds, I wish to mention the beds of sand and sandy loam which rest conformably on the upper surfaces of the clayey strata. (*Fig.* 1, *t.*) These sand beds are of a yellowish tint; the strata are horizontal, and appear, like the clays, equally free from pebbles or boulders. Their maximum thickness shown in the cliff is

forty feet, but they have evidently been eroded, and in some places completely removed, and their original thickness may have been much greater. In those parts of the section where the clay beds are contorted, these sands have been completely removed.

There is thus exposed at the Scarboro' Cliff beds of clay and sand of Interglacial age 140 feet in thickness, leaving out of account the extent to which they may reach below the lake level, and the amount which may have been eroded from the upper surface.

Though these strata are covered by beds of till, and, judging by the Humber Bay section, also rest on beds of the same material, indicating the intense action of ice both at periods before and after their deposition, they yet contain no more evidence of ice-action than would be found in the clays now forming beneath Lakes Ontario or Erie, nor indeed so much, for it is very probable that chance boulders might be carried and dropped on the floor of these lakes by shore ice; but so far as my observation extends, I have not detected a single boulder in any of these deposits. There is thus, independent of the evidence furnished by the fossils, sufficient proof in the character of these deposits to show a great difference in the climate at the time they were formed, to that which prevailed in the preceding and following Glacial eras.

The larger proportion of the fossils in these interglacial strata are remains of plants which occur in layers between the beds of clay and sand. Some of these layers are from half an inch to three-fourths of an inch thick; but such layers are unusual, and in general there is but a thin film of fibres covering the surface of each stratum of clay, hardly to be noticed but for their darker tint. Although so delicate, yet in a vertical section each film of plant fibres is distinctly seen as a thin dark line, and in some places there are twenty-one of these layers in the space of an inch. Where the clayey strata are two or three feet in thickness, the fibres are scattered through the beds without arrangement; but their general occurrence is in layers comparatively free from sediment. These plant-layers are nearly entirely formed of minute fragments, from one to two lines in length, of the stems, branches and leaves of mosses and other plants, with occasionally a portion of a branch, an inch or two in diameter, of some coniferous tree. The fragments are flattened by pressure, their edges are worn as if they had been long macerated in water. Though there is but little of the clay or sand in the thicker layers, there are plenty of very thin delicate scales of mica, a material which would take longer to settle in the water than the particles of clay. These layers have been so much compressed that they can be separated from the strata above and below, and there were some fragments on the beach which the lake waves had shaped into flattened cake-like forms, but had failed to disintegrate them. These plant-remains could be traced from the lowest beds of the clay visible at the lake level quite to the summit of the sand and loam beds above; but on account of the looser nature of the upper beds, they could not be so easily seen in these as in the clays below; there were sufficient traces, however, to show that during the whole period in which these beds of clay and sand, 140 feet in thickness, were being laid down, fragments of plants continued to be deposited in them.

A careful search amongst the layers of plant-remains, in which I have been much assisted by the Rev. W. A. Johnson, of Weston, has brought to light specimens of the following genera of plants and animals:—

Diatomaceæ.
Navicula.
Stauroneis.
Pinnularia.

Algæ.
Chara sp.

Musci.
Bryum.
Fontinalis.
Hypnum commutatum.
Hypnum revolvens?
Hypnum sp.

Lycopodiaceæ.
Spores?

Phanerogams.
Wood of pine or cedar.
Portions of leaves of rush and other plants.
Seeds of various plants.

Crustacea.
Cypris (of two or three species).

Coleoptera.
Elytra of Carabid.

Gasteropoda.
Planorbis.
Zonites?

The stems and leaves of mosses are very abundant in the layers, and yet retain their microscopic structure very perfectly. I am indebted to Professor Macoun, of Belleville, Ontario, for examining and determining the genera; the more doubtful specimens were submitted to Dr. James, of Harvard University. Hypnum commutatum, determined by Dr. James, has not hitherto been found on this continent further east than the Rocky Mountains; it also grows in England.

There is thus a very peculiar connection in the occurrence of this species fossilized at this place, intermediate between the widely-apart localities where it now grows.

Both the plant and animal remains so far discovered in these strata conclusively show that they are of land and fresh-water origin; not a trace of any marine organism has been found in them. The manner in which the layers of plant fibres are imbedded between the strata of clay seems to indicate that the sediments and plants were brought down by streams at periodical intervals into a lake, in which the clayey sediment first settled and the plants and lighter fragments, such as scales of mica, sank over them. It is not improbable that beds of a similar character to these at Scarboro' are now being deposited in some of the more inland lakes, where the surrounding country is still covered with forest trees. Each spring, the floods from the melting snows wash from the surface of the land, together with clay and sand, the small decaying portions of the stems and leaves of trees and lesser plants; these are carried into the lakes, where the fragments of plants float sufficiently long to allow the sand and clay brought down with them, to settle; but at last they become waterlogged and sink to the bottom, covering the surface of the heavier materials, and are in turn covered the following year by a fresh layer of clay. If this supposition is correct, the winters of that Interglacial period were characterized by abundant falls of snow, which, melting suddenly in the spring, produced flooded streams, thickly charged with sediment and débris, in the same manner as at present.

It is impossible now to determine the bounds of this interglacial lake basin. Considering that these deposits exist at places twenty miles distant from each other, and their thickness of 140 feet above the lake level, it seems improbable that they were deposited in a merely local hollow; and though beds corresponding to those at Scarboro' have not, so far as I am aware, been discovered at other places bordering Lake Ontario, I yet think that the basin in which they were laid down was co-extensive with that of the present lake. This basin had been previously hollowed out of the Palæozoic rocks by the action of the first glacier; and in the hollow left, when, through a changed climate, this glacier was dissolved, there were deposited this extensive series of strata of clay and sand mingled with plants, telling of a long succession of ages in which the climate was similar to the present.

The existence of such extensive lacustrine deposits completely sets at rest the theory of Dr. Dawson, that the large inland lakes were eroded by an Arctic current coming from the north-east, Neither in these deposits nor in any of the later glacial or post-glacial beds of Ontario west of the spur of the Laurentian Mountains, near Kingston, Ontario, has any evidence been found as yet which would lead to the conclusion that the sea has covered this inland basin at any time between the commencement of the Glacial period and the present; the fossils which have been found in these beds are all of fresh-water origin.

4. *Till, or Boulder Clay, No.* 2.—Resting unconformably on the surfaces of the lacustrine beds just described, are beds of till. (*Fig.* 1, b^2.) The character of this till is equally as well defined as those beds previously described, resting immediately on the Palæozoic rocks. The only respects in which it differs fiom the lower till are, that it has none of the larger slabs of the Hudson River rock, and the scratched pebbles in it seem to be nearly entirely of the blue Trenton limestone and black Utica shale. As the Scarboro' Cliff is nearer the outcrop of these rocks than the Garrison Common, this result could have been anticipated. There are also very few Laurentian gneissoid pebbles or boulders in it. This till covers the stratified beds beneath, with the exception of a short distance where it has been denuded, from end to end of the section, but its thickness varies considerably in different places. If the lower bed of till has been produced by a glacier, there can be no doubt that this upper till is due to the same cause. The effect of the first glacier in eroding so powerfully the hard Palæozoic rocks, would almost support the belief that no beds of such soft materials as the clays and sands above described, would be able to resist the destructive influence of the passage of a glacier over them. Whilst there is a difficulty in accounting for the preservation of these beds in the Scarboro' Cliff on the theory of this upper till having been produced by a glacier, the very fact of the absence of these beds in other areas round Lake Ontario, in which there is great probability they once existed, is strongly confirmatory of the theory that this second glacier swept away the greater portion of these beds, leaving only in one or two places traces of their existence. But even while these interglacial deposits escaped at Scarboro' the entire destruction which befel them elsewhere, they have retained abundant proof of having been subjected

to very powerful eroding forces similar to those which the first glacier produced on the underlying rocks. Thus at both ends of the Scarboro' Cliff only some 10 or 20 feet of the clay is seen, the beds above this, 120 feet in thickness, having disappeared, and in many places all traces of the clay beds have been eroded away down to and beneath the lake level, and the hollows are filled with till. The most striking proof of erosion, however, is seen towards the central portion of the section, where a breach has been made in the fossiliferous clays and sands, more than 100 feet deep and about 450 yards in length. For this distance the stratified beds have been completely removed, and the gap is filled up with the solid blue till, which forms a vertical cliff facing the lake, 100 feet in height. The face of this cliff is seamed with cracks, and shows a pseudo-columnar structure. This till is so far harder than the fossiliferous clays, that the waves of the lake are unable to make so much impression on it, and consequently this portion of the cliff forms a slight promontory. The extraordinary manner in which the clayey strata has been contorted in those portions of the cliff where the erosion has been greatest bears witness to the violence and intensity of the force which effected both the erosion and the corrugation of the strata.

Some of the smaller hollows in the fossiliferous clays at the easterly end of the section appear, however, to have been made by stream erosion, for the channels are partly filled with boulders and large pebbles below, overlaid by imperfectly stratified beds of fine silt and gravel, with striated pebbles. These graduate upwards into true till. It is not improbable that these filled-up channels may have been formed by streams running beneath the glacier. The thickness of the till in those parts of the cliff where the fossiliferous strata beneath are horizontal, varies from 10 to 70 feet; but this difference probably results in part from subsequent erosion.

5. *Laminated Clay and Sand, Interglacial.*—In the central portion of the Scarboro' Cliff there is a great basin formed in the till No. 2 just described. This basin may be due to the unequal deposition of the till, or to subsequent denudation and erosion of its beds. In this hollow there are extensive beds of fine laminated clay. (*Fig.* 1. *i.*) This clay is bluish or ash colour; it contains a larger proportion of lime than the fossiliferous beds below, but resembles them in being laminated and entirely free from stones and boulders. Up to the present I have been unable to find any fossils in these upper inter-

glacial clays. The strata are horizontal, and no corrugations are present. The basin filled by these clays extends for about a mile, and its greatest depth is about 90 feet. These strata form the upper portion of the first or lake terrace; but in the lower portion of the second terrace (*Fig.* 1, *v.*) there is a thickness of 50 feet of loam and sand, which appear to form one series of beds with the clay of the lower terrace. Laminated clays corresponding to these beds in character, and at an equal elevation above Lake Ontario, are seen at Yorkville and in the valley of York Mills, places about eight and twelve miles to the north-west of the Scarboro' Cliff.

These clays have every appearance of being lacustrine deposits, filling hollows in the till. Similar lake basins inclosed by banks of till still exist; Bond's Lake, twenty miles north of Toronto, is an example.

6. *Till, or Boulder Clay, No.* 3.—In the section of the second terrace there is a deposit of till about 30 feet in thickness, covering these laminated clays and sands. (*Fig.* 1, b^3.) There is but a small exposure of this highest layer of till at Scarboro'; but in the extension of this second terrace to the west of Scarboro', its beds are better displayed. The pebbles in this till bear the same marks of scratching and polishing as in the lowest till, but the matrix is of a more sandy character, and in many places there are small veins of gravel running through it. Though this till appears to be the product of a glacier equally as much as the lowest beds, yet the glacier forming it may have been of less dimensions than the early one, and probably may not have had exactly the same direction. It is very likely that this till may not be derived from the direct action of the glacier on the Palæozoic rocks, but rather may have been produced from the till of the earlier periods, which was again ground beneath the later glacier in its onward progress. This till No. 3 is the highest glacial deposit exposed in the Scarboro' Cliff; its summit is about 300 feet above Lake Ontario, or 530 feet above the sea level. Following northwards from the lake, the surface of the country quite up to the watershed between Lake Ontario and Lake Huron, that is, to an elevation of about 1,000 feet above the sea, appears composed of till, the pebbles in which testify to the path of the ice having been from the north-east.

7. *Stratified Sand and Gravel Post-Glacial.*—These beds marked "d" in the section (*Fig.* 1) form the upper portion of the Scarboro' Cliff in some places. They are of very recent date in comparison

with the beds just described, and appear to have resulted from the erosion and re-assorting of the till of the second terrace, when the lake was about 200 feet above its present level. They present the same characteristics as the beds of sand and gravel now forming by the action of the lake on the present lowest terrace. Some of the beds are of large rounded stones and boulders; others of smaller pebbles; but all are water-worn. False bedding is also seen in some of the layers. These sands and gravels rest unconformably over the earlier deposits; their maximum thickness is 50 feet; but they are very local in their distribution, and, fortunately for the agriculturist, the surface of the land for the most part is composed of the till or boulder clay with boulders scattered over it. I have been unable to find any shells in the beds at this place; but in beds of similar age in other parts of the Province, fresh-water shells have been found.

Erratic Boulders.—On the surface of the plateaux formed by the first and second terraces at Scarboro', these boulders occur, though they are not very numerous. Their distribution took place prior to the deposition of the post-glacial sands and gravels above mentioned. These boulders are of very various sizes and shapes, from that of a foot-ball up to blocks two or three feet in diameter. They are mostly of a rounded outline, but very rarely are any marks of striation to be seen on them. They are in this district generally scattered singly on the surface. By far the larger proportion of these boulders here are of Laurentian gneiss, with a few of Laurentian limestone, and of the lower beds of Trenton limestone, which to the north-east of this district rest immediately on the Laurentian rocks. On account of the area covered by the Laurentian rocks being so extensive, and the character of the rocks being very similar over large portions of that area, it is not always practicable to trace the gneissoid boulders to the particular beds whence they have been derived. On this account the evidence of a boulder whose source can be traced to a certain locality is important. I had the good fortune to find at Yorkville, about 250 feet above the lake, a surface boulder of Potsdam sandstone, with the characteristic fossil, Lingula acuminata, abundantly and beautifully preserved in it. As the only outcrop of this rock is at the easterly end of Lake Ontario, this particular boulder, whether carried by glacier or iceberg, must have been transported one hundred and sixty miles to the west of its original home, directly contrary to the present drainage of the country.

It has been generally supposed that these erratic surface boulders have been distributed by icebergs which floated from the glaciers yet remaining on the Laurentian range during the submergence of the last Glacial epoch; but their occurrence in the central portion of the plateau of Western Ontario, at levels of 1,200 feet above the sea, renders this theory improbable, for a submergence sufficient to float icebergs over this area would also be sufficient to cover the greater portion of the Laurentian range, which only averages 1,600 feet above the sea, and thus prevent the formation of a glacier on it. In the lower levels of the country some of these glaciers may have been carried by shore ice during the submergence; but it seems more probable that many of these boulders were left where they are at present when the glacier in whose mass they were imbedded gradually melted. The peculiar absence of striæ on these boulders is not altogether to be explained by the exfoliation which frost and heat produce on some kinds of gneiss, but probably arises from their having become imbedded in the glacier, and not having been exposed to the grinding action beneath it. The enormous number of these Laurentian boulders scattered over Canada and the States for hundreds of miles to the south and west of the range, would be sufficient, if they could be collected, to form a very respectably-sized mountain range, and render improbable the idea that icebergs or coast ice could have accomplished such an immense work.

Probably of contemporary age with the distribution of the erratic boulders, there are in some places in Western Canada extensive ridges of water-worn gravel and boulders, believed to resemble the kames and eskers of Britain. They do not occur in the limits embraced by my paper, and I merely mention their existence as part of the series of glacial and interglacial deposits.

Later than these kames are the terraces seen at various levels round the inland lakes, nowhere more plainly than to the north of Toronto. These terraces are believed to indicate so many intervals, during which the lake continued at a certain elevation sufficiently long to wear back a terrace along its shores in the same manner as it now wears back the Scarboro' Cliff. These terraces are said to exist up to an elevation of 1,000 feet above the sea-level to the north of Toronto; and thus, to have formed them, Lake Ontario must have been 770 feet above its present level, and formed part of a vast inland sea which embraced not only the greater part of Canada, but also the adjoining western and south-western States. From an imperfect examination, however, it appears to me doubtful if the *higher* terraces furnish unequivocal evidence of having been formed by the wearing back of the lake. There is hardly any doubt, however, that the various lake basins of Ontario, Erie, Huron, Michigan and Superior, formed at the close of the Glacial period but one enormous lake or sea, and the evidence is completely in favour of its being fresh water. It has not been ascertained to what extent this surface may have been depressed in relation to the sea level at that period, or whether this great body of water was held in by barriers of glaciers or accumulations of glacial débris which have since been removed.

During the period at which the lake was at the higher levels, the drainage of this portion of Canada reached the sea by way of the Mississippi Valley, and it is only since its level became lower than that of Lake Erie that the Niagara gorge commenced to be excavated, a period of very recent date in comparison with that of the formation of the till and the interglacial strata.

The later geological formations gradually merging into those still in progress, are ridges of sand and gravel similar to those at Burlington Heights, Ontario, and the valleys of the present streams. In these comparatively recent strata elephant remains have been found.

If I have rightly interpreted the facts shown in the cliffs at Scarboro' and the Garrison Common, then it appears that from the commencement of the Glacial period there is evidence of the presence of glaciers overflowing this portion of Canada at three different periods at least, with intervals of milder periods between. Following the melting of the first glacier, represented by the scratched rocks and the lowest beds of till, the first interglacial interval continued sufficiently long for the fossiliferous clays and sands, 140 feet in thickness, to be laid down. These deposits testify to a climate similar to the present one; they are overlaid by glacial till in some places 70 feet in thickness, during the formation of which an Arctic climate for the second time prevailed. To this Arctic cold there succeeded a milder period, in which the laminated clays, 90 feet in thickness, were deposited; though these clays show no signs of ice action, yet, on the other hand, they are without fossils, therefore the evidence as to the climate of this era is not so clear as that of the first Interglacial epoch; though moderate, it may have been much colder than the present. This second Interglacial interval is again followed by a fresh glacier, bringing with it beds of till, showing the presence of intense cold again. Whether this alternation of climate was repeated, or whether this third period of Arctic cold gradually changed to our present interglacial condition, the Scarboro' Cliffs contain no higher beds to inform us.

The absence of mountain ranges, and the comparative level of the surface of Canada, preclude the idea that these deposits of till of different ages were formed by a mere temporary advance and retrogression of a glacier, descending from mountain summits into valleys in which a genial climate generally prevailed, as might be urged in the case of Switzerland. It would require more than a few seasons of milder and colder temperature to bring about the melting and then the re-forming and advance of a glacier, in a country which is a comparative plain for hundreds of miles. The Interglacial intervals in this country indicate changes of climate lasting through very long periods.

I will now endeavour to show the extent to which the changes shown in the Scarboro' Cliff are corroborated by sections seen in other parts of the interior basin of the continent. There is great difficulty in making a comparison, on account of the very imperfect manner in which the observations of this description of strata have been conducted, and the indefinite sense of the terms employed. For instance, all the beds of the Scarboro' Cliff are summed up in the "Geology of Canada," as belonging to the divisions called the Erie and Saugeen clays, though beds strictly corresponding to the definition of these divisions can hardly be said to be present. The Erie clays are stated to be stratified, of a blue colour, to hold boulders and pebbles in greater or less abundance, and to be without fossils. The Saugeen clay is a stratified brown calcareous clay, with but few boulders or pebbles, and doubtfully containing fresh water shells. The all-important difference of distinguishing between non-stratified till and stratified clays seems hardly to have been made in describing these deposits, and more reliance seems to have been placed on difference of colour than difference of structure. The lower beds are believed to be always blue, and are called the Erie clays; the upper ones brown, and are named the Saugeen clays.* That this classification is generally inapplicable is easily seen when it is considered that the colour and character of these clays depends upon that of the rocks

* Geology of Canada, p. 896.

beneath, or those of the localities from which the ice has travelled, and therefore clays of different colours may be contemporaneous. Thus on this side of Lake Ontario the till is blue, because the rocks to the east and north-east are also blue; but if we cross the lake, the till is of a red or reddish-brown, from having been formed out of the red Medina rocks. Even, however, in a blue clay district the distinction of colour will not hold good, for a chemical change takes place on exposure in some of the blue clays, and they are altered to a brownish or yellowish tint. This alteration is very partial, and I think that many of the beds described as brown Saugeen clays, resting unconformably on blue Erie clays, are merely due to the oxidation of the upper portion of the blue clays. Some very good illustrations of this change of colour may be met with at the Humber Bay Cliff.

There is no necessity to search for beds of till corresponding to those of the Garrison Common. The entire north-eastern portion of the continent has been overflowed by this first glacier, and left the striated surface of the rock and till as witnesses of its presence. It would be impossible, however, to state positively whether deposits of till, even where they rest on the Palæozoic rocks, are due to the first or a succeeding glacier. It is doubtful if any pre-glacial beds newer than the Palæozoic strata have been spared in this part of the continent; the first evidence we have of the life of this region since the time of the long since extinct species of the Devonian rocks is contained in these interglacial clays, the flora and fauna of which are still existent.

It is very probable that these beds of sand and gravel, occurring in some parts of Canada and the adjoining States, stated to be Pre-Glacial on account of being overlaid by till, may in reality be of Interglacial age, and the till covering them may have been produced by a later glacier. If it had not been for the small outlier of the fossiliferous clays at the Humber Bay, the beds in the Scarboro' Cliff might have been regarded of Pre-Glacial age. The buried channels of streams which have been discovered in many places in Ohio are very probably Pre-Glacial; but they may nevertheless have been further hollowed out and deepened by the first glacier. It is significant that in the State of Ohio, which has been surveyed by a staff of excellent geological observers, no loose beds of sand or gravel have been discovered of an age immediately preceding the Glacial epoch; any Pre-Glacial remains which may have existed have been entirely swept away.

I cannot find any notice of the discovery of fossiliferous deposits of Interglacial age corresponding with those at Scarboro', in any part of Western Ontario. Sir W. Logan notices beds of vegetable material near the Grand Sable,* Lake Superior, covered by a great thickness of stratified sand and gravel; but the evidence shows the beds to be of Post-Glacial rather than Pre-Glacial age. Instances of the trunks of trees being found in yellow clay, in wells 10 to 20 feet from the surface, at Toronto, are recorded by Prof. H. Y. Hind;† but these may have occurred in some of the stream channels similar to those seen in the till No. 2 at Scarboro', and belong to a later date. I have examined the cliffs bordering Lake Ontario in many places on the north shore, and the Canadian portion of the south shore, without finding any beds which could be correlated with the fossiliferous clays and sands at Scarboro'. There are, however, some beds of Interglacial age filling the V-shaped sinus in the Niagara escarpment, between St. David's and the Whirlpool, which may be considered to be of contemporaneous age with the Scarboro' beds. This sinus, so ably described by Sir Charles Lyell,‡ and lately by Mr. Thomas Belt, F.G.S,§ is from one to two miles in width at St. David's, and gradually diminishes, so far as can be ascertained, until it ends in a cul-de-sac near the Whirlpool at Niagara, where it is about the same width as the present Niagara River. This sinus itself is believed by Mr. Belt and some other geologists to have been formed by the erosion of a pre-glacial stream in the same manner as the present gorge; but its character is so entirely different from that which the present Niagara River has made, that it can hardly have been effected by the same agent. Sir Charles Lyell says that "it bears no resemblance to the deep, narrow chasm in which the Niagara flows," and he styles it an ancient valley now filled with drift, giving no opinion as to how it was produced. It may seem rash for me to venture to express an opinion where so great a master of the science was silent, but I think this cul-de-sac has been due to the first glacier which ploughed it out. Valleys of a similar character are to be met with in other places in this escarpment of Niagara dolomite; for instance, the one at the western extremity of the lake in which the town of Dundas, Ontario, is situated; another one occurs at Owen Sound: in all these cases there

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* Geology of Canada, p. 906.

† Geology of Canada, p. 904.

‡ Travels in North America, 1841-42, Book II., chap. 19.

§ Quarterly Journal of Science, 1875.

is no evidence of streams having been the means of eroding these wide-mouthed valleys, whilst both near Dundas and Owen Sound there are plain traces of glaciers having passed up them. The fact of the existence of ancient stream beds leading from the south-west end of Lake Erie, in the direction of the Mississippi valley, and showing that the pre-glacial drainage of that area followed that direction, militates against the theory of a Niagara Falls existing of Pre-Glacial or Interglacial date, to which this old valley has given rise. The deposits at the Whirlpool filling this ancient St. David's valley, are beds of stratified clay and sand below, overlaid by a conglomerate and beds of true till. These lower deposits are at the same level above Lake Ontario as the interglacial clays and sands at Scarboro'; and though no fossils have been found in the small portions of the beds exposed, it is not improbable that they may have been formed at the same time, whilst the till above them may be contemporaneous with the till No. 2, at Scarboro'.

Some years since Professor Chapman,* of University College, Toronto, investigated the superficial strata of western Ontario in order to determine if any marine deposits existed in them. He failed to find any marine shells, but detected shells of fresh water molluscs, in one place 40 feet above Lake Ontario, in another 18 feet above Lake Couchiching. These shells were found in stratified sands and gravels of what Professor Chapman terms "drift deposits." As these, however, are similar in character and composition to the deposits now forming in the present lakes, and are apparently not overlaid by any beds of till or boulder clay of a later date, it is very probable that all these shells are of Post-Glacial age, and date from the time when the lakes were at a much higher level than at present.

Similar shelly sands are described by Mr. Robert Bell, F.G.S.,† at elevations of 78 feet above Lake Huron, or 656 feet above the sea, and by Dr. Workman at 30 feet above Lake Ontario. These shell beds belong to a period comparatively modern when compared with the Scarboro' fossiliferous clays and sands.

The glacial deposits in the States of Ohio, Illinois, Indiana and Minnesota have been carefully studied and described by Dr. Newberry, Professors Winchell and Orton, Colonel Whittlesey and others, and a succession of beds resembling in many respects that at Scarboro'

* Canadian Journal, 1861, p. 221.

† Canadian Naturalist and Geologist, Vol. VI., 1861.

appears to exist throughout these States. Nowhere, however, can I find an account of any exposure on the scale of that of Scarboro'; these geologists have had to study the relative position of the strata from borings for artesian wells or shafts sunk for coal, and small exposures in stream valleys, and consequently the succession of the strata in different places is at present a matter of discussion. But in many places in these States there is evidence of one if not two Interglacial periods, during which deposits of plant remains have been found. In the southern part of Minnesota, Professor Winchell describes beds of peat resting upon and also overlaid by till, or unmodified drift, as he terms it. At Bloomington,* in the central portion of Illinois, there are beds of clay with peaty remains, which appear to resemble those at Scarboro'; these beds are covered with a solid mass of till or "hard-pan," from 50 to 60 feet in thickness.

In Dr. Newberry's very able resumé of the glacial strata of Ohio,† the succession of the lower beds is stated as follows: (1.) Lowest, Till, or boulder clay. (2.) Erie clay, or non-stratified and stratified beds of blue clay. (3.) Forest-bed or peat-bed. (4.) Laminated clays and gravels, &c.

Over the boulder clay in Ohio there is a series of blue clays, the upper portion of which are stratified, but contain no fossils. The forest beds above these clays are the remains of an ancient soil in which coniferous trees grew, and beds of peat 20 feet in thickness in some places. In these beds are found the remains of mammoth, mastodon, the giant beaver and other animals. Laminated clays and gravels cover up these peat beds, Dr. Newberry stating "that there is no satisfactory proof that an ice sheet passed over the State of Ohio after the accumulation of the old forest bed; that it seems scarcely possible that the clay above could have been spread by glaciers, and the forest bed or boulder clay be left so intact over large areas."

This succession resembles that of Scarboro' in the order of the deposits, with the difference that there are only a few feet of peaty soil, instead of the 140 feet of lacustrine clays and sands to testify to the intervening mild period. Dr. Newberry's doubt as to a second glacier having reached that portion of Ohio, seems to have arisen from these incoherent beds of soft materials remaining intact; but the fact is indubitable of the second glacier passing over Canada, and yet sparing some of the fossiliferous clays.

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* Geology of Illinois, Vol. IV., p. 179.
† Geology of Ohio, Vol. II.

In Indiana the forest-bed is believed to underlie the till or boulder clay, and is thus supposed to be Pre-Glacial; but it is probable that the true succession is as revealed at Scarboro', and the overlying till is due to the second glacier, which overflowed the country after the mild Interglacial period, during which the central basin of North America was covered with forests.

In Eastern Canada the marine fossiliferous deposits which Dr. Dawson has named the Leda clays and Saxicava sands appear to have been formed towards the close of the Glacial period, and later than any deposits of till or boulder clay; consequently they are of much more recent date than the interglacial clays and sands of Scarboro', and the forest beds of the Western States. Dr. Dawson,* in his description of these glacial beds, remarks, "that it is not possible to ascertain the existence of boulder clays of different ages, superimposed on one another;" a conclusion which may be correct in Eastern Canada, but certainly will not apply to the glacial deposits of the inland portion of the continent.

Though the general succession of the later glacial deposits in the Western States appears to have been similar to that of this portion of Canada, the data at present are not sufficient to allow of a detailed comparison.

From the history of the Glacial period in Britain, contained in the admirable work of Mr. James Geikie, F.R.S., "The Great Ice Age," it may be seen that there is evidence of several alterations of Arctic cold, and temperate and even warm climates during that age. There can be but little doubt, that whatever may have been the causes of these successive changes of climate, the entire northern hemisphere was affected by them, and the cold and warm periods happened simultaneously on both sides of the Atlantic. The succession of Glacial and Interglacial periods revealed by the Scarboro' Cliff is only what might have been anticipated from the discoveries made in Britain.

It may be advantageous to give a short summary of the various events which the cliff sections described, show to have taken place.

1. A vast glacier which striated the Palæozoic rocks, eroded the lake-basins, and produced the lowest beds of till. Climate Arctic.

2. Complete disappearance of the glacier; the land covered with vegetation; Lake Ontario filled with fresh water to a higher level by at least 150 feet than at present; in the lake extensive beds of clay

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* Canadian Naturalist and Geologist, Vol. VI., 1872.

and sand were formed, in which plants and other remains washed off the land were imbedded. Climate temperate, similar to the present.

3. A fresh glacier covered the country and ploughed out the lacustrine deposits of the previous period, leaving another sheeting of till. Climate again Arctic.

4. Disappearance of the glacier, and formation of lacustrine clays in the hollows of the till, but without fossils. Climate probably still cold.

5. Again a glacier, but probably of less dimensions than the previous ones, the till being of a looser character. Climate Arctic.

6. Contemporaneous with the melting of the last glacier occurred the distribution in part of the erratic boulders, followed by the formation of the gravel ridges, or kames and eskers; the submergence of the land; the formation of the lake-terraces and the erosion of the present stream-valleys. The climate during these events may have been similar to the present.

Further investigations in other localities may show that the succession of changes indicated by the Scarboro' Cliff does not embrace all those which have taken place in this portion of Canada during the Glacial period. Very much remains to be done in the way of collecting observations before a complete knowledge of these so-called superficial strata can be obtained. The name given to them indicates the manner in which they have been generally considered. Whilst great attention has been devoted to the Palæozoic rocks, these more recent strata have been deemed hardly worthy of notice. The succession of the Palæozoic rocks in this portion of Canada is so simple and regular, that their history is by this time tolerably well ascertained; but there is plenty of work for those interested in the science of geology to search the records of the post-tertiary strata.

ANALYSES OF IRON ORES AND ANKERITES

FROM THE

ACADIA MINES OF LONDONDERRY, NOVA SCOTIA.

BY E. J. CHAPMAN, PH. D.,

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The following analyses of some of the Londonderry iron ores and ankerites may not be without interest, as supplementing, in part, the article by Professor Robert Bell, in the present number of the *Journal.** As regards these analyses—now published for the first time, although made about a year ago—all the samples were of good size, and were regarded as fair representatives of the portions of the vein from which they were taken.

(1.) IRON ORES.

	1.	2.	3.	4.	5.
Fe^2O^3	98.52	84.10	83.17	82.52	77.78
Al^2O^3	0.24	0.30	0.42	0.38	0.21
MnO	0.16	0.23	1.04	0.84	1.17
MgO	0.27	0.11	0.15	0.14	0.12
CaO	0.08	0 18	0.13	0.16	0.20
SiO^2	0.66	3.03	4.12	2.28	6.92
P^2O^5	tr	0.24	0.29	0.22	0.27
SO^3	tr	0.06	0.02	0.04	0.03
Aq.	tr	11.63	10.67	13.36	13.32
Metallic Iron	68.96	58.87	58.22	57.76	54.44
Phosphorus	0	0.106	0.125	0.096	0.118

No. 1.—A specular, red ore, of scaly or micaceous structure, from Martin's Brook, West Mines. Average sp. gr. 4.88. Weight per cubic foot, 304 lbs.

* Additional reference may be made to the "Acadian Geology" of Dr. Dawson, and to Mr Selwyn's report and plan, in the Survey Report for 1872. Also to the writer's "Outline of the Geology of Canada, 1876," in which a brief notice of the district, and its relations to the surrounding country, will be found.

No. 2.—A brown (or partly red) ochreous hematite, labelled "Friable Ore," from Martin's Brook, West Mines. Average sp. gr. 3.57. Weight per cubic foot, 222 lbs.

No. 3.—A brown, earthy-looking and partly ochreous ore, but containing specks and strings of metallic lustre. Average sp. gr. 3.13 (3.01—3.28). Weight per cubic foot, 195 lbs. Labelled "Porous or Spongy Ore," from Martin's Brook.

No. 4.—A brown hematite of fibrous-botryoidal structure and high lustre. Labelled "Kidney Ore," from Martin's Brook. Average sp. gr. 3.85. Weight per cubic foot, 240 lbs. The silica in this ore, and also in No. 3, separated as a gelatinous residuum.

No. 5.—A brown hematite of somewhat open texture, but fibrous-botryoidal in places. From Folly's Mountain, East Mines. Average sp. gr. 3.53. Weight per cubic foot, 220 lbs.

NOTE.—In the Report of Progress of the Geological Survey for 1872, complete analyses of three samples of brown hematite from the Acadia Mines are given by Dr. B. J. Harrington; and of three other samples—one of red, and two of brown hematite—from these mines, by Mr. Christian Hoffman. These analyses, although the samples were mostly taken from other parts of the property, agree, as a rule, very closely in their results with those of the above series; but in a sample from Totten's Brook, Dr. Harrington found rather more than 20 per cent. of carbonate of lime. The amount of phosphorus, also (0.370) found in a brown ore from Cumberland Brook, is higher than in the samples from Martin's Brook.

(2.) ANKERITES.

	1.	2.	3.	4.
CO^2	44.39	44.58	44.64	44.36
CaO	28 69	26.90	27.49	28.48
MgO	11.08	12.44	12.28	11.82
FeO	15.17	15.30	15.03	14.21
MnO	0.61	0.66	0.54	0.44
SiO^2	0.04	0.06	0.04	0.63

These values correspond to :

	1.	2.	3.	4.
$CaCO^3$	51.22	48.02	49.08	50.86
$MgCO^3$	23.28	26.12	25.80	24.83
$FeCO^3$	24.46	24.67	24.23	22.90
$MnCO^3$	0.98	1.08	0.87	0 72

No. 1.—A hard, solid ankerite, from "Blast Furnace Quarry :" almost pure white in colour, but with brownish streaks here and there. Effervesces freely in cold dilute acids, and becomes dark-brown on ignition. Sp. gr. 2.99—3.08. Average weight per cubic foot, 188 lbs. An analysis of another portion of this sample gave :—$CaCO_3$ 52.12, $MgCO_3$ 23.14, $FeCO_3$ 23.71, $MnCO_3$ 0.96, SiO_2 trace.

No. 2.—A pale-brown, hard, compact ankerite, from Blast Furnace Quarry. Effervesces freely in cold acids, and becomes dark-brown on ignition. Sp. gr. 2.004. Weight per cubic foot, 187 lbs.

No. 3. — A pale-brown ankerite (almost white internally), of cleavable lamellar structure, from Martin's Brook. Other characters as in Nos. 1 and 2.

No. 4.—A white, highly cleavable ankerite, with ochreous stains in places, from Folly Mountain, East Mines. Other characters as above.

Analyses of other samples of Londonderry ankerite, by Dr. Dawson, Dr. C. T. Jackson, and Professor How of Nova Scotia, will be found in the Geological Survey Report for 1872. In the samples analysed by the writer, the average amount of metallic iron, it will be seen, is equal to 11½ per cent. The value of the material as a flux is somewhat lessened, however, by the large percentage of carbonate of magnesia.

THE SYSTEMATIC POSITION OF THE SPONGIADÆ.

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The views of naturalists prior to 1820 with reference to this subject are now purely of historical interest, for the late Prof. Grant had not till after that date recorded the beautiful series of experiments which gained him early his fame as a zoologist. By these, however, the animal nature of the Sponges was undoubtedly proved, although it was not till much later that these organisms, after having been bandied about from one kingdom to another, at last found a resting-place among the lowest types of animal life. We find, for instance, even Johnston, who contributed so much to the knowledge of the Scotch littoral fauna, drawing fanciful analogies between the Sponges and their namesakes the Fungi: "The Tethea, the naturalist may say, is the sea's copy of the earth-born Scleroderma, and he may remind us that, like the sporules of sponges, the sporules of fungi are equally locomotive."[1]

Although certain distinctively animal characteristics were discovered so early in the present century, it is only within the last few years that sufficient data for accurately determining the relationships of the Sponges have accumulated. The cause of this is partly to be looked for in the predominating attention devoted to their hard parts by systematists, partly also in the fact that naturalists were inclined to assume of the marine forms what had been proved with reference to the anatomy and reproductive phenomena in Spongilla; a form which, from its accessibility, gave rise to the researches of Meyen, Carter and Lieberkühn, but which is now recognized, as is the case with so many fresh-water forms of groups essentially marine, to be aberrant in many respects.

For our increased information we are indebted in great part to the impetus given to the study of development by the evolution-hypothesis,

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[1] Brit. Spong. and Lith. 1842.

but also to the great strides made in the region of histological inquiry by improved methods. I propose in the present paper to consider chiefly the nature of the evidence derived from these sources which bears upon sponge-relationships.

It need not occasion much surprise that the opinions of naturalists with regard to these have varied much, for, apart from the want of adequate information as to structure and development, there is a total want of forms transitional to other groups, such as, *e.g.*, we find between the Vermes and the various large sections of the animal kingdom derived from that group. Attempts have been made, of course, to point out such transition forms: Dr. Carpenter,[2] *e.g.*, indicates the Thalassicollina as leading from the Polycystina to the Spongiadæ; Haeckel, however, has so largely increased our knowledge of these as of the other Radiolaria, that we now know the groups (Radiolaria and Spongiadæ) have little more in common than a skeleton formed partly of silica. Again, Dr. Wallich regards the Dictyochidæ as intermediate between Thalassicolla and the sponges. I quote his arguments from a recent paper:[3] "The basket-shaped framework of the living Dictyocha is never single, but invariably double, the concavities being placed face to face, and the two portions retained in position solely by the sarcode body which fills and surrounds them. . . . . . The most remarkable feature, however, of Dictyocha, and the one which at once establishes its alliance with the siliceous sponges, is that every part of the siliceous framework is tubular." Dr. Wallich seems to have overlooked Haeckel's discovery,[4] that in Aulosphæra, Aulacantha and other Radiolaria the spines are tubular, and are further filled with sarcode derived from the extracapsular soft mass, so that a tubular framework is by no means confined to Dictyocha; and again, a tubular siliceous framework can hardly be said to be a distinguishing characteristic of the Sponges, as such a continuous system of tubes has only been shown to exist in a small section of the Hexactinellida.[5]

After glancing at the present position of our knowledge of sponge structure, we shall again return to the real and supposed affinities of the group. Suffice it to say, that the Spongiadæ form a class bounded

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[2] Introd. Study Foramin.
[3] Am. Mag Nat. Hist., Feb, '77, p. 174.
[4] Die Radiolarien, 1862, pp. 263, 358.
[5] Marshall, Zeit. fur wiss. Zool., B. xxvii., p. 120.

by better marked limits than are found with most sections of the animal kingdom, and further, that the peculiarities of their organization are such as to render it necessary for us to recognize in them a section similar (to give an instance) in value and independence to the Echinodermata.

Many naturalists are disposed to accept, provisionally at any rate, the division of the animal kingdom into Protozoa and Metazoa advanced by Haeckel;[6] and there is no doubt, if developmental characters have that importance allowed to them to which modern zoology points, that Haeckel's division is founded on a firm basis.[7] The characters affirmed of the Metazoa and denied of the Protozoa, according to this arrangement, are the following: 1st, the formation of germ-lamellæ, arising from the division of the egg cell into many cells; 2nd, the presence of a true intestine (except in a few retrograded forms) lined by the innermost of these lamellæ; and 3rd, the presence of true tissues differentiated out of the cells of these primary lamellæ. The evidence which I have to bring forward with regard to the Sponges, although unhappily not obtained from all of the sections of the group, and somewhat scanty from the third (histogenetic) point of view, still indicates that in each of these three points they are true Metazoa.

The difficulties which are experienced in tracing out the reproductive phenomena in the Sponges are so great, that the misapprehensions of the earlier spongologists need cause us no surprise. At one time the cells lining the ciliated chambers were supposed to be concerned in the reproductive process; at another, a peculiar sort of internal gemmation was suspected from the escape of the larvæ by the oscula. It is especially within late years that the generative elements have been detected and described by various authors, and in fact the appearance of Haeckel's account of the development of the calcareous sponges,[8] and the indications there presented of his famous Gastræa-Theory, turned the attention of a number of naturalists to the study of the development of these much-neglected forms. First, Metschnikoff[9]

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[6] Die Gastræa-Theorie.

[7] Van Beneden has recently indicated a third sub-kingdom, the Mesozoa, for the reception of the peculiar genus Dicyema, which lives parasitically upon the spongy renal organs of Cephalopoda. There is here no digestive or body-cavity; the entoderm is represented by a single axial cell, covered by a flat epithelium of ectodermal cells, and this differentiation into two kinds of cells takes place after cleavage of the egg.

[8] Die Kalkschwamme.

[9] Zeit. fur wiss. Zool., B. xxiv., p. 1, *et seq.*

challenged the accuracy of Haeckel's statements; then Oscar Schmidt[10] followed with an account of observations which seemed to sap the very foundations of the Gastræa-Theory. The distinguished histologist, F. E. Schulze,[11] however, in a paper on the structure and development of Sycandra raphanus, showed that the gastrula-stage does exist in the ontogeny of the calcareous sponges, while his observations have been confirmed and extended by the researches of C. Barrois[12] on the embryology of certain sponges of the British Channel.

It is still uncertain what form the male generative elements assume in the Sponges, and most attempts to discover anything answering to these have failed. They have been asserted to take the ordinary spermatozoid-form, and Lieberkühn figures those of a Spongilla possessed of oval heads and short tails. Carter[13] has described spermatozoids from a Microciona (with pyriform heads and long tails attached to the broad end of the pear), and again from Sycandra compressa (the latter in a dead condition with conical heads and long tails.)

Barrois (Loc. cit.) has described from an Isodictya certain bodies which possibly represent the mother cells of the male elements. These are found in the mesoderm along with the eggs, and appear as clear cells closely opposed while in situ, and each provided with a large nucleus; when separated from the sponge by teasing, they are seen to be arranged in rows, clear plastic threads intervening between the individual cells. The transformation of these cells in granular balls Barrois considers preliminary to the formation of sperm cells, and draws a parallel between this and the development of the spermatozoids in Hydra as described by Kleinenberg. If future researches should show that the eggs are actually impregnated by the products of these granular balls, an important point of agreement between Hydra and the Sponges will have been demonstrated, and the conviction will be strengthened that it is here (at the base of the cœlenterate series) that the inter-relationships of Sponges and Cœlenterata find their strongest expression.

The ova of the calcareous sponges have been recognized for some time, and are characterized by the absence of any investing membrane,

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10 Zeit fur wiss Zool, B. xxv., Supp p. 127, *et seq*

11 Zeit fur wiss. Zool, B xxv., Supp p. 247, *et seq.*

12 Ann des Sci Nat Zool., T iii 1876.

13 Ann Mag Nat. Hist, V. xiv., p. 105 *et seq.* 1874.

so that although generally rounded or oval (measuring 0.04 – 0.05 m.m. in diameter) they often assume a singularly amœboid appearance; so much so, Haeckel says, as to have been taken for parasitic Amœbæ. They possess a germinal vesicle surrounded by granules and containing a nucleolus. Similar to these in all essential particulars are the eggs of the siliceous sponges, which in addition, however, are characterized by the presence of pigment even before cleavage, as well as of certain bodies interpreted as nutritive by Barrois, and compared by him to the pseudocells of Hydra.

The ova are always formed in the mesoderm, sometimes (Calcispongiæ) immediately under the entodermal cells of the ciliated chambers, sometimes (Fibrospongiæ) with some thickness of mesoderm between them and any of the branches of the canal system. Their fecundation by thread-like spermatozoids is described by Haeckel in Sycortis quadrangulata, but has escaped the notice of other observers. It is probable, as eggs have been observed without a germinal vesicle, that fecundation is followed by its disappearance and the formation of a new embryonic nucleus prior to the appearance of the first cleavage-plane, which curiously has an undulating optical outline in Halisarca.

A summary of Barrois' results from a study of the development of the different groups will serve to indicate the frequent important points of divergence between these.

Calcispongiæ :—

The cleavage is total, regular, and a cleavage-cavity is soon formed When sixteen cells have resulted, a differentiation into two kinds is observed, better expressed, however, at the completion of cleavage: a hollow embryo of Haeckel's amphiblastula type results, in which the anterior cells are long, slender and hyaline, the posterior rounded, granular and opaque. This passes to a transitory amphigastrula stage, in which the posterior cells, having been invaginated into, and thus filling up the cup formed of the anterior cells, project from its mouth by their further growth. At this stage the embryo bursts through the entoderm of the mother, and makes its way to the outside by the agency of the long cilia now developed on the anterior region. These help to give a characteristic appearance to the free larva, the posterior cells of which undergo a further differentiation into a crown of cells (the indication of the future mesoderm) next the mouth of the gastrula and a posterior mass, the cellular nature of which becomes gradually less and less distinct. Fixation and flattening follow, no trace of the cavity of the gastrula is left, and the two regions of the larva are only recognizable as two distinct layers, an upper (formed of the anterior cells) clear, nucleated, with pores and amœboid processes which corresponds to the ectoderm of the adult sponge, and a lower (formed of the posterior cells), granular and opaque, which corresponds to the mesoderm and entoderm of the adult. The sponge next contracts into a cylindrical form and bristles with spicules, the straight spicules appearing before the rayed forms; these latter have a definite arrangement, an odd ray pointing towards the base of the sponge. The osculum is formed afterwards, but as it does not correspond to the gastrula-mouth, and indeed may be formed in different ways, it is of little morphological significance.

Myxospongiæ—Halisarca:—

In this group the cleavage is total and regular, resulting in the formation of a blastula with a very large cleavage cavity. It is not till the embryo becomes free that there is any difference between its anterior and posterior regions. This difference is first expressed by the posterior cells becoming large and granular, and in their pushing out short and stout cilia which contrast with the long delicate cilia of the anterior cells; a constriction between the two regions follows, and the further stages are practically the same as in the Calcispongiæ. The layers formed by flattening are absolutely homologous to those in the former group, and the development of the ciliated chambers and canals in the lower layer, entirely independently of each other, is alone worthy of remark.

Fibrospongiæ—Verongia:—

The differentiation of the egg into two regions is early marked by the aggregation of pigment posteriorly: when the blastula-stage is arrived at, the posterior cells may be distinguished from the anterior by being destitute of cilia and deeply pigmented, while the limit between the two regions is indicated by a row of mesodermal cells provided with long stout cilia.

Halichondrida:—

Here, as in the Myxospongiæ, the two regions are differentiated but slowly; the posterior of these is pigmented and destitute of cilia:

it forms a granular mass, filling up the cavity formed by the anterior cells, and frequently projected at one or more points through this layer: mesodermal cells with strong cilia are formed from it, and in these, even while the larva is in a free state, the spicules appear. After fixation, which may happen at any of the exposed parts of the internal granular mass, flattening into two layers takes place, in the lower of which the ciliated chambers appear as independent closed sacs, and after these the fissures which represent the future canal system. The oscula, one or more in each young sponge, seem to be formed simply by the collection of water between the two layers which transitorily gives rise to a tubular projection of the outer layer with a blind end. This being eventually burst, the osculum is established, and the tube collapses from the contraction of the ectoderm; the connection with the canal system is merely secondary. From this it becomes apparent that the osculum is no mouth, nor does it correspond to the "person." The horny fibres are only formed after fixation, and are primarily derived from the ectoderm; afterwards they extend into the lower layer and surround the spicules.

Such are the developmental phenomena ascertained for the Spongiadæ, and they undoubtedly demonstrate the fact that these animals are true Metazoa. Beyond this, however, they are of interest as indicating the way to a true conception of the individuality of the sponge, and are indeed of still wider significance from a comparative point of view.

It has been and still is with some a question whether a sponge is to be considered as an individual or a colony of individuals, but indeed it is necessary in many classes to use the word with some caution, from the different constructions put upon it zoologically.

If we accept Huxley's term "zoological individual" as equivalent to "the total result of the development of a single egg," it is evident that, except where concrescence of two young sponges has taken place, the sponge is such an individual. But this expression is highly undesirable, being in the first place frequently incongruous with the ordinary notion of an individual (as where, through asexual multiplication of some kind or another, perfectly independent and completely organized individuals are ultimately produced from a single egg); and, in the second place, involving a conception of an antithetical relation between asexual and sexual multiplication which does not exist in nature.

The Cœlenterate group offers many suggestions for a proper restriction of the word. There we meet with colonies composed of numerous individuals, all of which are sometimes anatomically and physiologically complete, and again others of which the members are individuals only from a morphological point of view; physiologically they are nothing but organs. In fact, we have to look to form and not to function in estimating the individuality of the members of a colony. Here we are brought face to face with a difficulty in applying this standard to the Sponges, for in their fixed condition they are as a rule totally destitute of a ground-form, and well merit the name of Amorphozoa applied to them by the older naturalists. This renders any distinction between growth and continuous budding impracticable in the Spongiadæ, for typical form and size are both absent; whereas in the Hydroida, for instance, the individuals can only grow till they reach a certain size, any excess of nutriment being expended in the formation of new buds. Unless it be true, then, that certain of the simplest calcareous sponges (Asconidæ) retain the larval ground-form throughout life, and are capable of repeating it by a process of continuous gemmation (forming an "Ascon-stock"), we have no data for applying the terms individual or colony to the group, as they are applied in the Hydroida.

Haeckel considered that a plurality of oscula indicated a plurality of individuals, on the ground of homology between the osculum of the young sponge and the mouth of the gastrula, the formation of further oscula in the adult form being, according to him, only a homological repetition of the first through asexual multiplication. This view must now be abandoned, as Barrois' researches conclusively show that the osculum has nothing to do with the mouth of the gastrula, and indeed, like the inhalant apertures of these organisms, is only secondary in its nature.

The idea of the colonial nature of the sponge, founded on the conception that the cells lining the ciliated chambers are the animals of the sponge (Spongozoa—Carter), is now entirely untenable, for besides leaving unaccounted for the bulk of the soft parts of the organism, it is quite incongruous with the course of development from the egg.

It does not come within the limits of the present paper to do anything but indicate the suggestiveness, from a general point of view, of the ontogeny of the Sponges. Two points strike me as being worthy of remark: the evident derivation of the mesoderm or skeletogenous layer from the primary entodermal cells, and the formation of the generative elements in that same layer so derived.

The presence of an alimentary canal may be regarded as an essential element in the definition of the Metazoa, being invariably present except in such cases which (in conformity with their parasitic habits —like the Tapeworms—) distinctly show a retrograde descent from forms possessed of such a canal.

That an alimentary region exists in the sponges is beyond all doubt; its disposition, however, in most members of the group has certain characteristic peculiarities. Haeckel has shown us in his monograph how we may pass by easy transitions from the simplest calcareous sponges (the Asconidæ) where the entoderm forms a continuous layer, lining, as in a Hydra, the whole of the cavity of the animal, to the most complicated forms (the Syconidæ), where, instead of being continuous, it is restricted to certain globular dilatations of the canal system, which is hollowed out in the mesoderm. It may be argued that if the osculum of a sponge does not represent the primitive mouth of the embryo while in its transitory gastrula-stage, the ciliated chambers cannot represent the gastral cavity of the embryo, and consequently are not homologous with the alimentary canal of other Metazoa. Now the possibility of such a homology is not done away with by the fact that the osculum would seem to be little more than a specialized pore; it is quite conceivable that the gastral cavity should be temporarily obliterated by the increase in number and size of the entodermal cells, and that when these are scattered into groups by the growth of the quickly developing mesoderm, they should again tend to separate and form a cavity.

That the cells of the ciliated chambers are the true food-absorbing cells of the sponge, has been incontestably demonstrated by Mr. Carter; that their peculiar form, however, or even the peculiar action of the flagella in whipping food particles into them,[14] can be considered any proof of their being individual Flagellate Infusoria is by no means necessary. As well might we assert that the amœboid cells met with in higher animals are true Amœbæ on account of their form and their conduct in the ingestion of particles. It is probable that the contractile vesicles described by Prof. James Clark in the entoderm cells of Leucosolenia botryoides, are the vacuoles described by F. E. Schulze in Sycandra raphanus.[15]

[14] H. James Clark, Mem. Bost. Nat. Hist. Soc.. N. S., Vol. I., p. 326.

[15] Loc. cit., p. 257.

There is still a wide field for histologists in the investigation of the elements of the sponge flesh. It has been ascertained that we have to do with a body composed of three layers (ectoderm, mesoderm and entoderm), in each of which the constituent cells are discoverable occasionally without the use of special reagents.

The entoderm cells especially can be detected without any trouble, and present the form of cylindrical epithelial cells, broad at the base, and invested by a delicate layer of hyaline protoplasm, which forms at the free end a marginal frill of the shape of a wine glass, from the centre of which there projects a flagellum formed of the same layer. In the basal portion of the cell is lodged a distinct vesicular nucleus, surrounded by granules, and occasionally by vacuoles.

The ectoderm cells are formed of a thin flat epithelium with distinct globular nuclei, and two to three bright refractive nucleoli, discoverable in the Calcispongiæ[16] without reagents, but necessitating the silver method in the Fibrospongiæ.[17] These cells abut upon each other with the intervention of but little intercellular substance. This layer is not confined to the outer surface, but extends into the canal system through the oscula (Schulze).

The great bulk of the sponge flesh unquestionably belongs to the mesoderm, and constitutes indeed what has been called the sarcode of the sponge. It was understood at one time to be entirely structureless, and Lieberkühn was the first to prove its cellular character by showing that heating to the point of coagulation of albumen separates the cellular elements of the flesh of Spongilla. It has been suspected for some time, and is now apparent from the researches of Schulze and Metschnikoff, that we have here to do with a substance similar to the gelatinous connective tissue (Gallert-Gewebe) of the Medusæ, and like it containing frequently specialized contractile elements. The cells, which give rise to the intercellular jelly-like matrix, are usually provided with straggling processes which may anastomose; and there have been detected in addition to these amœboid cells, similar to the wandering connective tissue corpuscles which we meet with in higher forms.

The contractile elements observed in the mesoderm are of the ordinary spindle-shaped character, and have been especially noticed in the Corticate group. O. Schmidt, however, has also discovered

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16 F. E. Schulze loc cit, p. 250.

17 Metschnikoff Zeit. fur wiss. Zool., Book xxvii., p. 279.

them at an early stage of development in the larva of Amorphina, lying transversely immediately under the ciliated exoderm.

The origin of the spicules in this, which is unquestionably the skeletogenous layer, requires further investigation.

From the above-adduced considerations, it is evident that the sponges are true Metazoa, although by no means of a specialized type; in fact, they must be regarded as having diverged early from the base of the metazoan series. We must look to the lowest of the series for their nearest relations, and thus confirm what Leuckart suspected years ago from a comparison of the canal system of the Sponges with the gastro-vascular apparatus of the Cœlenterata. If we compare the groups, however, as to development, structure and form, their divergent characteristics become immediately apparent. Perhaps this is best seen from a comparative study of the Sponges and Hydra which, with Greeff's Protohydra, forms the least specialized cœlenterate form. Such a comparison will suggest in the sponges many points of resemblance to this cœlenterate group, and yet others of departure. Among the former may be noticed the structure of the eggs, the presence of pseudocells, (the resemblance of the spermatozoids), and lastly, development of the generative elements in a layer (interstitial) intervening between ectoderm and entoderm. Among the latter may be noticed the total absence of typical form in the sponges, the greater differentiation of the body layers, and the greater specialization of their tissues.

Phylogenetically, this may be taken to indicate that the groups of the Spongiadæ and Cœlenterata are of independent origin, and that indeed we may represent the primordial Metazoa (Gastræades-Haeckel) as branching off by three different roads: those where the ground-form is lost in the adult (Spongiadæ); those where the tendency is to assume a radial form (Cœlenterata); and lastly, those in which bilateral symmetry predominates (the remaining Metazoa).

APPENDIX.

Since writing the above an important contribution to the literature of the Sponges, in the form of a paper on the structure and development of Halisarca, by F. E. Schulze, has reached me.[18] The discovery that the ectodermal cells are ciliated in this group, necessitates a dis-

[18] Zeit. fur wiss. Zool., B. XXVIII, p. 1-48.

tinction between these and the "collar-cells" of the entoderm. Of great interest also is the discovery of true spermatozoids. Halisarca lobularis is diœcious. The generative elements are developed in the mesoderm, each egg and sperm-mother-cell being provided with a capsule formed of flattened, endothelium-like cells. The form of the spermatozoids is characteristic, the head being pear-shaped, and the tail (measuring 0.08 m.m. in length) set on to it at right angles. The course of development indicated by Schulze corresponds with Barrois' description, with the exception that the posterior end of the free larva is figured as possessing longer cilia than the anterior part.

SYNOPSIS OF THE FLORA OF THE VALLEY OF THE ST. LAWRENCE AND GREAT LAKES,

WITH DESCRIPTIONS OF THE RARER PLANTS.

BY JOHN MACOUN, M.A., *Botanist to the Geological Survey.*

(*Continued from page 364.*)

POTENTILLA, L. Cinque-foil.

P. Norvegica, L.

Indigenous. Fields. New Brunswick (Dr. Fowler). Labrador coast (Butler). Common in Quebec (Brunet). West coast of Newfoundland (Dr. Bell). River Rouge (D'Urban). Near St. Anne (Prof. Bell). Common in Eastern Ontario (Billings). Common in Central Canada, New Road, Thunder Bay, Lake Superior (Macoun). Nicolet, Chippawa (Maclagan). Common in Western Ontario (Logie, Ellis, Saunders, Gibson). Mississagui and Drummond Islands, Lake Huron (Dr. Bell). From Lake Superior across the plains to Quesnelle in British Columbia (Macoun). Arctic America and Sitcha (Torr. & Gray).

P. Norvegica, L. Var. hirsuta, Michx.

Indigenous. On rocky ground. Tadoussac, Quebec (Brunet).

P. paradoxa, Nutt.

Indigenous. Lake shores. Burlington Bay, Lake Ontario (J. M. Buchan).

P. Canadensis, L. Common Cinque-foil.

Indigenous. Dry soil. New Brunswick (J. F. Mathews). Vicinity of Quebec; St. Hyacinthe (Brunet). Common in Eastern Ontario (Billings). Montreal Island (Dr. Holmes). Common in Central Canada (Macoun). Common in Western Ontario (Logie, Saunders, Ellis, Gibson). River du Loup (Dr. Thomas). Plains of the Saskatchewan (Bourgeau).

P. Canadensis, L. Var. simplex, Torr. & Gray.

Indigenous. Moister soil than the last. North shore of Lake Superior (Agassiz).

P. argentea. L. Silvery Cinque-foil.

Indigenous. Dry barren fields. New Brunswick (Dr. Fowler). Sea shore, River du Loup (Dr. Thomas). Toronto (Prof. Ellis). Colborne · fields near Picton, Prince Edward County; near Kingston (Macoun).

P. Pennsylvanica, L.

Indigenous. Dry gravelly soil. St. Croix; River du Loup (Brunet). St. Roche des Autruts, Quebec (Maclagan). Lake Superior (Prof. Ellis). Oak

Point to Edmonton and westward to the Rocky Mountains (Macoun). Saskatchewan Plains (Bourgeau). Through British America to Kotzebue's Sound (Torr. & Gray).

P. arguta, Pursh.

Indigenous. Rocky and gravelly hills. New Brunswick (Mathews). Devil's Rapids, River Rouge (D'Urban). Common in Central Canada; 11 miles up the Kamministiquia (Macoun). From Fort Garry westward through Peace River Valley to the Rocky Mountains (Macoun). British America to lat. 65° N. (Richardson).

P. Anserina, L. Silver-weed.

Indigenous. Brackish marshes and river banks; shores of the lakes. New Brunswick (Dr. Fowler). Quebec and Labrador (Brunet). West coast of Newfoundland (Dr. Bell). River du Loup (Dr. Thomas). Common throughout Central and Western Canada. North shore of Lake Superior (Agassiz). Saskatchewan Plains (Bourgeau). Fort Edmonton; shore of Little Slave Lake, and along Peace River to the Rocky Mountains (Macoun). Arctic America and Greenland (Torrey & Gray). Islands of Lake Huron (Dr. Bell).

P. fruticosa, L. Shrubby Cinque-foil.

Indigenous. Wet grounds. River Restigouche; Island of Anticosti (Brunet). West coast of Newfoundland (Dr. Bell). New Brunswick (Mathews). Belmont Lake, Peterborough County, Ont., scarce; very abundant along Lakes Huron and Superior (Macoun, Gibson). Plains of Saskatchewan (Bourgeau). Montreal Island (Dr. Holmes).

P. tridentata, Ait. Three-toothed Cinque-foil.

Indigenous. Rocky ground and gravelly soil. New Brunswick (Dr. Fowler). Cape Rouge, Cape Tourmente, Straits of Belle Isle (Brunet). South coast of Labrador (Butler). Newfoundland (Torr. & Gray). River du Loup (Dr. Thomas). Three Rivers and Belœil (Maclagan). Tadoussac (Drummond). Marquette, Lake Superior (Dr. Bell). Abundant around Lake Superior; Lake of the Woods; Fort Edmonton; Fort Assinaboine; Little Slave Lake (Macoun). Saskatchewan Plains (Bourgeau). To lat. 64° N. and Greenland (Torr. & Gray).

P. palustris, Scop. Marsh five-finger.

Indigenous. Cool bogs and marshes. Labrador (Butler & Brunet), and Anticosti (Brunet). New Brunswick (Mathews). River du Loup (Dr. Thomas). Chain Lake, River Rouge (D'Urban). Island of Montreal (Dr. Holmes). Frequent in Central Canada (Macoun). Common in Eastern Ontario (Billings). Frequent in Western Ontario (Buchan, Ellis, Saunders, Gibson). Islands in Lake Huron (Dr. Bell). Thunder Bay, Lake Superior; marshes along the Dawson Route; Deer Mountains west of the Arthabasca; Upper British Columbia (Macoun). Saskatchewan Plains (Bourgeau). Arctic Circle, Kotzebue's Sound and Greenland (Torr. & Gray).

P. maculata, Poir.

FRAGARIA, Tourn. Strawberry.

F. Virginiana, Ehrhart. Common Wild Strawberry.

Indigenous. Rich woodlands and meadows. Common from Newfoundland (Richardson) and Labrador (Butler) to Lake Superior (Macoun). From Lake Superior to Edmonton, and westward through Peace River to the Rocky Mountains (Macoun). To Arctic America, lat. 64° (Richardson).

F. vesca, L. Wood Strawberry.

Indigenous. Fields and rocky places. Frequent in Ontario and Quebec New Brunswick (Dr. Fowler). River du Loup (Dr. Thomas). North shore of Lake Superior (Agassiz). Bruillé Portage, Dawson Route (Macoun). St. Joseph's Island, Lake Huron (Dr. Bell).

Dalibarda, L.

D. repens, L.

Indigenous. Wooded banks. New Brunswick (Dr. Fowler). Common at Quebec (Brunet). River Rouge (D'Urban). Near Hamilton (Logie). Nicolet, Montreal (Maclagan). Victoria County, Elliott's Falls (Macoun). Gore Bay, Lake Huron (Dr. Bell).

Rubus, Tourn. Bramble.

R. odoratus, L. Purple Flowering Raspberry.

Indigenous. Woods and thickets. Quebec, St. Joachim (Brunet). Lake Grenville, River Rouge (D'Urban). River du Loup (Dr. Thomas). Montreal, Nicolet, Niagara (Maclagan). Common in Eastern Ontario (Billings). Abundant in Central Canada (Macoun). Common in Western Ontario (Buchan, Saunders, Ellis, Gibson). St. Joseph's Island, Lake Huron (Dr. Bell). Goulais Bay, Lake Superior (Prof. Bell).

R. Nutkanus, Mocino.

Indigenous. Rocky thickets. Shore of Lake Superior (Dr. Pitcher). North shore of Lake Superior (Prof. Ellis). From Thunder Bay to Sault Ste. Marie, Shebandowan Lake, Dawson Route; in woods near Fort St. John, Peace River, and westward through the Rocky Mountains to Quesnelle (Macoun). Saskatchewan Plains (Bourgeau).

R. chamæmorus, L. Cloud-berry.

Indigenous. Sphagnous swamps. Labrador (Brunet, Butler). West coast of Newfoundland (Dr. Bell). New Brunswick (Mathews). Common at River du Loup (Dr. Thomas). Deer Mountains, west of the Arthabasca; Portage between Little Slave Lake and Peace River (Macoun). Greenland, Behring Straits, Unalaschka, Lake Winnipeg (Torr. & Gray).

R. arcticus, L.

Indigenous. Stem low, herbaceous, sometimes diœcious, unarmed, somewhat pubescent, mostly erect, 1-2 flowered; leaves trifoliolate; leaflets rhombic-ovate or obovate, petiolulate, glabrous, obtusely serrated; stipules ovate; sepals lanceolate, acute; petals roundish entire or emarginate; flowers of a deep rose-colour, large; fruit purplish-red. Labrador and Anticosti (Brunet). Newfoundland (Torrey & Gray). North-west angle of Lake of the Woods; marshy thickets west of Fort Pitt, Saskatchewan River; Peace River Plains (Macoun). Rocky Mountains (Bourgeau). Greenland and Kotzebue's Sound (Torr. & Gray).

R. triflorus, Richardson. Dwarf Raspberry.

Indigenous. Cedar swamps and low wet woods. Common throughout Ontario and Quebec. New Brunswick (Mathews). North shore of Lake Superior (Agassiz). Labrador (Butler). West coast of Newfoundland (Dr. Bell). From Thunder Bay, Lake Superior, westward across the continent to Quesnelle in Upper British Columbia (Macoun). Hudson Bay (Torr. & Gray).

R. strigosus, Michx. Wild Red Raspberry.

Indigenous. Thickets and hills. Common in Ontario and Quebec. Newfoundland (Dr. Bell). Labrador (Butler). New Brunswick (Dr. Fowler). Lakes Huron and Superior (Bell, Gibson, Macoun). From Lake Superior westward by Peace River Valley to Quesnelle in Upper British Columbia (Macoun).

R. neglectus, Peck.

Indigenous. Thickets and woodlands. One mile below Shannonville, Hastings County, and frequent in the Counties of Northumberland and Victoria; common at Owen Sound (Macoun). Doubtless frequent through Central and Western Canada.

R. occidentalis, L. Black Raspberry. Thimbleberry.

Indigenous. Rich moist woods and cultivated fields. St. Joachim and Cape Tourmente (Brunet). Island of Montreal (Dr. Holmes). Common in Eastern Ontario (Billings). Below the Mountain, Hamilton (Logie). Chippawa, Malden (Maclagan). County Huron, Ont. (Gibson). Abundant in Central Canada; Owen Sound (Macoun).

R. villosus, Ait. Common or High Blackberry.

Indigenous. Borders of thickets and woods. Common throughout Ontario and Quebec. New Brunswick (Dr. Fowler). Mississagui Island and Bruce Mines, Lake Huron (Dr. Bell). Loon Portage, Dawson Route (Macoun). West coast of Newfoundland; Mississagui Island and Bruce Mines (Dr. Bell).

R. villosus, Ait. Var. frondosus, Gray.

Indigenous. Trailing over rocks in thickets and along fences. Abundant along the Grand Trunk Railway at Shannonville, Hastings County; and at the Carrying Place at the head of the Bay of Quinté (Macoun).

R. Canadensis, L.

Indigenous. Thickets and rocky hills. New Brunswick (Mathews). Rich woods, River du Loup (Thomas). Quarantine Station, Quebec (Brunet). Sandy and rocky places along the River Rouge, Quebec (D'Urban). Borders of woods east of Belleville; and at the Nepigon River, Lake Superior (Macoun). Navy Island, Niagara River (Maclagan).

R. hispidus, L.

Indigenous. Trailing amongst grass in beaver meadows. New Brunswick (Mathews). Woods north of Prescott Junction, rare (Billings). Beaver meadows and marshy flats throughout the northern portions of Addington, Hastings and Peterboro' Counties (Macoun). Nicolet and Niagara (Maclagan). Common in swamps at London (Saunders).

R. castoreus, Fries. (?)

Indigenous.

Rosa, Tourn. Rose.

R. setigera, Michx.

Indigenous. Borders of thickets. Malden (Maclagan).

R. Carolina, L.

Indigenous. Borders of lakes and marshy streams. New Brunswick (Mathews). Weller's Bay Lake, Ontario; North River, Belmont, Peterboro' County; Partridge Lake and Gull Lake, Addington County; swamp near Belleville, Hastings County; shores of Lake Isaac and Pike River, Bruce Peninsula (Macoun). Near Komoka, twelve miles from London (Saunders). St. Catharines, Chippawa and Malden (Maclagan). Whiskey Island, Lake Huron (Dr. Bell). County Huron, Lake Huron (Gibson).

R. lucida, Ehrhart. Dwarf Wild Rose.

Indigenous. Dry soil, or along margins of swamps. New Brunswick (Mathews). Borders of woods, Quebec, Charlesbourg and Labrador (Brunet). Newfoundland (Torr. & Gray). Common in Eastern Ontario (Billings). Rare on Rice Lake plains (Macoun). Fields west of Hamilton (Logie). St. Catharines, Malden (Maclagan). Grand Island, Lake Superior (Prof. Bell). Cape Smyth, Lake Huron (Dr. Bell).

R. blanda, Ait. Early Wild Rose.

Indigenous. Rocks and banks. Common throughout Ontario and Quebec. New Brunswick (Mathews). Newfoundland (Dr. Bell; Torr. & Gray). Manitoulin Islands, Lake Huron (Dr. Bell). North shore of Lake Superior (Macoun). From Fort Garry westward to Quesnelle in Upper British Columbia (Macoun). To Great Bear Lake (Richardson).

R. rubiginosa, L. Sweet Brier.

Naturalized from Europe. Roadsides and thickets. Frequent throughout Ontario and Quebec. New Brunswick (G. F. Mathews).

R. micrantha, Smith. Smaller-flowered Sweet Brier.

Naturalized from Europe. Roadsides and thickets. Vicinity of Hamilton (J. M. Buchan).

R. stricta, Lindl.

Indigenous. Much branched; stems armed with numerous setaceous scattered, often deciduous prickles; flowering branches mostly naked; leaflets 7-9, oval, firm, glabrous, not shining; the petiole glandular-hispid; stipules lanceolate, mostly glandular-ciliate; flowers 1-3, on glabrous or glandular-hispid peduncles; calyx-segments spreading; fruit ovoid, pendulous. *Lindley-Ros. p. 42, t. 7.* North shore of Lake Superior (Agassiz). North and east coast of Lake Superior (Macoun). Plains of the Saskatchewan (Drummond), Whiskey Island, Lake Huron (Dr. Bell). From Fort Garry to Lac la Nun (Macoun).

CRATÆGUS, L. Hawthorn. White Thorn.

C. Oxyacantha, L. English Hawthorn.

Introduced from Europe. More or less spontaneous. New Brunswick (Mathews). Charlesbourg (Brunet). Bank of St. Lawrence, two miles west of Brockville (Billings). Frequent in the Counties of Hastings and Peterborough (Macoun).

C. coccinea, L. Scarlet-fruited Thorn.

Indigenous. Thickets and rocky banks. Common throughout Ontario and Quebec. Up the Kaministiquia River, Lake Superior; Mud Portage, Dawson Route (Macoun). Saskatchewan Plains (Bourgeau). West coast of Newfoundland (Dr. Bell).

C. tomentosa, L. Black Thorn.

Indigenous. Thickets. New Brunswick (Mathews). Lobinière and Montreal (Brunet). Near Prescott (Billings). Rather rare in Central Canada (Macoun), Hamilton (Logie). Rather rare, vicinity of London (Saunders). Rare on eastern coast of Lake Huron (Gibson). Nicolet, Chippawa, Malden (Maclagan). Saskatchewan Plains (Bourgeau).

C. tomentosa, L. Var. pyrifolia, Gray.

Indigenous. Thickets. Michipicoten Island, Lake Superior; American Portage, Dawson Route (Macoun).

C. tomentosa, L. Var. punctata, Gray.

Indigenous. Thickets. Abundant in Ontario. Shallow Lakes. West of Fort Ellice, Saskatchewan Plains (Macoun).

C. Crus-galli, L. Cockspur Thorn.

Indigenous. Thickets. Beaufort, Quebec (Brunet). Niagara and Malden (Maclagan). London, common (Saunders). County Huron, Ont., rare (Gibson). Whiskey Island, Lake Huron (Dr. Bell). Owen Sound (Macoun).

PYRUS, L. Pear. Apple.

P. coronaria, L. American Crab-Apple.

Indigenous. Glades, &c. Common, London (Saunders). Prince's Island, Lake Medad (Logie). Chippawa and Malden (Maclagan). Kettle Point, Lake Huron (Gibson).

P. arbutifolia, L. Var. melanocarpa, Gray.

Indigenous. Damp thickets. New Brunswick (Mathews). Newfoundland (Torr. & Gray). Common, Quebec, Charlesbourg (Brunet). River du Loup (Dr. Thomas). Port St. Francis; St. John's, Quebec; Thousand Islands (Maclagan). Common in Ontario (Macoun, Logie, Saunders, Gibson). North shore of Lake Superior (Agassiz). South shore of Labrador (Butler). St. Joseph's and Cockburn Islands, Lake Huron (Dr. Bell). Sturgeon Lake, Dawson Route (Macoun).

P. Americana, DC. American Mountain-Ash.

Indigenous. Swamps and rocky woods. New Brunswick (Dr. Fowler). Newfoundland (Dr. Bell). Quebec and Charlesbourg (Brunet). River du Loup, common (Dr. Thomas). River Rouge (D'Urban). Nepean Township (Billings), Sparingly found in woods, Hastings and Northumberland Counties; Owen Sound and north shore of Lake Superior (Macoun). St. Joseph and Cockburn Islands (Dr. Bell). Labrador (Butler). Maline Rapids, Dawson Route (Macoun). Saskatchewan Plains (Bourgeau).

AMELANCHIER, Medic. June-Berry.

A. Canadensis, T. & G. Var. Botryapium, Gray. Service Berry.

Indigenous. Along streams. Very common throughout Ontario and Quebec. New Brunswick (Mathews). Newfoundland (T. & G.) North shore of Lake Superior (Agassiz, Macoun). Manitoulin Islands, Lake Huron (Dr. Bell).

A. Canadensis, T. & G. Var. oblongifolia, Gray.

Indigenous. Along streams. Cape Rouge (Brunet). New Brunswick (Dr. Fowler). Common at River du Loup (Dr. Thomas). Lake Medad (Logie). Along the Kaministiquia River, Lake Superior, westward through Peace River Valley (Macoun).

A. Canadensis, T. & G. Var. oligocarpa, Gray.

Indigenous. Along streams, swamps, &c. Cape Rouge (Brunet). New Brunswick (Dr. Fowler). Common at River du Loup (Dr. Thomas). Cedar swamp north of Norwood, rare; Fishing Islands, Lake Huron (Macoun). South coast of Labrador (Butler). Newfoundland, Hudson's Bay, Saskatchewan Plains (Torrey & Gray). Loon Portage, Dawson Route (Macoun).

SAXIFRAGACEÆ.

Ribes, L. Currant or Gooseberry.

R. Cynosbati, L.

Indigenous. Abundant in thickets and pasture fields. Common at Lotbinière (Brunet). Common in rocky woods, River Rouge (D'Urban). Nicolet, Montreal? Kingston, Niagara, Malden (Maclagan). Common throughout Ontario as far west as the Bruce Peninsula.

R. oxyacanthoides, Linn.

Stems usually clothed with bristly prickles; subaxillary spines 1-3 often united at the base; leaves roundish, subcordate 5-lobed pubescent or nearly glabrous, the lobes deeply toothed or crenate; peduncles very short, about 2-flowered, calyx-tube cylindraceous, pubescent at the base within; the segments spreading, rather longer than the stamens, and about twice the length of the obovate petals; style cleft to the middle, hairy at the base, a little exceeding the stamens, fruit smooth. Indigenous. Rocky margins of rivers and lakes. Abundant in New Brunswick (Fowler). Quarantine Station and Anticosti (Brunet). Red Bay, Lake Huron; Sault Ste. Marie; Thunder Bay and Pie Island, Lake Superior; Island in the Lake of the Woods; Saskatchewan Plains and westward to Stewart's Lake, Upper British Columbia (Macoun).

R. hirtellum, Michx.

Indigenous. In wet meadows and swamps, also amongst rocks in the north. New Brunswick (Fowler). Quebec, on rocks, Saguenay, and at the Quarantine Station (Brunet). Along the sea shore, River du Loup (Thomas). Common in marshy meadows around Belleville; Owen Sound; around Lake Superior; Fort Edmonton on the Saskatchewan and Fort Assinaboine on the Arthabasca (Macoun). Mississagui, St. Joseph and Cockburn Islands, Lake Huron (Dr. Bell).

(To be Continued.)

SOME CANADIAN NOMS-DE-PLUME IDENTIFIED:
WITH SAMPLES OF THE WRITINGS TO WHICH THEY ARE APPENDED.

BY HENRY SCADDING, D.D.

(Continued from page 348.)

[My specimens of the writings of Patrick Swift should have preceded those given of the productions of Legion and Cinna.]

About the year 1826 or 1827, there appeared in the *Colonial Advocate*, a well-known Canadian paper of the day, a name which became subsequently a *nom-de-plume* of great note, if not notoriety, in Upper Canada. In the first instance, I believe, Patrick Swift figured simply as an interlocutor in an imaginary conference on public affairs, held in a private parlour at Toronto, or York, as the place was then called. But he afterwards appeared as the supposed compiler of a remarkable almanac, which for several successive years found its way into probably every house in Upper Canada. This publication had a purpose, independently of the use implied by its title. It was intended to advocate a radical reform in the government of the country. Patrick Swift addressed himself especially to the yeomen voters of Canada; and his pages bristled, not only with statistics of almost every kind, but with grievances and abuses, curtly and pointedly stated. At the same time the remedies were named as clearly and as plentifully. On looking calmly back now on the times in which this almanac was issued, we shall all allow that Mr. Patrick Swift was not so bad a counsellor of the public as he was once represented to be. Borrowing an idea from Benjamin Franklin, the earlier numbers of this publication were entitled "Poor Richard," with the secondary heading of "The Yorkshire Almanac," with reference possibly to the Canadian county of York, in which York or Toronto was situated. The name of the author or editor is given on the title-page, thus: "Patrick Swift, late of Belfast, in the Kingdom of Ireland, Esq., F.R.I., grand-nephew of the celebrated Doctor Jonathan Swift, Dean of St. Patrick's, Dublin, etc. etc." In later issues it appears as "Patrick Swift, Esq., M.P.P., Professor of Astrology, York." The Almanac for 1834 has dropped the "Poor Richard," and also the reference to "Yorkshire," and exhibits the fuller title of "A New Almanac for the Canadian True Blues, with which is incorporated the Constitutional Reformer's Text Book, for the Millennial and Prophetical year of the Grand General Election for Upper Canada, and total and everlasting downfall of Toryism in the British Empire."

I now proceed to give a specimen or two of Patrick Swift's style as a propagandist of Reform. After giving a long and most minute enumeration of taxes imposed in England, Scotland and Ireland, he tells the Canadian yeomanry: "In short, everything that has an existence on the face of the earth, or under the earth, or in the firmament of heaven, is heavily taxed; and these enormous taxes are laid on and expended by a body called the House of Commons, the majority of the members of which are neither directly nor indirectly the representatives of the people, but are the nominees of lords, bishops, and wealthy gentlemen. So that, if the representatives of every great county, city and populous borough in England, Ireland and Wales, were to vote for a reduction of standing armies, tithes and taxes, and for retrenchment and economy, the rotten borough and Scots close county members could and would outvote them, and uphold corruption. Yorkshiremen in Upper Canada," Swift exclaims, "think on these things! Laws grind the poor, when rich men make the laws." This, it must be noted, was written in 1831.

Then, after an analysis of the Upper Canada Parliament of 1831, showing the nationality of each of its fifty members and the numbers represented by each member respectively, he points out an injustice which seems to result from the existing distribution of seats: "The population of Upper Canada," he says, "is estimated at 215,750, which is under the actual number of souls. Assuming the fact," he continues, "that the property is in proportion to the population, and then taking population as the basis of representation, fifty members would give one representative to every 4,315 inhabitants. But, according to the present mode of proportioning the members, the minority pass laws to bind the majority. For: The members of the four towns, and for the counties of Simcoe, Durham, Essex, Kent, Wentworth, Norfolk, Oxford, Stormont, Dundas, Ottawa, Haldimand, Frontenac, and Hastings, are in number 26—the population they represent being 70,500—while the remaining counties of the province, containing 145,250 inhabitants, are represented by only 24 members, or less than half the house. Thus the representatives of less than one-third of the people are more in number than the representatives of the other two-thirds. Again: the counties of Norfolk, Dundas, Hastings, Frontenac, Simcoe, Haldimand, and Essex, and the towns of Brockville and Niagara, with half the county of Durham, possess a population of 33,250, and send 15 members to the House of Assembly—while the counties of York and Carleton, with a population of 33,500, send only three members; so that, if by a popular legislative body it is meant to obtain an expression of public opinion on matters of government, the three votes of Messrs. Morris, Ketchum and Mackenzie are a greater indication thereof than the fifteen votes given for the places before mentioned."

In the Almanac of 1834 an elaborate scheme is presented for a thorough organization of the Reformers of Upper Canada. Directions are given for the formation of "Central Committees, Town, County and Provincial Conventions, and Regular Nominations," as "the sure legal Weapons by which Reformers may Triumph." The closing exhortation is: "It must not discourage the Reformers of any township, if they happen to find themselves in the minority as compared to the other inhabitants. Let them meet, few and small as they may be, and observe the above usages, the same as if they counted thousands. Time, which does much, is in their favour: they may be sure that Upper Canada will form no exception to the other parts of this continent: liberal principles must prevail: freedom is indigenous in our soil." To the whole document is quaintly added: "*Sic subscribitur.* Patrick Swift."

A brief summary of principles given just before will be of interest, as it will be seen that all of them have been accepted and incorporated in our existing provincial constitutions, with the exception of the one which Patrick Swift himself at the moment did not care to press. "The Reformers," he says, "are to be known by their principles, which are: the control of the whole revenue to be in the people's representatives; the Legislative Council to be elective; the representation of the House of Assembly to be as equally proportioned to the population as possible; the Executive Government to incur a responsibility; the law of primogeniture to be abolished;

the principle of Mr. Perry's Jury Bill to be adopted; the Judiciary to be independent; the Military to be in strict subordination to the Civil authority; equal rights to the several members of the community; every vestige of church-and-state union to be done away; the lands and all the revenues of the country to be under the control of the country; and education to be widely, carefully, and impartially diffused. To these I would add that we ought to choose our own Governors; but I know that there are some Reformers who have not made up their minds upon that question: I therefore advise it be not pressed." In regard to the exception named, he expressed himself in another part of the Almanac, thus: "Patrick Swift would very willingly exchange General Colborne for a Governor such as is pictured in the following anecdote: A late number of the *London Courier* contains the following extract of a letter from America: 'I am travelling in Vermont State for pleasure and information. I have journeyed 500 miles in my own carriage, by easy stages, and have not seen a single person in my progress to whom I should have dared to offer alms! As I was detained an hour or two a few days since, I saw a sturdy-looking farmer pass the inn, driving a one-horse cart loaded with wool, on which he was seated. He drove to a store, shouldered his bales of wool, one after another, and placed them in the merchant's shop. Who do you think he was? Palmer, the present Governor of the State of Vermont.'" This story would, of course, be well relished by the majority of those for whom the Almanac was prepared. The second edition of the number for 1834 has an exasperating dedication. It is addressed to three gentlemen who were the writer's most formidable political antagonists; two of them in England, one here. It reads thus: "To E. G. Stanley and R. W. Hay, Secretaries of State for the North American Colonies, and John Beverley Robinson, Judge and Tory Politician, at York, in Upper Canada, to whose uniform support of oppression and misrule in Church and State, and steady friendship for Canada's and Ireland's oppressors, the public are chiefly indebted for this extra edition of twenty thousand 'Canadian True Blue Almanacs:' it is specially dedicated and inscribed by their trusty and well-beloved cousin and councillor, Pat. Swift." "E. G. Stanley" was subsequently the well-known Earl of Derby. It is scarcely necessary to mention, after all this, that Mr. Patrick Swift was Mr. William Lyon Mackenzie, editor of the *Colonial Advocate*, and many times elected a member of the Provincial Parliament of Upper Canada.

[My notice of "Reckoner," "Mentor" and "Mercator," should have been inserted before, among the writers on miscellaneous subjects.]

I regret that I am unable to give a sample of "Reckoner," the author of seventy essays on various subjects, said to have appeared in the *Kingston Gazette*, *circa* 1811. This writer was the Rev. Dr. Strachan, while yet a resident at Cornwall. I have seen communications from the same pen, in the *Christian Recorder* and the *Canadian Magazine*, signed N. N., the finals of the writer's real name. I must record also the pseudonym of "Mentor," appended to a series of letters in the *Kingston Herald*, 1839–44, afterwards collected in pamphlet form. They are a contribution to the literature of Canadian jurisprudence on the subject of discrepancies in lines of survey, arising from variations in the magnetic needle in successive years; a curious and dry subject, but yet of much interest, in Canada, to the numerous patentees and grantees of land, and even affording occasion now and then for a rhetorical burst, as, for example, here: "This province was the asylum," Mentor says, "provided by his Majesty George the Third, of revered memory, for faithful and attached subjects, who, after their settlement in a wild and uncultivated wilderness, soon experienced the liberality of a generous and just sovereign. His munificent donations of land, in compensation for their losses in property, and supplies for the three first years of the settlement, amidst obstacles and difficulties nearly insuperable, are not equalled in the history of any people or nation under any other government. With a recollection of these rewards, and under a sense of their legal and just rights, the author, under the signature of Mentor, is fully aware and sensible that the Loyalists, their heirs and descendants, do and will regard usurped occupancy, and illegal possession, and encroachment upon their patented rights and estates, with feelings of indignation and discontent towards the holders by injustice and spoliation; but towards the Government they will cherish the feelings of gratitude and loyalty; and moreover, they will justly appreciate the legacy of land left to them by their fathers, and to which they will adhere with associations of fond attachment." "Mentor" is understood to have been the Rev. George Okill Stuart, heir to lot 24 in the first concession of Seigniory No. 1. (afterwards known as the township of Kingston), as surveyed by Deputy Surveyor-General Collins, in 1783.

The series of letters signed "Mercator," addressed to the *Montreal Herald* in 1807, in the "Contest between the Earl of Selkirk and the Hudson's Bay Company on the one side, and the North West Company on the other," and afterwards issued in pamphlet form, was from the pen of the Right Hon. Edward Ellice.

I notice next one or two writers under pseudonyms whose object was the promotion of emigration and the instruction of emigrants. I enclose them in my list, however, not on this account, but because the productions themselves, being of a superior character in point of matter and style, may be said to have entered into our Canadian literature. First I name the "Backwoodsman," author of a volume entitled "Statistical Sketches of Upper Canada;" published in London by John Murray, Albemarle Street, in 1832, but dated from Goderich, on Lake Huron. The nine chapters of the little work are filled with useful statistics and matter-of-fact information, but all cleverly spiced throughout with pleasant humour. Backwoodsman undertook its composition because he was constantly in the receipt of inquiries, couched of course in polite terms, and expressing the writer's sincere sorrow for taking up so much of his valuable time: "After having filled some reams in answer," Backwoodsman says, "and when every other packet brought one, and no later than last week I had two to answer, things began to look serious, and so did I; for I found that if they went on at this rate, I should have no 'valuable time' to devote to my own proper affairs. And therefore, it being now midwinter," Backwoodsman says, "and seeing no prospect of my being able to follow my out-of-door avocations for some weeks, I set myself down in something like a pet to throw together and put in form the more prominent parts of the information I had been collecting, to the end that I might be enabled in future to answer my voluminous correspondents after the manner of the late worthy Mr. Abernethy, by referring them to certain pages of *My Book*."

Here is one of Backwoodsman's reasons why emigrants from the British Islands should prefer Canada to the United States:

"It is to many who happen to have consciences no light matter to forswear their allegiance to their king, and declare that they are willing to take up arms against their native country at the call of the country of their adoption; and unless they do so, they must remain aliens for ever; nay, even if they do manage to swallow such an oath, it is seven years before their apostasy is rewarded by the right of citizenship. In landing in His Majesty's dominions, they carry with them their rights of subjects, and, immediately on becoming 40s. freeholders, have the right of voting for a representative."

Some tables at the end of the volume, showing the resources and estimates of the Province of Upper Canada in the year 1832, would, if quoted at length, amuse probably as well as instruct, in these days when, to a Canadian minister of finance even in a province, such figures must seem a mere bagatelle. Here are Backwoodsman's conclusions on a review of these tables. He considers the prospects they hold out to be encouraging. He indulges, at the same time, in a little banter on the wisdom of the Upper House, which, it would seem, had just stopped the supplies, and that too at an inopportune moment. The remark about the consequent increase in the surplus is probably a joke.

"From these statements it will appear," he says, "that the revenues of the colony are in a very flourishing state; as last year we paid off 10 per cent. of the public debt, and this year, the Upper House having rejected the supplies on nearly the last day of the Session, when the mischief could not be remedied, it is probable the surplus will be considerably greater. It has been eloquently said of the Earl of Chatham, that he 'advanced the nation to a high pitch of prosperity and glory by commerce, for the first time united with, and made to flourish by war.' In like manner, though by no means Chathams, the legislators of Upper Canada have, for the first time I suspect, succeeded in uniting revenue with debt, and making it flourish by debt; for it will be seen that the debts of the province have been contracted chiefly for the purposes of public improvement, and that the public works, as they develop themselves, will not only repay the money expended on them, but become a permanent source of revenue to the colony. Of the £47,490," he goes on to say, "of taxes raised on the subject, directly and indirectly, we may estimate that £10,000 is paid by the United States for British goods smuggled across the frontiers, leaving £37,490 as the whole of the provincial taxes to be paid by 300,000 people,—that is to say, in even money, about 2 shillings sterling a head. So that, it appears, Brother Jonathan, with all the apparent economy of his institutions, pays to his general and particular governments ten times as much as we do; and unfortunate John Bull, who, poor fellow, is much worse able to afford it, just about twenty-five times as much."

"Backwoodsman" was Dr. William Dunlop, a distinguished contributor to Blackwood and Fraser long before his settlement in

Canada,—to the *former*, under the *nom-de-plume* of Colin Ballantyne, R.N. His early life was full of adventure in India, and, previously, on this continent, as a surgeon in the Connaught Rangers, during the war of 1812–13–14. He was also widely known by the sobriquet of the *Tiger*, for his having succeeded in clearing the island of Saugur, in India, of that pest. Dr. Dunlop died at Lachine in 1848. A fine portrait of him exists in Toronto, the property of the late Capt. Dick. It was to be seen at the Queen's Hotel in Toronto.

In 1849, a writer assuming the pseudonym of a "Pioneer of the Wilderness" produced two volumes of notes on Upper Canada, under the general title of "The Emigrant Churchman." Richard Bentley was the publisher. As a well drawn picture of western Canada at the time, it retains considerable value. "The Pioneer" was a man of superior education, a keen observer, and a skilful writer. Here is what he had to say of Brockville and the Thousand Islands: "A few miles steaming, after leaving Prescott, brought us to Brockville, which, to the author's taste, presents one of the prettiest and most interesting localities on the river side in all Canada. It is situated upon rather a steep bank, the approach to the town being prettily overshadowed by trees, amongst which the church stands a conspicuous object. A little further on, the river abounds with the prettiest rocky islets, most of them wooded more or less, among which, on a fine summer afternoon, the white sails of tiny pleasure-skiffs may be seen gleaming here and there, giving visions of health and innocent aquatic recreation. What a spot for a few Cambridge or Oxford eight-oars to turn out in! The effect of the handsome boating uniforms of the crews, and perfect appointment of the galleys of Cam or Isis, with the gay blazonry of their silken ensigns floating in the wind, the boats dashing bravely up to their stations, or shooting with racer-like velocity through the varied scene of isle and wooded bank and river, amidst the cheers of admiring thousands, was all that was wanting to complete the vision to the eye of an English University man. I am not aware," the Pioneer adds, "whether this right manly and gallant exercise is followed with any ardour by the University of Toronto. The open shores of Lake Ontario are wanting, however, in the diversity of beauty presented by the scenery around Brockville; and while we yet muse we are dashing and splashing on till islet after islet, rocky and grove-crowned, sweeping into view in lovely and still varying succession, proclaims our approach to the far-famed Lake of the Thousand

Islands. Of all the exquisite scenery that it has been the author's privilege to gaze upon, nothing that he can remember approaches this in beauty. As we shot through the open narrow and intricate channels of this watery paradise, the scene was reposing in all the luxurious softness of a gorgeous Canadian autumnal sunset. And as the glowing beams poured their bright torrents of radiance through natural watery vistas, or turned the liquid expanse to molten gold, the glorious islets seemed at times to float in light, realizing the dream of some fairy scene of paradise. Sometimes we would shoot past a spot of exquisite beauty, almost touching the shore; anon, just as our liquid pathway appeared entirely closed in, we would sweep off at an angle and open another unexpected channel, or catch a glimpse of the main-land as we wended by some bay of surpassing outline, heavily fringed with wood, all gloriously parklike to the water's side, holding forth happy visions of many a calm retreat and home of peace and love, when the axe and the plough of the colonist should have carved out an abode where the lines were fallen indeed in pleasant places. Around on the other side, a long sweep of a bay would open up towards the American shore, where it is too difficult at times to distinguish earth from water, or air from either, so softly were the lights and shadows blended; and then the channel would narrow again, until at length we brought up to take in wood at the wild-looking settlement of Gananoque."

This "Pioneer of the Wilderness," who travelled over the country with a *bonâ fide* intention of selecting a home within its borders, was a clergyman of the Church of England, named Rose. His decease occurred not long after his settlement here.

Also, in 1849, there was published in London by David Bogue, Fleet Street, a volume of "Sketches of Canadian Life, Lay and Ecclesiastical"—having on its title page, as the designation of its author, "A Presbyter of the Diocese of Toronto." This was a work intended for the benefit and information of emigrants, not of the humblest class. It is a series of pictures, cleverly and vividly drawn from the life, linked together by means of a story, giving the supposed experiences of Harry Vernon, an English gentleman's fourth son, who takes a "lot" of land in a backwoods township called Monkleigh. The following passage describes an unfortunate species of settler, still perhaps not unknown in certain parts of Canada: "They were generally persons of education, and members of highly respectable families, who had been brought up to do nothing, and who, on arriving at man's estate, found *that* an occupation in which they could not afford to continue. As they found themselves fit for nothing in England, they, or their friends for them, resolved that Canada should have the benefit of their talents and usefulness; but, alas! in a majority of instances, those who were fit for nothing at home were observed to possess the very same characteristics abroad. Others of them, again, had acquired wild and repulsive habits, and after nearly rendering their fathers bankrupt, both in purse and patience, were sent out with a few hundred pounds to Canada, to reform and provide for themselves—a most sage and sagacious plan! and one which, almost without an exception, was productive of but one result, namely, the utter ruin of the class alluded to. Freed entirely from all restraint, they gave way to the most miserable dissipation, and then wrote home romantic fictions of their exertions and good behaviour, in hopes thereby to 'do the governor' out of a fresh remittance. Many of these young men, under the impulse of novelty, set to work vigorously along with their men, but being utterly unaccustomed to such employments, the solitary charm which it possessed soon disappeared, and they were glad to seek excitement and amusement wherever it could be found. Almost the only place where it could be looked for was at each other's shanties, where they would frequently congregate," etc. "The Presbyter of the Diocese of Toronto," who embodied the results of his own observation in these truthful and graphic sketches, was the Rev. W. Stewart Darling.

The educational question in Canada some thirty or forty years since presented a tangled web of difficulties to statesmen and philanthropists. How to maintain with consistency the theories of public education which hitherto had been almost exclusively acted on in the mother country, and how at the same time to meet the evident necessities of the composite people which was rapidly taking possession of British North America, was a problem discussed again and again, and the most gloomy consequences were foretold of variation from established traditions and routine. Happily at last the *solvitur ambulando* method was applied to the question; with the results—surely not disastrous—which we see around us at this day. Of the *noms-de-plume* attached to contemporary brochures on the subject of education of more than ordinary note, I select three: "Graduate," "Scotus," "British Canadian." Graduate's memorable brochure, entitled "The University Question Considered," appeared in 1845, and it essentially helped to defeat a bill which was brought into the House in that year affecting the charter of King's College. The sample which I give of Graduate speaks of the necessity of repose for the well-being of learned societies. I do not know that the delightful dream indicated was ever realized by the learned society whose tranquillity was at the moment disturbed. "Frequent changes are injurious to any establishment," Graduate says, "but ruinous to a University. It is impossible that the objects of such an institution can be attained if it be subjected to repeated modification. Alterations, if often introduced even by its own authorities, are most prejudicial to its welfare; but the very anticipation of external interference in its management would produce the most mischievous effects. *Non solum adventus mali, sed etiam metus ipse affert calamitatem.* Repose is absolutely essential to its success; if disturbed, or even liable to be disturbed, it must fail. Its pursuits are such that they cannot be successfully prosecuted without peace and tranquillity. They require a devotion of the mind which cannot exist if apprehensions of change are constantly obtruding themselves, and every member of the establishment would feel the pernicious influence of this dread. The governing body would shrink from the responsibility of adopting any system as permanent which they knew not when they might be compelled to change; the professors would be paralysed in the discharge of even their routine duties, and instead of enjoying the liberty, or feeling the inclination to prosecute the favourite subjects of their study during their leisure hours, would be reduced to the miserable necessity of employing them in efforts to conciliate or struggles to resist the spirit of innovation; whilst the students would refuse to submit to discipline attempted to be enforced by those whose authority they knew might be abrogated or superseded by a power capable of revolutionizing the whole system and establishment." The "Graduate" who thus, at a troubled period of our local history, urged on legislators and others the indispensable necessity of establishing tranquil surroundings for a seat of learning, is to be identified with the writer whom we have already seen, as "Maple-leaf," inaugurating amongst us a higher literature, the Rev. Dr. McCaul.

A noticeable series of letters on educational topics appeared in the *Hamilton Gazette* about the year 1850, subscribed by the *nom-de-plume* of Scotus. They were exceedingly well written, and deserved to be collected, as they were, in pamphlet form. They repay perusal still, being a valuable contribution, on the conservative side, of the vexed question of religious education. As a specimen of Scotus, I select a passage containing a view somewhat opposed to a popular notion on the subject of education; and also the statement of a fact connected with Scotland which is not generally realized:

"In order to raise up a national system of education in any country," Scotus says, "instead of beginning at the bottom and ascending upwards, you must reverse the order and begin at the top and descend downwards; or, in other words, you must first erect a noble university, filling its chairs with men illustrious in science and literature, and thereby create in the public mind a TASTE for learning in its highest departments; and afterwards, the inferior schools will follow as a matter of course. Or, to make use of a simile, the supplying of a country with education may be likened to the supplying of a great city with water,—the first step in the business is to erect a great reservoir or fountain-head, from which the lesser streams may be diffused in all quarters. The foundation on which I rest my argument is, I humbly conceive, sound and obvious. Literature and science are things for which there is naturally no demand, GENERALLY, in the public mind in any country. A taste for these refinements of civilization must, therefore, be first created by, as it were, a forcing process, and until that taste is so created, you may set about the erection of Common or District Schools till the end of time, but will find that all your labours have been vain and fruitless. * * * I am quite aware," Scotus then goes on to say, "that it is quite common to hear persons state, in reference to Scotland, that she owes all her education to her Parish Schools. A more ignorant assertion was never made. Scotland, and I flatter myself I know her well, owes all her education, PRIMARILY, to her Universities; and it may with safety be affirmed that had not these venerable fountain-heads of learning been first erected by the piety and munificence of her Kings and Churchmen, such an establishment as a parish school in Scotland would never have had an existence."

Our Scotus was Mr. David Burn, formerly Deputy Registrar for the county of Wentworth. The pamphlet containing his collected letters is entitled "Colonial Legislation on the Subject of Education."

I next mention the *nom-de-plume* of "British Canadian," attached to a long series of communications in the *Hamilton Spectator* some twenty years ago: treating ably of a great variety of public matters; among them, of education. I give as a specimen of "British Canadian" a short extract, which will serve to show the agitated state of the public mind on the subject of education in 1851. He strongly opposes, under the circumstances of the country, the retention of a faculty of theology in the national university. He says: "It is with difficulty that the great English universities retain their exclusive religious character: and surely it is needless to attempt to raise up such an institution in Canada, after the experience we have already had. Canada, which glories in its British parentage, is happily placed at such a distance from the seat of empire, that we can contemplate the throes of church and state corruption, if not without fear, at least not without warning: for just in proportion as the church derives support from the state, *i.e.* from the endowments of public property, so is the danger of religious commotion and sectarian enmity. This cannot be fostered by surer means than by the establishment of an exclusive university." "British Canadian," nevertheless, advocates a genial intermingling of religion with common affairs. On this point, he delivers himself thus, in Letter cxvii., wherein he draws a picture of the ways of the world, only too truthful: "Many persons, I am aware," he says, "are opposed to the introduction of religion in politics. Not because they are averse to religion, but because they consider it a subject too sacred to be mixed up with the news of the day. Politics with them is the business of the day: religion relates to eternity. In other words, all their talents and energies they devote to those objects which seem to promise worldly prosperity: and their hours of ease and lassitude they devote to religion. How mistaken such persons are, in separating religion from the more immediate business of their lives, I need scarcely point out. Suffice it to say, that by so doing they run the risk of losing the substance, while they are pursuing the shadow. Six days they labour, with no higher object in view than to increase their worldly store: the seventh day they generously devote to their soul's ease. They go to the house of God for an hour or so, and having criticised the sermon, the duties of religion they consider fulfilled: and they devote the rest of the week to secular affairs and politics. I admit that a newspaper is not the place where we should look for a sermon or discourses on the necessity of prayer and the virtues of a holy life; but there are circumstances connected with religion which render it not only proper, but which imperatively call upon us to take notice of them, and to urge them upon the consideration of our fellow-subjects. These circumstances exist in Canada West at the present moment." (This in January, 1851.)

The letters of "British Canadian" were from the pen of the late Mr. Edward Ermatinger, of St. Thomas, author of a valuable and interesting "Life of Colonel Talbot, and History of the Talbot Settlement."

I am now, finally, to identify some *noms-de-plume* which from time to time in the past have been appended to poetical productions of note in our Canadian periodicals, and to give samples of each. In accomplishing both portions of this part of my undertaking, I shall aim at brevity.

1. The first of my poetical *noms-de-plume* is that of "Roseharp." In 1823, a literary magazine was issued for a short time at York (Toronto), entitled "The Roseharp; for the Encouragement of Loyalty, Genius and Merit;" and in Fothergill's *Weekly Register* there were occasional communications in verse, subscribed "Roseharp." Here is a specimen, dated Jan. 8, 1824:

O where was Prudence, cautious power,
  When first my venturous youth began?
She came not to the Muses' bower,
Where passed I many an idle hour,
  To tell of life's short fleeting span;
Nor did she prophesy of woe
To chill my heart's impetuous glow.
  "But thou, O Hope, with eyes so fair,
    What was thy delighted measure?
    Still it whispered promised pleasure,
  And bade the lovely scenes at distance hail."
This was my favourite minstrel's song.
  My morn like his was fair and bright—
Then Hope with Pleasure danced along,
  And gave me visions of delight;
Then wildly throbbed each pulse at thy sweet smile:
O linger yet, sweet Hope, with me awhile.

The originator of the "Roseharp" miscellany, and the writer of the "Roseharp" pieces, was Mr. James M. Cawdell, attached for a time, in some capacity, to the Law Courts at Toronto, and formerly an officer in the army.

2. In 1825, also from the press of Charles Fothergill, appeared a rather elaborate poem entitled "Wonders of the West, or a Day at the Falls of Niagara," by "A Canadian." The *dramatis personæ* of the story are some French tourists. The metre and style are those of Scott's *Lady of the Lake*. Incidentally we have the following

lines in honour of Col. Nichol, recently killed by accidentally driving in the darkness of the night over the precipice at Queenston.

Nichol, the sympathetic tear shall flow
From all who knew thee, and from all who know
That, snatched in the prime of life from all that binds
The heart to earth, and gives to human minds
A wish to lengthen out existence here,
From fortune, friends, and family most dear,
Ambition's prize, nay, merit's claim, in sight,
Which thou had'st amply earned, both day and night,
With unremitting toil and anxious care,
Serving the country both in peace and war.
When thou had'st reached the summit and prepared
To cease thy toil, and reap thy just reward,
Thou wast, that moment, from the summit hurled
To be rewarded in another world.
Thy widowed mourner weeps, nor weeps alone—
A country's grief re-echoes to her moan;
Weeps for her statesman and her hero dead,
Nor hopes to find an equal in his stead.

"A Canadian" was Mr. James Lynne Alexander, afterwards a Clerk in Holy Orders.

3. "Erie-us" was a signature attached to poetical pieces in our local periodicals in and before 1838. I quote part of a "Eulogy on Sussex Vale in New Brunswick," thus subscribed :

Fanatic and hypocrite, disfigured in face,
Rant, cant, sect and radical, here find no place
The social relations to set all ajar,
And the sweets of a rational intercourse mar.
The politeness of kindness, the confidence fair,
Of integrity meek, unassuming,—the air,
The port, manner, habit, and action of truth
And true manliness, wrought into childhood and youth.
The graces of goodness unshackled by art;
The large hospitality warm from the heart;
The walk circumscribed by the duties of life;
These duties fulfilled without envy and strife.
Oh, sweet vale of Sussex! such things did I see
In thy children, the loyal, the happy and free;
And I praised the good ways that our forefathers trod,
For the building of man in the peace of his God.

I give another sample of Erie-us, taken from a poem of his of considerable length, written in 1818, and entitled "Talbot Road." It commemorates the patriotism and energy of Col. Talbot, the local eponymous hero: it describes the rise and progress of the settlement; its devastation by invaders in 1812; its rapid recovery. I select the writer's brief recapitulation towards the end of his poem. It reads like a passage from Drayton's *Polyolbion*. Occasionally a primitive local name, as Catfish Creek, is ill-adapted to poetic purposes. Thus Erie-us sings:

In Norfolk county, first the Talbot street,
East, makes its course through Middleton complete;
Thence into Middlesex, through Houghton gore,
And thence through Bayham, (where was marked before
A bridle-path)—thence Otter Creek comes down
From Norwich, lengthwise, nearly through the town,
On which, e'en now, the oar fair Commerce plies
And the first efforts of her empire tries—
Earnest of future wealth. Next, alongside
Is the fine thriving town of Malahide,
In which famed Catfish has its eastern source
And spreads the richest bottoms in its course.
Wellington mills, late-built, on Catfish stand,
To answer agriculture's loud demand;
A work substantial, such as should be found
Where a fine growing country stretches round.
In order next upon the list appears
Yarmouth, whose fame has filled ten thousand ears,
For beauteous plains, rich soil, translucent rills,
Its rolling surface and its verdant hills;
Its waving cornfields and its meadows gay,
Where bleating flocks already bound and play;
A town, St. Thomas, is in Yarmouth laid,
On a bold bank by Kettle river made,
O'erlooking the broad vale which 'neath it lies—
A striking picture in the traveller's eyes.
Southwold succeeds, in which the North Branch road
Turns off to Westminster, as has been show'd:
Next Dunwich, ending Talbot Road the East,
From whence it is denominated West.
Next Aldbro'. Now the reader must be sent
From Middlesex into the county of Kent:
Then follows Orford, &c.

"Erie-us" was Adam Hood Burwell, afterwards Col. Burwell, after whom Port Burwell on Lake Erie is named..

4. I have already given a poetical quotation from "Cinna," and identified the writer. That was from a piece in the style of Hood. I now give a few lines from a song in graver strain, by the same hand:

I trembled when her warbling voice
  Poured forth the tide of song,
And bade the admiring hearts rejoice
  Of all the listening throng.
Wealth ceased the while to sum his
  To catch the thrilling lays; [pelf,

And pride forgot his dream of self
  To utter words of praise.
The worm the rose's petals fold,
  Gnaws at its inmost core,
And love that never must be told
  Consumes the heart the more.

5. In 1843, "Plinius Secundus" published at Toronto his "*Curiæ Canadenses; or*, the Canadian Law Courts: being a Poem describing the several Courts of Law and Equity," &c. The writer adopts the Hudibrastic style. Thus he proceeds:

A Common Pleas was there erected,
Where Subject's Rights should be protected.
Then a Queen's Bench forthwith arose,
The Suitors' injuries to dispose,
With a Chief Judge and Puisnes four,
At every Term to ope the door:
Four times a year beginning Monday,
And always ending next to Sunday;
Cum Banco Sittings for Judgments, Pleadings
To be digested after readings,
And as *mortalium nemo sapit*,—
Appeal Court then the Record *capit*,
Where great and gravest heads do meet,
To make the Law still more complete.
Then skill and science to acquire,
Experience and forensic fire,
A Practice Court behold appended,
That Forms and Rules may be amended
Now, too, is heard from legal forts
A regular volley of *Reports*,
After command from Osgoode's Benches,
And charge from Chiefs in open Trenches.

The following lines enumerate the places of public resort to which the Judges may betake themselves, if they will, during Vacation:

Thrice happy soil, where, without measure,
Enjoyment may flow o'er with pleasure!
For Saratoga, or its drinks,
The Whirlpool or Niagara's brinks,
Or Caledonia's far-famed springs,
Or the ten hundred sparkling Rings
That deck St. Lawrence mighty river,
Guarding its spangled tide for ever,
The Judge from toil may well relieve,
Until his wonted strength retrieve.

"Plinius Secundus" was Mr. John Rumsey, an English attorney, who made Canada his home for a short time.

6. A writer in our periodicals in 1843 assumed the name of the poet who figures in Sir Walter Scott's *Pirate*, who had "once taken a pinch of snuff out of glorious John Dryden's snuff-box, and never suffered his friends to forget it"—Claud Halcro. I transcribe his "Crusaders' Hymn before Jerusalem:"

Now onward! for our banners in the wind are waving free,
The Sultan's troops are streaming forth like to a surging sea;
"God wills it!" is our battle-cry—Jerusalem our prize;
We couch the lance, we wield the sword beneath our monarch's eyes.
Hark! from the city of our God, our Saviour's hallowed shrine,
The Saracen's bold music floats, the silver crescents shine!
The Infidels have stalled their steeds within her sacred walls;
To draw the sword, our Christian faith—our knightly honour, calls!
The sun is up—on tower and wall he gilds the flashing spear;
But the Lord of Hosts is with us! Shall Christian warriors fear?

Raise not the lance, nor stay the sword from slaughter of the foe—
Peace offerings to the Holy Shrine the Moslem's blood shall flow!
Think on the weary pilgrim, o'er the long and toilsome way
Who dragged his limbs to Salem's walls his pious vows to pay!
Just Heaven! the blighting breath of war surrounds the sacred fane!
His humble prayer is laughed to scorn, his march of toil is vain!
Look on the holy city, that hath kissed a Saviour's feet,
E'en there the unbelieving dog with scorn our prayers would greet!
Then spur the steed, and brace the arm, and fling defiance high,
For the trumpet call hath sounded, and the turbaned host is nigh!

They come, they come, with hourrà wild, and many a bristling spear,
And the war-shout of the Paynim band breaks on the startled ear!
They call, with words of mystery—high-shouted, earnest prayer—
On Mahomet, their prophet false, his followers to spare!
But we unto the living God our hopeful incense send,
And the shouts of rival hosts with words of adoration blend!
Lo, in their van the crescent of bold Saladin, afar
Gleams brightly from the lesser host, and lights them to the war!
But our lion-hearted monarch waves aloft his trusty sword—
Then onward, we will triumph in our arm of strength, the Lord!

"Claud Halcro" was Mr. John Breakenridge of Belleville. Shortly before his early death, his poems appeared in a collected form.

7. Some forty years since, many Canadian readers were familiar with the *nom-de-plume* of "Zadig," subscribed to numerous fugitive pieces of graceful verse on historical and patriotic subjects. I tran-

scribe some stanzas by this writer, on the "Martial Music of England," which is described as perpetually encircling the habitable globe:

'Tis morn on green Australia's woods:
The broad Pacific's kindling floods,
  Flush'd with warm sunlight, glow;
A trumpet wakes the silent dawn,
A war-drum sweeps its summons on—
  Far, far, the glad sounds flow.
O'er spicy wave and Indian isle,
Such strains still greet the day-god's smile,
  Break the bold Briton's rest;
Fort William's stern reveillé beats,
O'er realm and main the brave sound fleets,
O'er the wild Afghan's far retreats
  To Ghuznee's vanquish'd crest!
Awake! pale giant of the Cape,
The sunlight gilds thy phantom shape!
Wake Mount of Lions, stern and hoar,
'Tis morn on Afric's golden shore;
  Then the bold echoes ring;
Answers the Spaniard's aerial height—
Gray Malta's tempest-scoffing might,
Ionia's isles of song and light,
  Hear the wild music sing.
Nor silent sleeps th' Atlantic wave—
  The chorus bursts once more
Up from the Gallic Thunderer's grave—
  Bermuda's summer shore.
Fair England's voice is swelling now
Round old Quebec's embattled brow;
  On, on the war-strains sweep,
O'er Erie's wave, o'er soft St. Clair,
Fresh clarions waft the burden there
  O'er Huron's giant deep.
Lone wood and lake the glad sounds wake,
  Till Columbia's rushing river
Sweeps its tribute song to the main along—
  Old England's might forever!

It was understood that "Zadig" was the *nom-de-plume* of Mr. J. H. Hagarty; since, the Hon. Chief Justice Hagarty.

8. I regret that I am not able to give a sample of "Isidore," an admired writer of verse some seventeen years since in Montreal periodicals. His pieces have been collected in book-form under the general title of *Voices from the Hearth.* They are said to evince poetic feeling, melody of diction, and happiness of expression. The

author's real name is Ascher. Though called to the Bar in the Lower Province, he has taken up his abode in England.*

9. One who, as a poet, appears to have sought to be known among us chiefly as "he who sang the Song of Charity," has, besides the composition bearing that title, contributed to our literature several pieces of permanent interest. I quote the close of a poem of his, entitled "A Canadian Summer's Night." It is a picturesque description of the sights and sounds and suggestions of a night spent on the waters of Lake Couchiching.

The lights upon the distant shore
That shone so redly, shine no more:
The Indian fisher's toil is o'er.

Already in the eastern skies,
Where up and up new stars arise,
A pearly lustre softly lies.

And time it were for us to take
Our homeward course across the lake
Ere yet the tell-tale moon awake.

O Night—where old shape-hauntings dwell,
Though now, calm-eyed:—for thy soft spell,
O soothing Night! I thank thee well.

Just before, a canoe had been passed, evidently bound for Rama. A momentary contest of speed between it and the white man's craft is described:

Swifter and swifter on we go;
For though the breeze but feigns to blow,
Its kisses catch us, soft and low.

But with us now, and side by side,
Striving awhile for place of pride,
A silent dusky form doth glide.

Though swift and light the birch canoe,
It cannot take the palm from you,
My little boat, so trim and true.

"Indian, where away to-night?"
"Homewards I wend: yon beacon-light
Shines out for me:—Good night!" "Good night!"

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* I have never observed a copy of Mr. Ascher's poems exposed for sale at any of the booksellers' in Toronto. The absence of inter-communication between publishers in the Canadian cities is a curious phenomenon. Books published in Quebec, Montreal and Halifax are by no means, as a matter of course, to be seen in Toronto; and, in like manner, books published in Toronto are not, as a matter of course, to be seen in Quebec, Montreal and Halifax. In a recent editorial of a literary paper of wide circulation published at Montreal (the *Canadian Illustrated News*), it was amusing to have the writer confessing that he had never seen Mr. Watson's "Legend of the Roses," although he had reason, he said, to believe it "a work of the highest character;" and two years had elapsed since its presentation to the public. This was because Mr. Watson's book happened to be printed at Toronto, and not in Montreal. It is probable that M. Edmond Lareau, of Montreal, had in 1874 never chanced to form the acquaintance of the *Canadian Journal*, published now for more than twenty years at Toronto, under the auspices of the Canadian Institute. We should otherwise have seen in his "Histoire de la Littérature Canadienne," some reference to the many valuable contributions to Canadian science, literature, and history which are to be found in its pages. M. Lareau's enumeration of Franco-Canadian writers is copious and interesting. On the issue of a new work in any Canadian town, might not a few copies be sent to the principal booksellers in each of the other Canadian towns for the inspection of customers; to be taken back if not sold within a given time? This practice would perhaps produce more buyers than the customary newspaper notices do at present.

He who sang the "Song of Charity," it is probably no serious breach of secrecy to state, was Professor Chapman of the University of Toronto.

10. To one more poetic *nom-de-plume* of distinction Canadian literature may in some sort put in a claim, namely, that of "Wil. D'Leina, Esq., of the Outer Temple." It is to be observed that the recent edition of a collection of "Spring Wild Flowers," to which that pseudonym was at first prefixed, is dated from Toronto; and some pieces now included in it will be recognized as having once graced the pages of the *Canadian Monthly*, published in Toronto. The author, speaking in his own name, in the new edition refers to these productions as "sins of his youth." *Splendida peccata*, will be the reader's observation after a study of the volume. I give brief samples:

> Oh, to be in Scotland now
> When the mellow autumn smiles
> So pleasantly on knoll and howe;
> Where from rugged cliff and heathy brow
> Of each mountain height you look down defiles
> Golden with the harvest's glow.
>
> Oh, to be in the kindly land,
> Whether mellow autumn smile or no,
> It is well if the joyous reaper stand
> Breast-deep in the yellow corn, sickle in hand;
> But I care not though sleety east winds blow,
> So long as I tread its strand.
>
> To be wandering there at will,
> Be it sunshine or rain, or its winds that brace;
> To climb the old familiar hill;
> Of the storied landscape to drink my fill,
> And look out on the gray old town at its base,
> And linger a dreamer still.
>
> * * * * * *
>
> Oh, to lie in Scottish earth,
> Lapped in the clods of its kindly soil;
> Where the soaring laverock's song has birth
> In the welkin's blue; and its heavenward mirth
> Lends a rapture to earthborn toil—
> What matter! Death recks not the dearth.

And here is the opening of a colloquy between "Earth and Sea."

Sitteth the green Earth and hearkeneth to the Sea,
Ever as its moaning waves croon lullabie ;
Ever as its troubled waves ask: "Earth ! Earth !
Where wert thou, mother auld, afore my birth ?
Where wert thou then, and what wilt thou be
In the coming time o' Eternitie ?"
Answereth the Earth to the vexed Sea :
"I was a maiden afore I bore thee ;
In the formless void, where nae sun had shone,
I was a maiden, and dwelt all alone ;
As like to sic home as a babe could be
Fresh come frae the womb of Eternitie."
"And what did'st thou in thy long, long home ?"
Answereth the green Earth : "Long did I roam ;
But Eternitie's wider than Chaos's pall,
An' God's eye's above, and his hand 'neath all ;
And I heard far-off sounds that whispered to me
In the crooning chimes o' Eternitie ;
An' the life divine was aye brooding o'er me,
Till Time woke frae dreaming when I bore thee.
Within th' eerie caves of thy dark, deep womb,
Strange types of being fand kindly home,
Till in forms of beauty young life gat free
Frae the lone, lang dream o' Eternitie."

This garland of spring flowers, which, after the lapse of perhaps a quarter of a century, has been presented to the world afresh by the Messrs. Nelson of Edinburgh, was put together by the hand of Professor Daniel Wilson, now of Toronto, of whose name Wil. D'Leina is a partial anagram.

I might add the *nom-de-plume* of "Fidelis," and identify it. Distinguished as it has now become amongst us, in the departments of poetry, of prose-fiction, of metaphysical discussion, it has won and will retain a place in our nascent literature. But it was no part of my design to glean in recently opened spaces in the Canadian field of letters, but to confine myself to products of the first clearings. Possibly hereafter a Canadian Warton, a Canadian Hallam, a Canadian Taine, desirous of seeing of what kind were the very first shootings forth of cultivated Canadian intellect, will be thankful for the enumeration of pseudonyms now given, and for samples of the writings to which they are appended.

In the future, I suppose, there will still from time to time be appearing, under feigned names, discussions of political, social, and general subjects, and works of fiction in prose and poetry, all so strongly stamped by cleverness and good sense, and so remarkable for the vigour, and purity, and beauty of their conception and execution, as to induce a general curiosity, and even pride, in relation to their authorship. But I think the fashion of writing in a veiled way will probably not again come into vogue to the extent in which it was prevalent during the reign of the Georges and previously. We have now to congratulate ourselves, not only on the settlement of numerous exasperating questions—which set our grandfathers at home and here by the ears, and the open discussion of which brought with it peril to life and limb—but also on the possession of a free press, and consequent upgrowth amongst us of a greater liberality of sentiment and a more charitable public opinion. Milton's doctrine has prevailed: "What advantage is it to be a man," asks Milton in his Areopagitica (ii. 78), "over it is to be a boy at school, if we have only escaped the ferula to come under the fescue of an imprimatur? if serious and elaborate writings, as if they were no more than the theme of a grammar-lad under his pedagogue, must not be uttered without the cursory eyes of a temporizing and extemporizing licenser? He who is not trusted with his own actions—his drift not being known to be evil, and standing to the hazard of law and penalty—has no great argument to think himself reputed in the commonwealth wherein he was born for other than a fool or a foreigner."

Writers here and in Britain will probably more and more hereafter, deliver what they have to say, over their own names, fearlessly and without reproach, enjoying the *kudos* and the gratitude which communities are ever ready to accord to those who will embody in apt language for them their own latent thoughts, and conveniently supply to them "aids to reflection," and sensible views of their surroundings in the universe. Such is the choice of the contributors to the modern influential periodicals, the *Contemporary* and the *Fortnightly*, each writer signing his own name, and "standing," as Milton speaks, "to the hazard of law and penalty." Or else, as we see done in the grave pages of the old Quarterlies, in the ever-ready, masterly daily leaders of the London *Times*, and in the multitudinous free-lance onslaughts of the *Saturday Review*, they will prefer to discuss questions wholly in the abstract, putting out of the way altogether the disturbing consideration of authorship, and letting words and arguments go exactly for what they are worth.

CANADIAN INSTITUTE.

ANNUAL REPORT OF THE COUNCIL FOR THE YEAR 1875-6.

The Council of the Canadian Institute have the honour to submit the following Report of the proceedings of the Society during the present year.

This year has been an important one to the Institute on account of the commencement of the new building, which is now nearly completed. At a special general meeting, held on the 6th of May last, the Council were authorized to take the necessary steps for the erection of a new building. On the 27th of June, the Council accepted tenders for the proposed work, and immediately afterwards the books and furniture of the Institute were removed to the School of Practical Science. A special general meeting, held on the 5th of July, authorized the Council to mortgage the premises of the Canadian Institute, in order to raise money for the contemplated undertaking; and the corner stone of the new structure was laid by His Honour the Lieutenant-Governor, on the 11th of August, 1876.

MEMBERSHIP.

It will be seen from the last Annual Report, that the members at the close of last Session numbered 342. During the past Session 27 new members have been elected, there has been one death, and one member has withdrawn. Hence the present Membership is nominally as follows:

Members at the commencement of the Session, Dec. 1st, 1875 ..		342
Members elected during the Session, 1875-6		27
		369
Deduct:		
Deaths	1	
Withdrawn	1	
	—	2
Total Membership Dec. 1st, 1876		367
Composed of:		
Honorary Members		2
Life Members		12
Corresponding Members		1
Ordinary Members		352
Total		367

Unfortunately, however, this number does not represent the actual Membership of the Canadian Institute, for of these 367 nominal members only 126 are in good standing, and receive copies of the Journal.

It is highly gratifying to note a large increase in the number of new Members elected during the past year. The number of new Members is one-third greater than in any year during the past thirteen years, and more than twice the average number. The Council would take this opportunity of urging upon Members the necessity of exertion in this direction, as upon the number and character of new Members introduced the future welfare of the Institute must depend.

Annexed will be found the Statement of the Treasurer, and an Appendix containing the titles of the books, pamphlets and papers received during the year.

COMMUNICATIONS.

The following valuable and instructive papers and communications were read and received from time to time, at the ordinary meetings held during the Session:

December 4, 1875.—Prof. Daniel Wilson, LL.D., on "The Esquimaux and the Post-Glacial Man of Europe."

December 18, 1875.—Rev. W. H. Withrow, M.A., on "The Antiquity of Man from a Conservative point of view."

December 18, 1875.—W. H. Ellis, M.A., M.B., on "Some remarkable Nitro-Glycerine Explosions."

January 15, 1876.—Rev. Dr. Scadding, on "Some Canadian Noms-de-plume identified."

January 22, 1876.—Andrew Elvins, Esq., on "The Cause of Planetary Rotation."

January 29, 1876.—W. Oldright, M.D., on "Legislation and Sanitary Science."

February 5, 1876.—Prof. R. Ramsay Wright, B.Sc., on "Haeckel's Anthropogenie."

February 12, 1876.—Prof. E. J. Chapman, Ph.D., on "The Detection of Titanium in Iron Ores," and one on "Some new Canadian Minerals."

February 19, 1876.—W. H. Ellis, M.A., M.B., on "A Borax Deposit of California."

February 26, 1876.—Dr. C. B. Hall, on "The Causes of Epidemics."

March 4, 1876.—Rev. W. H. Withrow, M.A., on "Types in Creation."

March 10, 1876.—Prof. J. Loudon, M.A., on "Lecture Notes," consisting of—

1. An Apparatus to illustrate the Recomposition of Light.
2. On a Method of determining the Differential Expression for Components of Acceleration.

March 18, 1876.—R. W. Phipps, Esq., on "The Possibilities of Canadian Nationality."

March 25, 1876.—Prof. Daniel Wilson, LL.D., on "Some traces of the Pre-Aryan Races of Europe."

April 1, 1876.—Dr. J. McCaul, LL.D., on "The Egyptian Memnon."

ADDITIONS AND DONATIONS TO THE LIBRARY OF THE CANADIAN INSTITUTE.

RECEIVED FROM DECEMBER 1ST, 1875, TO DECEMBER 1ST, 1876.

CANADA.—

Journal of Education, Quebec, for 1876.
Journal of Education, Ontario, for 1876.
Canadian Naturalist, Montreal, Vol. VII., Nos. 7 & 8; Vol. VIII., Nos. 1, 2. *The Society.*
Annuaire de L'Institut Canadien. De Quebec. *The Institute.*
Souvenir de Le Societé St. Jean Baptiste. De Montreal.
Canadian Entomologist for 1876. *The Society.*
Canadian Journal of Medical Science, 1876. *The Publishers.*
Statutes of Ontario, 39th Victoria.
Report of the Minister of Public Instruction, Province of Quebec, 1873-4. *The Department.*
Pharmaceutical Journal of the Ontario College of Pharmacy. *The College.*
Annual Report of the Entomological Society, Province of Ontario, for 1875. *The Society.*
Journal De L'Instruction Publique. Quebec.
Report of Progress for 1874-5, Geological Survey of Canada. *The Department.*
Annual Calendar of McGill College and University, Montreal.
Proceedings and Transactions of the Nova Scotian Institute of Natural Sciences, Halifax, for 1874-5.
Meteorological and Magnetic Reports of the Dominion of Canada. Supplement No. 3, 1876.
Histoire De L'Ile D'Orleans. Par L. P. Turcotte. *The Author.*
Le Canada sans L'Union. Par L. P. Turcotte. *The Author.*
Toronto of Old. By Rev. H. Scadding, D.D. *The Author*
A Synopsis of the Family Unionidæ. By J. Lea, LL.D. *John Notman.*

ENGLAND.—

Proceedings of the Royal Colonial Institute, Vol. VI. 1874-5.
Report of the Council of the Royal Colonial Institute on the Newfoundland Fishery Question. 1875. *The Institute.*
Remarks on a New Map of the Solar Spectrum. By J. Norman Lockyer. *The Author.*
Journal of the Anthropological Institute of Great Britain and Ireland. Vol. V., Nos. 2, 3; Vol. VI., Nos. 1, 2. 1875.
Free Trade and the European Treaties of Commerce. *The Author.*
The Creed of Free Trade. By D. A. Wells, LL.D. *The Author.*
Annual Report of the Royal Asiatic Society of Great Britain and Ireland. 1875. *The Society.*
Journal of the Royal Asiatic Society of Great Britain and Ireland. Vol. VII., Part 2; Vol. VIII., Part 1. *The Society.*
List of the Geological Society of London, 1874-5. *The Society.*

Quarterly Journal of the Geological Society of London. Vol. XXX., Parts 4, 5; Vol. XXXI., Parts 1, 2, 3, 4. *The Society.*

Proceedings of the Royal Geographical Society of London. Vol. XIX., Parts 1-7; Vol. XX., Part 1. *The Society.*

Journal of the Royal Geographical Society of London. Vol. XLIV. 1874. *The Society.*

Proceedings of the Literary and Philosophical Society of Liverpool. Vol. XXIX. 1874-5. *The Society.*

Bibliotheca Orientalis. By B. Quaritch. 1876. *The Author.*

The Science of the Weather. By B. 1867. *The Author.*

On the Tides of the Arctic Seas. By Rev. S. Haughton, D.C.L., F.R.S. *The Author.*

History of Free Trade in Tuscany. By J. Montgomery Stuart. 1876. *The Author.*

Annual Report of the Leeds Philosophical and Literary Society for 1875-6. *The Society.*

Proceedings of the Linnæan Society, Session 1874-5. *The Society.*

Additions to the Library of the Linnæan Society. *The Society.*

Journal of the Linnæan Society. Botany. Vol. XV., Nos. 81-84. *The Society.*

Journal of the Linnæan Society. Zoology. Vol. XII., Nos. 60-63. *The Society.*

SCOTLAND.—

Proceedings of the Society of Antiquarians, Scotland. Vol. IX.. Part 2; Vol. X., Parts 1, 2, 1873-4-5; Vol. XI., Part 1. *The Society.*

Transactions of the Royal Scottish Society of Arts. Vol. VIII., Part 5; Vol. IX., Parts 1, 2, 3, 1874-5. *The Society.*

Proceedings of the Royal Physical Society of Edinburgh, Session 1874-5. *The Society.*

Proceedings of the Royal Society of Edinburgh, Session 1874-5. *The Society.*

Transactions of the Royal Society of Edinburgh. Vol. XXV., Part 3. 1874-5. *The Society.*

Proceedings of the Philosophical Society of Glasgow. Vol. X., No. 1. 1875-6. *The Society.*

IRELAND.—

Proceedings of the Dublin University Biological Association. Vol. I., No. 1. 1874. *The Association.*

Proceedings of the Royal Irish Academy. Vol. I., Nos. 4-10; Vol. II., Nos. 1-3.

Transactions of the Royal Irish Academy. Vol. XXIV., Parts 19, 16, 17; Vol. XXV., Parts 1-19. *The Academy.*

Journal of the Dublin Royal Society. Vol. VII., No. 44. 1875. *The Society.*

UNITED STATES.—

Proceedings of the Academy of Natural Sciences, Philadelphia. Parts 2, 3, 1875; Part 1, 1876. *The Academy.*

Check List of Ferns of North America, north of Mexico. By John Robinson, Esq., Salem, Mass. *The Author.*

Memoirs of the Peabody Academy of Sciences. Vol. I., No. 4. 1876. *The Academy.*

Proceedings of the American Antiquarian Society. Oct. 1875; April, 1876. *The Society.*

Proceedings of the Boston Society of Natural History. Vol. XVIII., Parts 2 & 3. 1875-6. *The Society.*

Memoirs of the Boston Society of Natural History. Vol. II., Part 4, No. 4. *The Society.*

Journal of the Franklin Institute, Philadelphia. Vols. CI., CII. 1876. *The Institute.*

Transactions of the Academy of Science, St. Louis. Vol. III., No. 3. 1876. *The Academy.*

The Ninth Annual Report of the Peabody Institute, 1876. *The Institute.*

Memoirs of the Historical Society of Pennsylvania. Vol. XXXI. *The Society.*

Catalogue of Paintings and other objects of interest belonging to the Historical Society of Pennsylvania. *The Society.*

Historical Map of Pennsylvania. *The Society.*

The Inauguration Discourse, delivered at the opening of the New Hall. By J. W. Wallace, Esq., Pres. 1872. *The Society.*

Bulletin of the Essex Institute. Vol. VII. 1875. *The Institute.*

Proceedings of the Davenport Academy of Natural Sciences. Vol. I. 1867-76. *The Academy.*

Biographical Sketch of William Penn. *Hist. Soc. of Pennsylvania.*

Charities conducted by Women. Reported before the Committee of the United States Senate, 1876.

Twenty-sixth Annual Report of the New York State Museum of Natural History. 1874. *The Museum.*

Fifty-seventh Annual Report of the New York State Library. 1875. *The Library.*

Life History of Birds of Eastern Pennsylvania. By J. G. Gentry, Esq. Vol. I. 1876. *The Author.*

INDIA.—

Records of the Geological Survey of India. Vol. VIII., Parts 1-4; Vol. IX., Part 1. 1876.

Palæontologia Indica. Sec. 9, Parts 2, 3 & 4.

Memoirs of Geological Survey of India. Vol. II., Part 2.

FRANCE.—

Le Valhalla des Sciences Pures et Appliqués. Par Leopold Hugo. Paris, 1875. *The Author.*

Bulletin de la Société Geologique de France. Tomes XXII.-XXIV. *The Society.*

Annales Des Mines. Tomes VIII., IX.

Memoires Des Sciences Naturelles De Cherbourg. Tome XVIII.

Lectures Courantes des Ecoliers Français. Par Graumont. Paris, 1876. *The Author.*

ITALY.—

Cosmos. By Guido Cora. 1874-5-6.

SPAIN.—

Anuario Del Observatorio De Madrid. Año XI., XII. 1871-2.

Resumen De hos Observaciones Meteorologicas Efectuades en la Peninsula. Madrid. 1869-70.

Observaciones Meteorologicas en Observatorio De Madrid. 1870-71.

NETHERLANDS.—

Archives Du Musée Teyler. Vols. I., IV. 1875-6.

Archives Neerlandaises des Sciences Exactes et Naturelles. Tome X., XI. 1885-6.

On the Osteology of the Tasmanians. By J. B. Davis, M.D. F.R.S. 1874.

Zur Speciesfrage. Von H. Hoffman. 1875.

Révision Des Espéces Synancéoïdes. Par B. Bleeker. 1874.

Nederlandsch Meteorologisch Jaarboek. Voor 1871.

VIENNA.—

Verhandlungen der Kaiserlich Königlichen Zoologisch Botanischen Gessellschaft in Wien. Band XXV. 1876.

Mitheilnngen der Kais. Kongl. Geographischen Gessellschaft Wien. 1875.

BREMEN.—

Abhandlungen herausgegeben vom Naturwisseuschaftlichen Vereine zu Bremen. Bd. IV., V. 1875-6.

Beilage No. 5 do. do. 1875.

HAMBURGH.—

Verein für Naturwissensch. Unterhaltung, Verhandlungen. Bd. II. 1875.

KÖNIGSBERG.—

Physikalisch-Oekonomischen Gessellschaft. Schriften X.-XV. 1869-74.

STOCKHOLM.—

Kongl. Svenska Vetenskaps Akademien Handlinger. Bd. 1870-1-2-3.

Bihang, 1, 2, 3. Ofversigte, 28-32. 1871-5.

Lefnadsteckningar, 1, 3. Études Echinoidèes. Par S. Lovén.

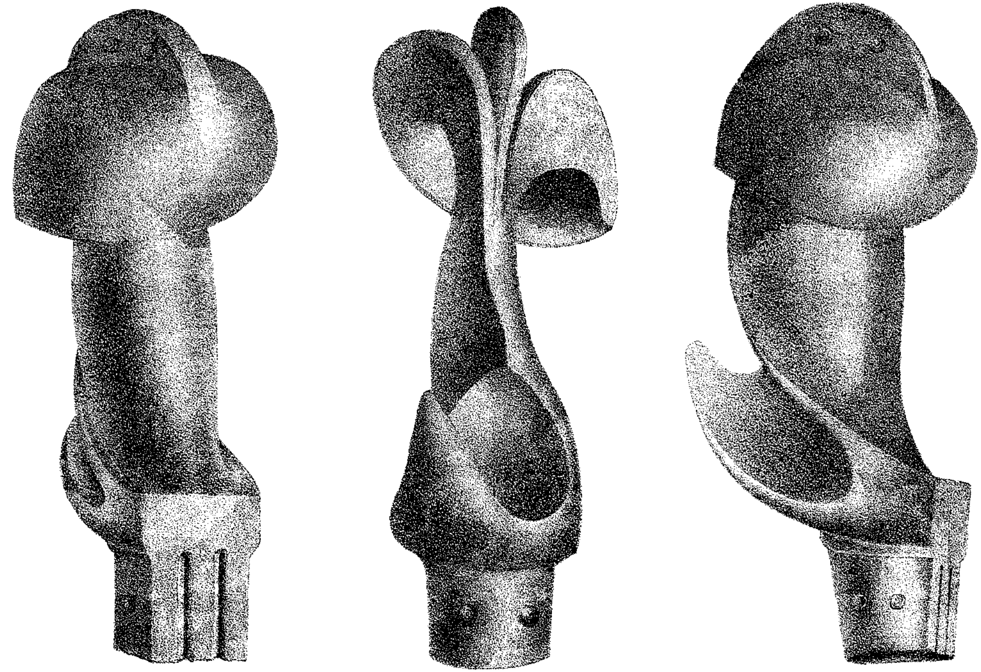
BRAZIL.—

Archives De Museo Nazional. Vol. I. 1876.

The Devonian Trilobites and Molluscs of Erere, Province of Para. By Prof. T. Hart.

SOMERS ISLAND.—

Witchcraft in the Somers Island. Parts 1 & 2. By Major-General Lefroy.



Copp, Clark & Co. Lith. Toronto.

Handle of Bronze Sickle. Lake of Bienne

THE CANADIAN JOURNAL.

NEW SERIES.

No. XCV.—JULY, 1877.

LEFTHANDEDNESS.

BY DANIEL WILSON, LL.D., F.R.S.E.

Under the title of "Righthandedness," the specialities of this common attribute of man, and the sources and characteristics of the occasional deviation from it, have been discussed in a former paper.* I now propose, under the present title, to supplement it with some additional suggestions and illustrations.

If righthandedness can be referred to any anatomical cause—such as the position of the viscera, their relative weight on the two sides of the body, the development of the subclavian arteries, or the predominance of one of the cerebral hemispheres,—then its general prevalence, or assumed universality, among all races and in all ages, is easily accounted for; and lefthandedness may be traced, with reasonable probability, to a reversal of the normal anatomical conditions of the body. But no theory is of any value which fails to account for the exceptional lefthandedness, no less than for the prevalent righthandedness. The evidence of righthandedness as a predominant habit is obvious; but its source is not yet certainly determined, and acquires a fresh interest in so far as this natural endowment or habit is peculiar to man.

If righthandedness is referable to anatomical causes, some traces of it may be looked for among mammalia generally, and especially

* Canadian Journal, N. S., Vol. xiii., p. 193.

among the anthropoid apes; and the occasional occurrence of lefthandedness should be easily accounted for. If, on the other hand, it has its origin in a habit engendered by enforced usage resulting from combined action, as in the reaping field, at the oar, at the forge, or in concerted military action, this involves only the concurrent use of either hand; and it need no more surprise us to find lefthanded races, than to observe that our usage in writing from left to right reverses that of ancient semitic nations. On the latter assumption indeed it would seem opposed to all probability that, alike in the Old and the New World, nations living apart, in utter ignorance of each other, should be found uniformly manifesting a preference for the same hand. But no example of a lefthanded race is known, unless a vague reference previously quoted from Stobæus can be accepted in proof of it; while the preferential use of one hand, long anterior to any historical evidence of righthandedness, is proved by terms for right and left hand occurring in the vocabularies alike of ancient civilized nations, and of untutored savages, such as those of New Zealand, Polynesia, and Australia; as well as among the rudest tribes of the New World. It only remains to determine whether in every case the so-called right hand has been the member of that side of the body to which we apply the term. If the superiority of one hand over the other is no more than the result of acquired habit, consequent on the necessity for uniform action in many combined operations, then it is inconceivable that among races isolated, and without intercourse throughout the historic period, as in the Pacific Islands, Australia, and America, all should have chanced to adopt the same hand. But if, on the contrary, the dexterity of the right hand is dependent on organic causes common to man, then the exceptional and abnormal character of lefthandedness becomes obvious. Hence the desirableness of observing the manifestations of any preferential use of one or the other hand among savage races. The Maories of New Zealand, as already noted, manifest a prevalent righthandedness, especially in the use of the musket in their war dances. The musket, it has to be borne in remembrance, is purposely constructed for a righthanded people; and hence, as a righthanded instrument, it would have sufficed to determine the bias, among any people previously using either hand indifferently; but the Maori tongue proves the existence of a native righthandedness altogether prior to European intercourse; and the same appears to be characteristic of most, if not all, of the Polynesian languages. The word *tau*, which in the Hawaian signifies *ready*, in the Tahitian *right*, *proper*, and in the New Zealand *expert*, *dextrous*, is the common Polynesian term for the right hand. In the Vitian language, as spoken in various dialects throughout the Viti or Fiji Islands, the distinction is still more explicitly indicated. There is first the common term *linga*, the hand, or arm; then the ceremonial term *dáka*, employed in speaking of that of a chief, but which, it may be presumed, also expresses the right hand, as, while there is no other word for it, a distinct term *sema* is the left hand. The root *se* is found not only in the Viti, but also in the Samoa, Tonga, Mangariva, and New Zealand dialects, signifying to err, to mistake, to wander; *semo*, unstable, unfixed; while there is the word *matau*, right, dexter, proving the recognition of the distinction.

An occasional correspondent of the *Times* communicated a series of letters to that journal in the latter part of the past year (1876), in which he embodied anthropological notes on the Fijians, obtained, as he states, both from his own observations during repeated visits to the Islands, and from conversation with English, American, and German settlers, who may be met at the port of call and on the route in either direction between San Francisco and the Australian Colonies. "The Fijians," he says, "are quite equal in stature to white men; they are better developed relatively in the chest and arms than in the lower limbs; they are excellent swimmers, and, if trained, are good rowers. Lefthanded men are more common among them than among white people; three were pointed out in one little village near the anchorage."

Observations of this class will no doubt accumulate when attention is more fully directed to the inquiry, and so help to determine whether or not man is congenitally righthanded, and has, from anatomical structure, a specific right and left side. On this subject Sir Thomas Browne quaintly remarks in his "Religio Medici:" "Whether Eve was framed out of the left side of Adam, I dispute not, because I stand not yet assured which is the right side of a man, or whether there be any such distinction in nature." Dr. Struthers, Professor of Anatomy in the University of Aberdeen, who has long directed his attention to this subject, thus writes to me: "I have again and again verified the fact in my own children, that in early childhood there is no preference for one hand more than the other."

But though this is undoubtedly true of the majority, a certain number of children will be found to manifest a distinct preference, at a very early age, for one or the other hand. In the case of a niece of my own, the lefthandedness showed itself very early; and in my grandson, it was independently observed by its mother and nurse, and brought under my notice, that so soon as he was able to grasp an object and transfer it from one hand to the other, he gave the preference to the left hand. A like decided preference for the right hand, though doubtless also comparatively rare, is more frequent; and the further research is carried, the more manifest does it appear that the preferential use of what we designate the right hand is natural and instinctive with a sufficiently large number to determine the prevalent usage. With a smaller number an equally strong impulse is felt prompting to the use of the left hand; but my opinion remains unchanged, that with the majority righthandedness is no more than the result of prevalent custom and education.

Attention has already been drawn to the indications pointing to the simultaneous use of the right and the left hand by two fellow flint workers in the primitive flint-pits of Norfolk, styled "Grime's Graves." But some more recent disclosures are suggestive of the preferential use of the right hand among the men of Europe's palæotechnic dawn.* The recovery of specimens of imitative art, the work of the Troglodytes of the Mammoth and Reindeer Periods of Southern France, has familiarized us with carvings and etchings, executed with a remarkable degree of freedom and artistic truthfulness, by a people living at the head waters of the Garonne, under social and climatic conditions closely analogous to those of the Esquimaux of the present time. In dexterity of handling and faithful portraiture, the specimens of primitive art greatly surpass the most ingenious examples of drawing or etching executed by modern savages. The drawing especially of the mammoth, traced with a pointed implement on a tablet of ivory, found in La Madelaine Cave, on the river Vézère, is replete with interest, alike as a piece of contemporary portraiture of the long-extinct proboscidian of Europe, and as an evidence of the intellectual development of contemporary man. But the drawings and etchings on ivory thus executed by contemporaries of the mammoth and reindeer of Southern France have also a value for us

* *Vide* Prehistoric Man, 3rd Ed., Vol. i., p. 107.

in their indication of a preference given to the right hand by the draughtsmen of that remote age. The mammoth drawing, and other palæographic tablets representing groups of reindeers, horses, &c., are executed in profile, looking to the left, as a righthanded draughtsman naturally does, from the greater facility of execution, when no special reason prompts him to deviate from that direction. They are, in fact, righthanded drawings; and the examples thus far adduced seem to point to this as the uniform characteristic of the etchings of the Troglodytes of the Vézère.

As already shown in the former paper, the member of the body designated the right hand among the ancient Hebrews, Greeks and Latins, and probably among the Sanskrit-speaking Aryans, was the same as we now understand by that term. But all of those were civilized races, and in sufficient geographical propinquity to have derived the same custom or usage from a common source. It is otherwise with the primitive cave-dwellers. In the rudest states of society man as a tool-using animal has the preferential use of one hand engendered in him, so soon as he engages with others in combined operations. As he progresses in civilization, and improves on his first rude weapons and implements, the habitual use of them in one hand leads to their adaptation specially for it, and thus the lefthanded workman is placed at a further disadvantage; and an additional bias is given to righthandedness. But here, also, the inveterate lefthanded manipulator at times re-instates himself on a fair equality with his rival, by providing himself with lefthanded tools and other appliances. I have recently learned of two lefthanded carpenters, with benches so adapted to their own special use; and am told of a scythe adapted to the requirements of a lefthanded mower. But it is more frequently in the pastimes of leisure hours that the lefthanded operator is tempted to put himself on an equality with others in the special adaptation of his tools. The favourite Scottish game of golf is one in which the implements are of necessity righthanded, and so subject the lefthanded player to the greatest disadvantage, unless he provides his own special clubs. The links at Leith have long been famous as an arena for Scottish golfers. King Charles I. was engaged in a game of golf on these links when, in November, 1641, a letter was delivered into his hands, which gave him the first account of the Irish Rebellion. According to the anecdote, as recorded in the *Archæologia Scotica* by Mr. Tytler, of

Woodhouselee, on reading the letter, he suddenly called for his coach, and leaning on one of his attendants, in great agitation drove to the palace of Holyrood, from whence he set out the following day for London. The same links were a favourite resort of his younger son, James II., while still Duke of York; and some curious traditions preserve the memory of his keen relish for the game. There accordingly golf is still played with keenest zest; and among its present practisers is an ambidextrous golfer, who has provided himself with a double set of right and left drivers and irons; so that he can use either hand at pleasure according to the character of the ground or the position of the ball, to the general discomfiture of his one-handed rivals. The Scotchmen of Montreal and Quebec have transplanted the old national game to Canadian soil; and the latter city has a beautiful course on the famed historical battle-field, the scene of Wolfe's victory and death. There their experience recently induced the Quebec Golf Club, when ordering spare sets of implements for the use of occasional guests from the Old Country, to consider the propriety of ordering a lefthanded set. In the discussion to which the proposal gave rise, it was urged to be unnecessary, as a lefthanded player generally has his own clubs with him; but finally it was compromised by ordering two lefthanded drivers; so that on a lefthanded golfer turning up he will have to putt with his driver. The considerateness of the Quebec golfers for their lefthanded rivals was no doubt stimulated by the fact that there is a skilled golfer of the Montreal Club whose feats of dexterity as a lefthanded player at times startle them. One of the Quebec golfers writes to me thus: "There is one lefthanded fellow belonging to the Montreal Club who comes down occasionally to challenge us; and I have watched his queer play with a good deal of interest and astonishment."

Such illustrations of the growing disadvantage to which the lefthanded workman is put, as civilization develops arts and pastimes with tools or implements specially adapted to the right hand, all the more strongly demonstrate the innate constitutional tendency to lefthandedness in a certain percentage of cases: since the whole tendency of such artificial righthanded appliances is to foster a uniform prevalent usage, and as far as possible to eradicate lefthandedness. But this is only a result of the innate tendency of the majority. We learn from the palæographic tablets of the Vézère caves, that at a time vastly more remote than Hebrew or Greek records, and among a people in the most primitive condition of savage life, the preference appears to have been given to the same hand which has been recognized as the right hand among all civilized nations of historic times. Such concurrent evidence seems to point to a uniform preference for the same hand from remotest times, such as could not fail to eradicate any mere exceptional habit; and so suggests with renewed force that the use of the right hand is traceable to some peculiarity of organic structure, or to some physiological law generally affecting the human organization. Nor is it necessarily limited to man. As already shown, there are indications suggestive of a disposition in some at least of the lower animals to employ one limb in preference to the other.

A writer in the *Cornhill Magazine,* when referring to one remarkable class of manifestations which seem to show that the faculty of speech is mainly if not wholly dependent on the left side of the brain; or at any rate that *aphasia,* or the loss of the power of vocal expression of ideas, is accompanied with disease of that side of the brain: says, "Rightsidedness extends to the lower races. Birds, and especially parrots, show rightsidedness. Dr. W. Ogle has found that few parrots perch on the left leg. Now, parrots have that part at least of the faculty of speech which depends on the memory of successive sounds, and of the method of reproducing such imitation of them as a parrot's powers permit; and it is remarkable that their left brain receives more blood, and is better developed than the right brain." The same writer expresses his doubt as to monkeys showing any tendency to righthandedness. This is a point to which careful attention should be directed where opportunity offers. In my former paper I noticed the interesting treatise by Dr. Buchanan, Professor of Physiology in the University of Glasgow, on the "Mechanical Theory of the Predominance of the Right Hand over the Left." But I was not then aware that Professor Struthers had followed up his observations by a series of careful investigations, the results of which are set forth in his paper entitled, "On the relative weight of the viscera on the two sides of the body; and on the consequent position of the centre of gravity to the right side." He there notes that, "While the viscera of the quadruped have the same general lateralized position as in man, there is a reason why this should be carried to a greater extent in man than in the quadruped, owing to the much greater lateral development of the chest and abdomen of the human figure, in order to adapt it to the erect posture, as contrasted with the great lateral flattening of the trunk in quadrupeds. The equipoise is therefore more disturbed in man than in the quadruped; and it may be observed that the same consideration applies to the child, in whom the chest is at first narrow, and in whom it undergoes rapid increase of breadth when the child begins to walk: the period at which, according to the gravitation theory, the predominance of the right hand should begin to be developed. To this reason why the position of the centre of gravity to the right side should have more influence in man than in the quadruped, may be added the fact of the erect posture, enabling the gravitating influence to operate at once on the whole one side of the body."

The necessities of the monkey as a climber no doubt tend to bring all its limbs into constant use; but possibly careful study of the habits and gestures of monkeys may disclose, along with ambidextrous facilities, some traces of a preference for the limbs on the one side. The elephant has been repeatedly affirmed to betray a strongly marked rightsidedness; and this has recently been reiterated in a communication made by Mr. James Shaw to the Anthropological sub-section of the British Association, where he noted the "curious fact that elephants have been frequently known to use the right tusk more than the left in digging up roots, and in doing other things." But the statement is vague, and, even if confirmed by adequate proof, can scarcely be regarded as the equivalent of righthandedness. I formerly referred to the greater development of the left tusk of the walrus in a specimen in the Museum of the University of Toronto. I have since learned of other examples of this; and am assured by an old Hudson's Bay factor that it is of frequent occurrence both in the walrus and narwhal. On this subject Dr. Struthers remarks: "When we examine the instances of unequal development on the two sides, among animals constructed on the symmetrical plan, it does not appear that there is any preference in nature for one side more frequently than for the other. Among the mammalia, we observe that it is the left tusk of the narwhal which is normally so greatly developed. In birds the ovary and oviduct which are developed are almost always the left. In serpents, the lung which is so much developed, compared with the other, is the right. Among fishes, the pleuronectidæ, or flat fishes, present a remarkable a-symmetry in the twisting of both orbits, and partly of the mouth, to one side, that which they present to the light. In the sole it is the right side, in the turbot it is the left side, to which the eyes are turned; but it is not uncommon to find this reversed, and in the flounder the eyes are found nearly as often on the left as on the right side." The question of anatomical symmetry is, however, a different one from that of equipoise, and the whole question of a preferential rightsided action in the case of the lower animals is still an open one. Dr. P. H. Pye-Smith says, "The primitive human condition we must suppose to have been one of perfect symmetrical structure and ambidextrous function. For this is the condition of all the higher vertebrates which can be best compared with man; complete bilateral symmetry of all the organs is the state of the human embryo at an early stage; and all the simpler actions, such as climbing, rowing, swimming, are performed with both hands. The alternate action of the limbs in the horse, and that of both sides together in the camel, would equally imply complete symmetry of the nervous centres; though even here we seem to have the first step to differentiation, indicated by the preference for the right foot to lead with in the canter, which is impressed on saddle-horses for our convenience." The communication of Mr. Shaw, above referred to, is only known to me from the very brief notice of it in a local paper; but so far as appears, he merely repeated previous statements relative to the preferential use by the elephant of its right tusk. The general result which he is indicated as affirming, in reference to the main question, is that "there is a constitutional reason for the preference given to the right hand; but this tendency he believed had been much strengthened by habit."

The archæological evidence in proof of the antiquity of the use of the right hand may be expected to increase when attention is directed to the subject. The Vézère relics suggest its prevalence in an era when man and the mammoth were contemporary in Central Europe. The handle of a bronze sickle found in 1873 at the lake-dwelling of Möringen, on the Lake of Brienne, in Switzerland, still more conclusively demonstrates the habit in a later, though still prehistoric age. Bronze sickles have long been familiar to the antiquary among the relics of Europe's Bronze Age, and their forms have been shown in various archæological works, and included among the illustrations of Dr. Ferdinand Keller's "Lake Dwellings;" but the example now referred to is the first known illustration of the complete hafted implement. The handle is of yew, and is ingeniously and tastefully carved so as to lie obliquely to the blade, and allow of its use close to the ground. But a greater interest attaches to the fact that it is a righthanded implement, carefully fashioned so as to adapt it to the grasp of a very small hand, and as incapable of use by a left-handed shearer as a mower's scythe. Its peculiar form is shown in the accompanying illustration; and Dr. Keller, in noting that the handle is designed for use by the right hand, adds: "Even in the Stone Age, it has already been noticed that the implements in use at that time were fitted for the right hand only." This, however, like other generalizations on the subject, is an assumption resting on very insubstantial evidence. Examples of implements of the Stone Age, whether palæolithic or neolithic, suggestive of any discrimination in the use of one hand in preference to the other, must be exceedingly rare; and so far as the deer's horn picks recovered from "Grime's Graves" flint pits afford any illustration of this, primitive tools are not invariably righthanded.

When formerly treating of righthandedness, I was not aware of an interesting article by Dr. Pye-Smith, in the "Guy's Hospital Reports for 1870–71," from which I have quoted above. I am indebted to the author for a revised reprint, entitled "The connection of Left-handedness with transposition of the Viscera and other supposed Anatomical Causes." The theory that lefthandedness is due to the transposition of the viscera, or to the exceptional origin in certain cases of the left subclavian artery before the right, as shown in my former paper, not only lacks confirmation, but is contradicted by ascertained facts. The first of these explanations, which refers left-handedness to the transposition of the viscera, is noticed by Dr. Pye-Smith as "the only explanation, so far as I know, which has been offered of the peculiarity." This theory has been often proposed, has received the high sanction of Professor Hyrtl, of Vienna, and is supported by some undoubted cases in which the two conditions coexisted. But, as Dr. Pye-Smith remarks, "A few such instances only prove that transposition of the viscera does not *prevent* the subject of the abnormality from being lefthanded. Though attention has hitherto been little drawn to this point, there are enough cases already recorded to show that for a person with transposed viscera to be lefthanded is a mere coincidence." In confirmation of this, Dr. Pye-Smith refers to four cases, one of which came under his own observation in Guy's Hospital, where the subjects of the abnormal disposition of the viscera had been righthanded.

Dr. Struthers has shown from a series of very carefully conducted observations by himself and others, that "as far as the viscera alone are concerned, the right side is at least $22\frac{3}{4}$ ounces heavier than the left, and that this is reduced $7\frac{3}{4}$ ounces by the influence of the contents of the stomach, leaving a clear preponderance of at least 15 ounces in favour of the right side." The preponderance of the right side, he adds, is probably considerably greater than 15 ounces, and it is rendered still more so in the erect posture. The total weight of viscera on the right side he states at $50\frac{3}{4}$ ounces, while that of the left side is only 28 ounces, giving a visceral preponderance on the right side of $22\frac{3}{4}$ ounces, which he reduces, as above stated, by deducting $7\frac{3}{4}$ ounces for the contents of the stomach. But if this relative excess of weight on the right side be the true cause of the prevalent righthandedness, the transposition of the viscera ought to be invariably accompanied with a corresponding lefthandedness; whereas this is proved not to be the case.

The other theory, which refers lefthandedness to the abnormal arrangement of the blood-vessels, and especially of the right and left subclavian artery, is more difficult to test, since, with rare exceptions, the evidence lies beyond reach of observation in the living subject. So far, however, as ascertained facts can be appealed to, they fail to sustain the theory. Dr. Pye-Smith states that he found the deviation from the normal arrangement of the primary branches of the aorta, in which the right subclavian arises from the third part of the aortic arch, occur four times in 296 dissections. As this variation, he says, "cannot be recognized during life, its connection with lefthandedness is not easy to investigate. But in one case, at least, Dr. Peacock ascertained for me that the subject of this abnormality, whose heart and arteries he had examined for another purpose, was righthanded during life."

It thus appears that the source of right or lefthandedness is not traceable either to the transposition of the viscera, or to the disposition of the subclavian arteries. We are therefore led to seek for a physical cause for the preferential use of the one or other hand in the central nervous system. In this direction the eminent anatomist, Professor Gratiolet, looked for a solution of the difficulty. He maintained that in the early stages of fœtal development, the anterior and middle lobes of the brain on the left side were in a more advanced condition than those on the right side, the balance being maintained by an opposite condition of the posterior lobes. Hence, in consequence of the well-known decussation of the nerve-roots, the right side of the body—so far as it is influenced by brain-force—would, in early fœtal life, be better supplied with nervous force than the left side; and thereby movements of the right arm would precede and be more perfect than those of the left.

This statement of Gratiolet, relative to the earlier development of the left than of the right side of the brain, has been challenged by other observers; but many phenomena accompanying certain local injuries of the brain lend confirmation to the theory that the left lobe of the brain influences the action of the organs on the right side of the body, and *vice versa*.

"The opinion," says Dr. Pye-Smith, "that some difference between the two sides of the brain has to do with our preference for the right hand over the left may, perhaps, be supported by two very interesting cases of aphasia occurring in lefthanded persons, recorded by Dr. Hughlings Jackson and Dr. John Ogle. In both these patients there was paralysis of the *left* side, so that it seems likely that in these two lefthanded people the right half of the brain had the functions, if not the structure, which ordinarily belong to the left. To these cases may be added a very remarkable one published by Dr. Wadham (St. George's Hosp. Rep. 1869). An ambidextrous, or partially left-handed lad was attacked with left hemiplegia and loss of speech; he had partly recovered at the time of his death, twelve months later, and then the right insula, and adjacent parts, were found softened."

The remarkable difference in the convolutions of different brains, and the consequent extent of superficies of some brains over others apparently of the same size, have been a matter of special observation, with results lending confirmation to the idea that great development of the convolutions of the brain is the concomitant of a corresponding manifestation of intellectual activity. But the degree of development, and the complexity in the arrangement of these convolutions, often differ considerably in the two hemispheres of the same brain; and it seems not improbable that lefthandedness may prove to be traceable to certain structural differences between the right and left hemispheres. The variations in shape and arrangement of the convolutions in either hemisphere may be no more than the accidental folds of the cerebral mass in its later development in the osseous chamber of the skull, and within ordinary limits they probably exercise no appreciable influence on physical or mental activity. From long and careful observation, especially of children, I am satisfied that with the great majority righthandedness is mainly the result of education, or a compliance with prevailing usage. Little effort would be needed with such to superinduce lefthandedness. But there are a sufficient number of persons naturally and instinctively righthanded to determine the bias of the majority; though they cannot influence another, though smaller number, who have an equally strong and ineradicable impulse to the use of the left hand. Wherever, therefore, opportunity is afforded for examination of the brain, it is desirable that in every case of marked inequality between the two hemispheres, inquiry should be instituted as to the concurrence of a strongly pronounced right or lefthandedness.

But it has also been affirmed as the result of repeated observations, that there is often a decided difference in the weight of the two hemispheres of the brain. M. Broca states that in forty brains he found the left frontal lobe heavier than the right; and Dr. Boyd, when describing the results obtained by him from observations on upwards of 500 brains of patients in the St. Marylebone Hospital, says: "It is a singular fact, confirmed by the examination of nearly 200 cases at St. Marylebone, in which the hemispheres were weighed separately, that almost invariably the weight of the left exceeded that of the right by at least the eighth of an ounce." But the careful independent observations of Professor Wagner and Dr. Thurnam failed to confirm these results. From the weighing of the two hemispheres of eighteen distinct brains, Professor Wagner found the right hemisphere the heavier in ten, and the left in six cases, while in the remaining two they were of equal weight. Dr. Thurnam, without entering into details, states that the results of his weighings did not confirm Dr. Boyd's observations; adding that "fresh careful observations are certainly needed before we can admit the general preponderance of the left hemisphere over the right."

It has to be borne in remembrance that though the two hemispheres of the brain are sufficiently indicated in every case, there is no natural separation between them, and the division in the exact median line is a delicate operation, in which a very slight bias of the operator's hand will suffice to beget such a deviation from the true line as would fully account for the conflicting results referred to. On the assumption that right and lefthandedness are traceable to the relative development of the two hemispheres of the brain, the results very well accord with actual manifestations. There is a noticeable excess in the examples of greater weight of the left than of the right hemisphere; but apparently a still larger number of cases are to be found where it is difficult to determine any noticeable bias either way. But other observers have assigned much more comprehensive functions, and a nearly independent action, to the two hemispheres of the brain.

Dr. Brown-Sequard, who strongly favours the idea of the superiority alike in size and weight of the left over the right hemisphere, reverts to an argument derived from lefthandedness when discussing his theory that the two hemispheres practically constitute two distinct brains, each sufficient in itself for the full performance of nearly all mental operations, though each also has its own special functions, among which is the control over the movements and the organs of opposite sides of the body. "Every organ," he says, "which is put in use for a certain function gets developed, and more apt or ready to perform that function. Indeed, the brain shows this in point of mere size; for the left side of the brain, which is used most, is larger than the right side. The left side of the brain also receives a great deal more blood than the right side, because its action preponderates; and every organ that acts much receives more blood." He accordingly affirms that the growth of the brain up to forty years of age, if not indeed to a considerably later period of life, is sufficiently marked to require the continued enlargement of the hat. Speaking of himself, as having then passed his fifty-sixth year, he says:—"There is no period of six months that has passed that I have not found my hat, if neglected and put aside, has become too small. The head growing is very strong proof that the brain grows also." The opinions advocated by the leading anatomists of Europe in the earlier years of the present century, differed widely from this. It was indeed maintained by Sœmmering, the Wenzels, and Tiedemann. that the brain attained its greatest development not later than at seven or eight years of age. But, without going so far as Dr. Brown-Sequard is prepared to do, the old idea as to the complete development of the brain in youth is now abandoned, and the latest observers have produced evidence in proof of the brain increasing in weight, so that the greatest average weight occurs between thirty and forty years of age. They do not, however, indicate any such increase in actual bulk as Dr. Brown-Sequard implies; nor does the evidence lend confirmation to the idea of any very prevalent difference in the size or weight of the two hemispheres. In the majority of cases, indeed, the comparatively early ossification of the sutures would alone suffice to preclude the possibility of such a growth of the head as Dr. Brown-Sequard assumes to be demonstrable even beyond the age of fifty-six. Without due allowance for the stiffness of a new hat, and the shrinking of an old one when out of use, the hat-measurements on which he relies may prove very deceptive. But, on his assumption relative to the normal excess of the left hemisphere of the brain, there ought to be a greater equality between the two hemispheres in a lefthanded than a righthanded person, owing to the more equal employment of the two sides of the brain by the latter. But he fails to appreciate the bearings of his own argument in the case of a lefthanded person conforming in many ways to the usage of the majority, yet instinctively giving the preference to the left hand. He dwells on the fact that very few lefthanded persons have learned to write with the left hand, and that those who can do so do not write nearly so well with it as with the right hand. "Therefore," he says, "the left side of the brain, even in persons who are lefthanded naturally—so that the right side of the brain controls the reasoning faculties and their expression,—can be so educated that the right hand, which that side of the brain controls, produces a better handwriting than that by the left hand, though that is controlled by the better developed brain." The reasoning here is alike partial and misleading. The lefthanded person systematically submits to disabilities in his efforts to comply with the usage of the majority, not only in holding his pen in the right hand, but in the direction and slope of the writing. A lefthanded race would naturally write from right to left, sloping the letters towards the left, and so would place the righthanded penman at a like disadvantage, wholly independent of any supposed change in the functions or preponderating energy of either hemisphere of the brain. But even in the absence of practice, the command of the left hand in the case of a truly lefthanded person is so great that very slight effort is required to enable him to write with ease with that hand.

A striking illustration of this has recently been communicated to me. The Chief Manager of one of the Canadian Banks had occasion to complain of the letters of one of his local agents as at times troublesome to decipher, and instructed him in certain cases to dictate to a junior clerk who wrote a clear, legible hand. The letters subsequently sent to the manager, though transmitted to him by the same agent, presented in signature, as in all else, a totally different caligraphy. On inquiry it turned out that his correspondent was lefthanded, and by merely shifting the pen to the more dextrous hand, he was able, with a very little practice, to substitute for the old cramped penmanship, an upright, rounded, neat, and very legible handwriting.

In formerly treating of this subject, under the title of "Right-handedness," I entered with some minuteness into my own personal experiences, as one in whom the instinctive preference for the left hand remains unaffected by education and the enforced habit of a lifetime. At the Buffalo meeting of the American Association for the Advancement of Science, I was attracted by the facility with which Professor Edward S. Morse used his left hand when illustrating his communications by crayon drawings on the blackboard. His ability in thus appealing to the eye is well known. The Boston *Evening Transcript*, in commenting on a course of lectures delivered there, thus proceeds: "We must not omit to mention the wonderful skill displayed by Professor Morse in his blackboard drawings of illustrations, using either hand with facility, but working chiefly with the left hand. The rapidity, simplicity, and remarkable finish of these drawings elicited the heartiest applause of his audience." Referring to the narrative of my own experiences as a naturally left-handed person subjected to the usual right hand training with pen, pencil, knife, &c., Professor Morse remarks: "I was particularly struck by the description of your experiences in the matter, for they so closely accord with my own; my teachers having in vain endeavoured to break off the use of the left hand, which only resulted in teaching me to use my right hand also. At a short distance I can toss or throw with the right hand quite as accurately as I can with my left. But when it comes to flinging a stone or other object a long distance I always use the left hand, as coming the most natural. There are two things which I cannot possibly do with my right hand, and that is to drive a nail, or to carve, cut or whittle. For several years I followed the occupation of mechanical draughtsman, and I may say that there was absolutely no preference in the use of either hand; and in marking labels, or lettering a plan, one hand was just as correct as the other." I may add here, that in my own case, though habitually using the pen in my right hand, yet when correcting a proof, or engaged in other disconnected writing, especially if using a pencil, I am apt to resort to the left hand without being conscious of the change. In drawing, I rarely use the right hand; and for any specially nice piece of work, should find it inadequate to the task.

The remarks with which Professor Morse follows up the above reference to his own personal experience furnish an apt, though undesigned, commentary on those above quoted from Dr. Brown-Sequard, relative to the education of the two sides of the brain, and the controlling of the right or left hand by the better developed hemisphere. The varying caligraphy of the letter of Prof. Morse exhibits features familiar to me in my own use of the pen; and he thus proceeds: "You will observe that the first page is written with the right hand, the upper third of this page with the left hand, the usual way [but with reversed slope], the middle third of the page with the left hand, reversed [*i.e.* from right to left], and now I am again writing with the right hand. As I have habitually used the right hand in writing, I write more rapidly than with the other." In the case of Professor Morse, the indications of the hereditary transmission of lefthandedness nearly correspond with my own. His maternal uncle, and also a cousin, are lefthanded. In my case, the same habit appeared in a paternal uncle and a niece; and my little grandson, not yet three years old, so far manifests a decided preference for the left hand. Dr. Joseph Workman, for many years Medical Superintendent of the Provincial Lunatic Asylum at Toronto, thus writes to me: "As to hereditament in lefthandedness, I believe in it. I had a maternal uncle lefthanded, and I well remember my mother's having many a battle with one—nay, I believe two—of her sons to suppress the proclivity." Cases of direct hereditary transmission—in one example, at least, through three generations,—were referred to in the former paper. But it is curious to note, in the above cited cases, how the tendency appears more generally to manifest itself collaterally than in the direct line of descent.

A Canadian friend, whose sister-in-law is lefthanded, thus writes to me: "I never heard of any of the rest of the family who were so; but one of her brothers had much more than the usual facility in using both hands; and in paddling, chopping, &c., used to shift about the implement from one hand to the other in a way which I envied. As to my sister-in-law, she had great advantages from her lefthandedness. She was a very good performer on the piano, and her bass was magnificent. If there was a part to be taken only with one hand, she used to take the left as often as the right. But it was at needle-work that I watched her with the greatest interest. If she was cutting out, she used to shift the scissors from one hand to the other; and would have employed the left hand more, were it not that all scissors, as she complained, are made righthanded, and she wished, if possible, to procure a lefthanded pair. So also with the needle, she used the right hand generally; but in many delicate little operations, her habit was to shift it to the left hand."

In those and similar cases, the fact is illustrated that the lefthanded person is necessarily ambidextrous. He has the exceptional "dexterity" resulting from the special organic aptitude of the left hand, which is only paralleled in those cases of true righthandedness where a corresponding organic aptitude is innate. Education, enforced by the usage of the majority, begets for him the training of the other and less facile hand; while by an unwise neglect the majority of mankind are content to leave the left hand as an untrained and merely supplementary organ. From the days of the seven hundred chosen men of the tribe of Benjamin, every one of whom, lefthanded, could sling stones at a hair's-breadth and not miss, and of Ehud, the lefthanded Benjamite, the deliverer of Israel from their servitude to Eglon, king of Moab, the skill of the lefthanded has been noticeable. Milton, in sportive satire, plays, in one of his sonnets, with the name of "Colkitto, or Macdonnel, or Galasp." The name—which is that of the Earl of Antrim's deputy, by whom the invasion of Scotland, on behalf of the Stuarts, was attempted in 1644,—does not assume a less strange aspect in its more genuine form of Alastair MacCholla-Chiotach; that is, Alexander, son of Coll, the Lefthanded. This was the elder Macdonald, of Colonsay, who was noted for his ability to wield his claymore with equal dexterity in the left hand or the right; and hence his soubriquet of Coll Kittoch, or Coll, the Lefthanded.

The skill of lefthanded artists has been repeatedly noted. Foremost amongst such stands Leonardo da Vinci, skilled as musician, painter, and mathematician, and accomplished in all the manly sports of his age. Hans Holbein, Mozzo of Antwerp, Amico Aspertino, and Ludovico Cangiagio, were all lefthanded: though the two latter are described as working equally well with both hands. In all the fine arts the mastery of both hands is advantageous; and accordingly the lefthanded artist, with his congenital skill and his cultivated dexterity, has the advantage of his righthanded rival, instead of—as is frequently assumed,—starting at a disadvantage.

According to a brief report in the *Glasgow Herald* of a discussion in the Anthropological subsection of the British Association on the paper of Mr. James Shaw, already referred to, Dr. Robertson appealed to the demonstration by Dr. Struthers, that there is greater solidity on the right side of the body than on the left, as a fact which probably accounted for the tendency to use the right hand. But assuming this to be demonstrable, the deduction by no means follows as a necessary result. Dr. Struthers has justly said, in the treatise referred to, that "the phenomenon to be explained is not why each individual uses one hand in preference to the other, the reason of which is evident, but why all nations and tribes of mankind yet known to us should prefer the same hand. It will be admitted," he adds, "that any theory which professes to explain this remarkable phenomenon—which has ceased to attract the notice of physiologists only because it has baffled satisfactory explanation,—deserves examination, especially when it supposes the cause to be a physical one acting within each individual." Hence the careful investigations of Dr. Struthers, with a view to determine, *First*, the exact usual position of the several abdominal and thoracic viscera in relation to the middle line of the body; and *Second*, the relative weight of the parts of those viscera which lie on either side of the middle line, as well as to determine the absolute weight of each viscus. The results, as already stated, rest on the most satisfactory data; but they fail to account for lefthandedness. In so far indeed as the investigations were made on adults, who had through a prolonged lifetime systematically given the preference to one side over the other, some of the observed facts may have resulted from this. It is, at least, much to be desired that opportunity should be found for repeating the same class of observations on well defined lefthanded subjects. In all such reasoning there is need of a clear discrimination between cause and effect, as well as between what is natural and seemingly instinctive, and what is the result of education or enforced habit. The extent to which education is systematically directed so as to develop the use of the one hand at the expense of the other, is illustrated by the conventional rules for the use of the knife and fork. It is not sufficient that the knife shall be invariably held in the right hand. The child is taught to hold his knife in the right hand and his fork in the left when cutting his food; but when either the fork or spoon is used alone, it must forthwith be transferred to the right hand. All voluntary employment of the left hand in any independent action is discountenanced as awkwardness or gaucherie; and thus the left hand, with a large majority, especially among the more refined and artificial classes of society, is rendered a comparatively useless member, employed at best merely to supplement the other.

Guided mainly by my own personal experience, I remarked incidentally, when drawing the former paper to a close, "that the same influences appear to affect the whole left side, as shown in hopping, skating, foot-ball," &c. But this is more partial and uncertain. Dr. Brown-Sequard affirms that rightsidedness affects the arms much more than the legs, and in proof of this he states that "it is exceedingly rare that the leg is affected in the same degree by paralysis as the arm." Dr. Joseph Workman thus writes to me: "When you say that leftfootedness is (only) as frequent as lefthandedness, I am quite sure you are in error. I remember well, when I was a boy, observing the fact among labouring men engaged in what was called in Ireland sodding potatoes, in ridges about five feet wide, instead of planting in drills: in any given number of men, from four up to a dozen, right and leftfootedness prevailed about equally. Each pair carrying up the work of a ridge required to be right and leftfooted men. I am myself leftfooted; and of eight brothers, I believe about four were left and four rightfooted. Sir Charles Bell, in asserting that 'no boy, unless he is lefthanded, hops on the left foot,' asserts far more than the fact. I believe every boy will hop on his *spade foot;* at least I do so, and I am not lefthanded; and I instinctively do so because I dig with this foot. You have appealed to your observation as to lefthandedness in reapers. I can corroborate your statement that it was very rare to see in Ireland a *boon* of reapers without one lefthanded among them."

The use of the lower limbs is much more independent of direct conscious volition than that of the hands, and the purposes to which their action is applied are rarely of a nature to invite special attention to them. There is, however, an instinctive tendency with many, if not indeed with the majority, to use one foot in preference to the other. In football, for example, it is not with most players a matter of mere chance which foot will be used in starting the ball. Possibly the same reason may help to account for the invariable tendency of a blindfold walker to deviate to one side or the other. It is scarcely possible to walk in a straight line with the eyes shut. The one leg apparently tends to outwalk the other.

In summing up the whole, it appears that lefthandedness is inherited and transmitted, though in an irregular manner and with varying intensity; that the range of the influence, to whatever source we may trace it, affects other organs of the same side only partially and uncertainly; but that, wherever lefthandedness is strongly developed, it is accompanied by more than average dexterity in the organ thus specialized. The full use of both hands, however, largely depends on education. The left hand is, with the majority of mankind, systematically reduced to the condition of a comparatively useless member of the body, alike contrary to reason, and without any justification either in the anatomy of the hand or in the requirements of the mind. Wherever the early and persistent cultivation of the full use of both hands has been accomplished, the result is greater efficiency without any counteracting awkwardness or defect. The experience of every thoroughly lefthanded person shows the possibility of training both hands to a capacity for responding to the mind with promptness and skill; yet at the same time it is none the less apparent that in cases of true lefthandedness there is an organic specialization which no enforced habit can wholly supersede.

ON THE PROBABLE NATURE OF THE SUPPOSED FOSSIL TRACKS

KNOWN AS PROTICHNITES AND CLIMACTICHNITES.

BY E. J. CHAPMAN, PH.D.,

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The Potsdam sandstone of Beauharnois and Vaudreuil (near the junction of the St. Lawrence and Ottawa rivers), and the same formation in the vicinity of Perth in Eastern Ontario, is well known to exhibit in places some remarkable track-like impressions, commonly known as "Protichnites tracks." These were at first supposed by Professor Owen to have been made by a tortoise, but were afterwards regarded as the tracks of several species of some unknown crustacean, "wholly distinct from anything presented by the crustacean forms of later geological periods or of the present day." They may be described generally as presenting in some cases a continuous —and in others an interrupted—central furrow, with a series of small pit-marks or indentations, at a distance of two or three inches on each side, along the entire length of the impression. The central furrow, or line of broken furrows, is regarded, by those who assume these impressions to be of animal origin, as having been formed by a ridge on the plastron of the crustacean, or perhaps by a styliform appendage attached, as in the limulus, to the abdomen of the animal, whilst the creature propelled itself by its numerous feet in shallow depths of water, or dragged itself along the exposed sea shore. In at least one of the discovered impressions, however, the lateral indentations are absent, and the impression consists simply of a strongly-marked central furrow, with a few parallel grooves on each side, the outermost of these being at a distance of a couple of inches or thereabouts from the median furrow. The absence of lateral pit-marks in this case, and the occurrence in their place of narrow grooves, was occasioned, it has been suggested, "by the limbs of the animal having been dragged along while the body was afloat." The impressions are evidently more or less fragmentary, but many of them are continuous over lengths of nine or ten feet; and in places they run in different directions, and occasionally cross one another.

The track-like aspect of these impressions is so striking, that any attempt to cast doubt on their animal origin may seem altogether futile. The fact that no crustacean remains (or other vestiges of animals by which they could have been produced) have been discovered in connection with them, is, of course, of no moment: as undoubted foot-tracks of reptiles and birds occur in the Connecticut Valley, and elsewhere, under similar circumstances. There is one point, nevertheless, and I think a strong point, which militates against their animal origin. The lateral indentations or supposed feet-impressions vary in number, as regards their grouping, in different "tracks," thus forcing Professor Owen to establish no less than four distinct species: *Protichnites multinotatus*, *P. octonotatus*, *P. septemnotatus*, and *P. alternans*, with a provisional species, *P. lineatus*, to include the track without lateral pit-marks.* The association of so many different species, if the supposed tracks be really of animal origin, is at least a very remarkable circumstance: one, indeed, that might cause doubt in unprejudiced minds as to the real nature of these impressions. But, if not the tracts of crustaceans or other animals, to what, it may be asked, can these impressions be due? I would suggest, but with all due apology for the heresy of the suggestion, that they may be nothing more than the impressions of large fucoids. Many of the existing *Melanospermæ* grow to a great length: and in many genera with flattened or riband-like fronds there is a well-defined midrib, sufficiently hard to make a distinct indentation when the frond is pressed on damp sand. The lateral indentations of our Potsdam impressions may have been made by groups of spores or sori arranged (as seen in many existing forms) along the sides of the frond. If it be said that the sori in existing fucoids could scarcely accomplish this, it would not be more unreasonable to infer that in these ancient sea-weeds the spores were of a somewhat harder or denser nature, than to have to admit with Professor Owen that the

* It may perhaps be urged that these species collectively are only intended to be provisional: the names applying not to the animals, but simply, as terms of convenience, to the "tracks." But if some of these impressions were really made by a crustacean with seven pairs of feet, whilst others were made by crustaceans having eight pairs, &c., they must certainly have been made by distinct, even if by closely related, species: using the term species in its conventional or commonly understood sense. In the crustacea, and indeed throughout the animal series generally, the number of the feet or legs, as a distinctive character, is especially definite.

crustaceans, by whose feet the indentations are commonly supposed to have been made, were "wholly distinct from the crustacean forms of later geological periods or of the present day." Even apart from sori, the air-bladders in many algæ, as I have often proved, are capable of making very distinct impressions on moist sand.

If the impressions be fucoïdal, the otherwise remarkable character of these lateral pit-marks, in differing in number and grouping in different impressions, becomes easily explained without the necessity of having recourse to imaginary specific distinctions. In the impressions in which they do not appear, it may be inferred that the fucoid had already scattered its spores, or that the development of the latter had not taken place, when the frond was cast upon the ripple-marked shore of the old Potsdam sea.

The supposed fucoidal origin of these impressions would not, I confess however, have been thus advanced, were it not for their association or connection in at least one locality—the vicinity of Perth, in Eastern Ontario—with impressions of an analogous character to which an animal origin can scarcely be atttibuted on any rational grounds. These are the impressions known as *Climactichnites*. It is probable that the supposed animal origin of these latter impressions would never have been conceived, but for their general relations to the *Protichnites* impressions. The two, it was seen, must evidently have had an analogous origin; but in view of the peculiar character of the *Climactichnites* impressions, the aid of some unknown mollusk was called in to explain their formation, although by some observers they have been looked upon as the trails of Trilobites. They may be described, generally, as being in the form of a band of several feet in length, although clearly fragmentary, with a width of from five to six inches. In their general dimensions they agree, therefore, very closely with the *Protichnites* impressions. But they differ from the latter in being traversed transversely by a series of narrow parallel ridges, about an inch and three-quarters apart, and by having a kind of beaded edge or border—the impression, as remarked by Sir William Logan, thus somewhat resembling a rope-ladder, whence the name *Climactichnites*. In some examples there is also a central groove or ridge running roughly parallel with the length of the impression.

The points here to which attention should be chiefly directed are, first, the presence of these numerous transverse ridges; secondly, their constancy, and the uniform clearness of their outline, throughout the impression; and thirdly, the unbroken continuity of the impression throughout its entire length. It must be evident that there are only two ways—both exceedingly improbable—by which these impressions could by any possibility have been made by any animal, whether crustacean or mollusk, or member of any other group. If the impression be really a track, the animal must either have had, or have been able to assume, the form of a complete sphere or cylinder with ribbed surface, and it must have possessed sufficient internal force to roll itself over and over throughout a length of many feet; or otherwise the creature must have moved forward by a series of spasmodic jerks or jumps, alighting always in an exact line with the end of the trail, so as to avoid the *slightest overlap* or other *break of symmetry* in the entire impression. Any other mode of progression would unavoidably have effaced or smudged the transverse grooves or ridges as the body of the animal passed over them. If formed by a mollusk also, we might naturally expect to find the shell of the creature (or at least casts of the shell) in the surrounding strata, because, if the transverse ridges were formed by the creeping foot, the beaded rim must be attributed to the aperture of the shell; and the latter, consequently, must have been of large dimensions, and the shell itself of considerable weight and solidity, and thus not unlikely to have become fossilized. The casts of gasteropod shells—*Ophileta, Pleurotomaria*—but none to which these impressions can be attributed, are not altogether absent from our Potsdam beds: and if these have been preserved, why not others? There is also another point which appears to be in complete opposition to the assumed track-origin of these impressions. In places, two, or even three, of these supposed tracks cross one another, but at the crossing points there is no sign of disturbance or smearing, so to say, such as must inevitably have occurred if one trail had been carried across another. As shown especially in Sir William Logan's original figure, representing a group of several "tracks" (Geol. of Canada, p. 107), the one impression simply conceals or lies over the other at these points, as would happen if two fucoid-fronds, or other similar bodies, were drifted together to a sandy shore, and were there covered simultaneously with sediment.

In attributing these impressions to large fucoids, we encounter, on the other hand, no real difficulty. Many algæ, it is well known, present transverse furrows; and a salient example of this character may be seen in our *Arthrophycus Harlani*, so abundant in many of the

Medina and Clinton beds. Whilst there are various strong objections, therefore, to the assumed animal origin of these *Climactichnites* impressions, there would appear to be really nothing of any moment to militate against the assumption of their fucoidal origin. I am not, of course, sanguine enough to imagine that the views advanced in this communication will be readily accepted. Prejudices and preconceived opinions are not easily abandoned: nevertheless, in view of the very doubtful nature of these impressions, I would suggest that the generic names by which they are at present known should be modified respectively into *Protichnides* and *Climactichnides*. The change, whilst involving but a single letter, saves us from a too definite expression of what may be, and to my thinking most assuredly is, an erroneous view.

UNIVERSITY COLLEGE,
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ON THE CONSERVATION OF ENERGY AND THE NATURE OF FORCE.

By JOHN GALBRAITH, Esq., M.A., C.E., Port Hope, Ontario.

Read before the Canadian Institute, March 17th, 1877.

The progress of scientific investigation has led to the discovery of innumerable laws by which the modes of material action are governed, and to which the various phenomena of the physical universe are referred. Having given certain observed facts and one or more of these natural laws as premises, we can, by a mere logical process, infer the resulting phenomena, the constant agreement of inferences thus drawn with observation affording accumulating evidence as to the truth of the laws.

Nevertheless, these laws are mysterious; and although we feel certain of their truth, there are many of us who cannot feel satisfied until we have discovered how and why they are as they are.

There is a space not yet bridged over between what are generally considered the necessary or essential properties of matter and its various laws of action. For instance, the ideas of form, extension in three dimensions, impenetrability and mass, seem to be properties without which we cannot conceive a material body to exist; but it is quite otherwise with gravity, or the various attractions and repulsions manifested in chemical and electrical phenomena. The fields open to science cannot be considered as fully explored until these laws have been shown to be necessary consequences; that is to say, logical deductions from the essential properties of matter, and some hypothesis as to the arrangement of matter.

The scientific world is at present divided into two great classes in regard to the nature of the action of matter on matter. One of these is content to rest with the assumption that it is possible for one body to affect the motion of another at a distance, according to the observed modes of action, without the intervention of a material connection between the two; the other class, on the contrary, maintains that this is impossible and inconceivable, and endeavours, from the hypothesis of a material connection, to show that the observed laws necessarily follow from the essential properties of matter.

These theories are known respectively as the doctrines of action at a distance, and action by contact.

In order to compare these theories, it will be necessary to fix upon some possible arrangement of the universe to which both classes of thinkers may yield assent, and then decide upon the merits of each of the above doctrines by applying them in explanation of natural phenomena, or by testing their consistency with inductions from natural phenomena other than the laws of attraction and repulsion.

Imagine then material bodies to consist of very minute indivisible particles of continuous matter, separated by minute intervals of space; also, suppose that all these bodies are surrounded and saturated, so to speak, with a highly elastic medium of extreme tenuity, which itself consists of much more minute particles of matter, separated by empty spaces. The first-mentioned matter corresponds to what may be called gross matter; the second, to the luminiferous ether. It is true that there is a conception of the constitution of matter which at first sight may seem to be different from the above, and which of late years has found great acceptance, viz., the notion that an atom is a vortex ring in a frictionless fluid; but the arrangement above assumed may include this, as the vortex atoms, if such there be, may be constructed out of the assumed material.

In accordance with the theory of action at a distance, the above particles of matter all act on each other by means of certain attractions and repulsions with which they are indued, and also by collision.

In the action by contact theory, the various attractions, repulsions, elasticities, &c., are referred solely to the motions of the particles, and their collisions. The touchstone by which we intend to test the rival theories, is the principle of the conservation of energy. It is true that observation has not completely established the truth of this principle as a law of nature, but the conviction of its truth is becoming stronger day by day as our observations increase; and no theory of the constitution and modes of action (or forces) of matter can be considered as likely to be true, which can be shown to be inconsistent with this principle.

In answer to the question, What is understood by the doctrine of conservation? a better answer cannot be given than the following, extracted from a book called "Faraday as a Discoverer," and appended by Prof. Tyndall to his treatise, "Heat a Mode of Motion." It is as follows: "Of the inner quality that enables matter to attract matter, we know nothing; and the law of conservation makes no statement regarding that quality. It takes the facts as they stand, and affirms only the constancy of *working power*. That power may exist in the form of MOTION; or it may exist in the form of FORCE, *with distance to act through*. The former is dynamic energy, the latter is potential energy; the constancy of the sum of both being affirmed by the law of conservation. The *convertibility* of natural forces consists solely in transformations of dynamic into potential, and of potential into dynamic energy, which are incessantly going on. In no other sense has the convertibility of force at present any scientific meaning."

The following quotation from Tyndall's "Heat a Mode of Motion," will illustrate the application of the principle to a special case:—"Suppose a certain amount of heat to be imparted to this lump of lead, how is that heat disposed of within the substance? It is applied to two distinct purposes: it performs two different kinds of work. One portion of it excites that species of motion which augments the temperature of the lead, and which is sensible to the thermometer; but another portion of it goes to force the atoms of lead into new positions, and this portion *is lost as heat*. The pushing asunder of the atoms of the lead in this case, in opposition to their mutual attractions, is exactly analogous to the raising of our weight in opposition to the force of gravity, a loss of heat in both cases being the result. Let me try to make the comparison between the two actions still more strict. Suppose that a definite amount of force is to be expended upon our weight, and that this force is divided into two portions, one of which is devoted to the actual raising of the weight, while the other is employed to cause the weight as it ascends to oscillate like a pendulum, and to oscillate moreover with gradually augmented width and rapidity; we have then the analogue of that which occurs when heat is imparted to the lead. The atoms are pushed apart, but during their recession they vibrate with gradually augmented intensity. Thus, the heat communicated to the lead resolves itself in part into atomic potential energy, and in part into actual energy, which may be regarded as a kind of atomic music, the musical part alone being competent to act upon our thermometers or to affect our nerves.

"In this case, then, the heat not only imparts actual energy to the vibrating atoms, but also accomplishes what we may call *interior work;* it performs work within the body heated, by forcing its particles to take up new positions. When the body cools, the forces which were overcome in the process of heating come into play; the heat which was consumed in the recession of the atoms being restored upon their approach."

These extracts will render the idea of conservation sufficiently plain. It may be explained that heat is communicated to a body either by the impulses of the ethereal waves, which is termed radiation, or by contact with the heating body, which is termed conduction; both these operations are combined in most cases of transference of heat.

Let us now consider the action of heating the lead from the point of view of the supporters of action at a distance.

One simple mode of conceiving the motion in this case is to suppose the particles in pairs, each pair revolving about its centre of gravity.

Since equal increments of heat produce equal increments of expansion within certain limits, the cohesive attraction between the particles of a pair must be constant between these limits, just as in raising a mass against the constant force of gravity the height to which it is raised is proportional to the energy expended. Again, while the temperature remains constant, the velocities will be constant. Hence the orbits will be circles. Since the increments of temperature and expansion are constant for equal increments of heat, they must bear a fixed relation to one another. Hence, as heat is applied, the increment of the radius must bear a fixed relation to the increment of the square of the transverse velocity corresponding to it. Thus, as the heat increases, the particles must be whipped around, as it were, in gradually widening spirals by the impulses of the ethereal waves, or of the particles of the heating body, or both; and when the temperature becomes stationary, the impulses must be so nicely adjusted as just to give the particles the velocity due to the circle in which they revolve at the final temperature, under the influence of the constant attraction. When one considers also that the planes of the revolving particles must be lying in every conceivable direction (since the dilatation is equal in all directions), which adds immensely to the chances of collision and consequent destruction of the proper motion, he will be unable to conceive how the impulses can be directed and adjusted, except by an intelligence little short of miraculous.

It is inadmissible to regard the orbits as lying in parallel planes, since a certain amount of heat would be required to separate these planes which would destroy the constant relation between the increments of temperature and expansion.

There is another way of conceiving the motion of the particles, which might be preferred. Suppose the particles, perfectly elastic and united in pairs as before, attracted by a constant force. If the particles of a pair be separated to a certain distance and left to their mutual action, they will approach each other with gradually accelerated motion, strike and rebound, retrograding through exactly the same degrees of velocity, come to rest at the original distance of separation, then repeat the motion. Thus we have a vibrating element. We may suppose the impulses of the ethereal waves, or of the particles of the heating body, to be such as constantly to renew motion lost by resistance. When the impulses are increased by additional heat, they may be such as to increase the amplitude of the vibrations in the same proportion as the actual energy is increased. On this supposition the average dynamic energy will represent the temperature, and the average amplitude the distance due to potential energy. So far all seems well, but there is a fatal objection to this arrangement, viz., the vibrations, as the heat is increased or diminished, will not be isochronous, which they must be to agree with observation. They might perhaps be made isochronous by supposing peculiar alterations in the impulses of the ether, but then the increments of potential energy would not correspond with the increments of heat, as they should to account for proportionate expansion.

The only attractive force which will give isochronous vibrations is one varying with the distance, which is inadmissible for the above reason.

The above are the simplest arrangements which can be devised on the theory of action at a distance, and we see how they fail.

If we suppose more particles admitted into a system, or other laws of attraction, we only increase the difficulty of arranging vibrations of the ether, which are required to explain observed phenomena. There is another objection to this theory which seems fatal to it. If I remember aright, it was noticed by Faraday.

If there be a system of say two particles revolving about each other, under their mutual attraction they have a definite amount of energy, actual and potential. Now, let a third particle come within the sphere of attraction of either particle, it will increase the energy of the system; there is no limit to the number of particles which might not become similarly incorporated with the system. Thus energy would be continually created by the chance proximity of other particles. We may perhaps get out of this difficulty by supposing the spheres of attraction of every particle to include all other particles, but we shall hereafter see that a supposition of this kind, which as far as our observation goes can only be made in the case of the attraction of gravitation, will be of no service.

Sir John Herschel, although a believer in action at a distance, shows very clearly, in a lecture on the "Origin of Force," that the principle of conservation, regarded merely as asserting the periodic restorations of actual or dynamic energy, cannot, from the very nature of the case, be proved—that, in fact, it is almost inconceivable that it should express a law of nature. He could be led to no other result, holding as he did the theory of action at a distance.

We now come to the theory of action by contact. The first question naturally asked is, what is understood by the term contact. Contact is to be taken in the same sense as in geometry. Two geometrical figures are in contact when adjacent surfaces, lines, or points, as the case may be, are coincident, and there is at the same time no space of three dimensions common to both. What is force according to this theory? This question may be answered thus: when two atoms are in motion, so that each would occupy a certain space at a certain time if the other did not exist, they will come in contact; and on account of their impenetrability, or, in other words, since two bodies cannot occupy the same space at the same time, their motions must be changed, and to this action the name force is given. It is simply collision or impact. It is measured in the usual way by the changes of momentum and direction, referred to certain space considered fixed.

Sir John Herschel, in the same lecture referred to above, shows most conclusively that the dynamic energy of a system constituted thus must infallibly diminish, and that at length a state will be reached when all relative motion will be destroyed; or that, where it does exist, the moving parts will fly off into space, never to meet again. It may be remarked that the atoms are assumed to be rigid. Herschel's reasoning is based upon the assumption that relative motion is necessarily destroyed in the collision of rigid bodies.

A rigid body is such that the distances between its parts are invariable. It is possible that rigidity is a necessary condition of continuous matter. However that may be, we shall assume our continuous atoms to be rigid, the truth of the assumption to rest on the coincidence of results with observation.

We have now to discuss the question, Whether is it true, or probable, that the collision of rigid bodies involves the diminution of relative motion?

It may be premised that the laws of collision have been deduced from experiment; the question now being whether the experimental results have been attributed to their proper causes?

The following are the results of experiment, as far as the change in relative motion by collision is concerned. When bodies collide, they change their form and acquire a common motion, in which case they are called inelastic; or else, after undergoing a certain amount of compression, they partially or wholly regain their form, to all appearance; in which case, they separate with a relative velocity which is always less than their relative velocity before impact; in this case, they are termed imperfectly elastic.

Besides the above changes, motions always continue in the interior of the bodies after they separate, or after they have acquired a common motion as wholes. These motions sometimes take the form of heat, sometimes of visible or audible vibrations, or both combined.

As before noticed, where the bodies are inelastic the change of form is always greatest, other things being equal.

Also, the time occupied by the impact is greater, as the change of form is greater for the same bodies. Where the change produced in the relative velocity by the impact is less, it is always found that there is less change in the condition of the bodies themselves, less heat is developed, the vibrations are of smaller extent, the change of form is less, and the time of contact is less.

From all these phenomena, it is fair to draw, as a very probable conclusion, that the principle of conservation of energy holds with regard to these bodies—that where the energy of the bodies considered as wholes is diminished, we always find a certain amount of energy in the parts; and we may be satisfied that if we could measure the energies due to heat, vibrations, etc., and add these to the energy of the bodies considered as wholes, that the sum would be the total energy before impact. I do not think that any scientific man of the present day would controvert this.

It may be said that the more perfect the elasticity of a body is, the greater is its tendency to yield up the motion of its parts before contact ceases, and that if perfectly elastic, it would be perfectly at rest in its interior when contact ceased.

If a helical spring be suspended horizontally as a pendulum, and be allowed to fall endwise against a vertical wall, its coils will be noticed to be in a state of intense vibration after contact ceases, and I think no one would assert that it is possible to conceive it to be so elastic as not to vibrate. The assertion would even involve a contradiction of terms.

The fact is, that a perfectly elastic body would vibrate for ever, external resistances being supposed removed; and that this is not the case in imperfectly elastic bodies, is simply because their vibrations are gradually destroyed by internal friction being converted into heat, which is in turn communicated to surrounding bodies.

Again, take a number of balls placed very close together, and connected two and two by elastic strings of such tension that if the end ball be pulled away from the others, the motion is communicated through the system with the same velocity as it is when the end ball is struck towards the others; and imagine two such systems with a different number of balls in each to collide endwise in the line of their common axis. Calculate now the motion on the supposition of the conservation of relative motion as between each ball, and it will be found that the relative motion of the systems as wholes after impact is less than it was before impact, and that the motion of the parts will exactly account for the difference.

Thus we have an example of bodies made up of perfectly elastic parts in the sense in which the word has hitherto been used, which as wholes collide like imperfectly elastic bodies.

Now in all these cases, what is it that we see invariably to accompany the loss of relative motion. Is it not motion among the parts?

Do we not see that as the motion of the parts is diminished the relative motion becomes greater? Is not the loss of relative motion less when the bodies are harder, more able to retain their form, and at the same time less elastic (in the sense of being subject to vibrations) and less liable to be heated; and in this case, also is not the time taken up by impact less?

What is the proper inference? Is it not that in the case of bodies whose parts are incapable of motion among themselves, the relative velocity after impact will be the same as before impact, and the impact will be instantaneous.

Hence rigidity, instead of being inconsistent with the doctrine of conservation of energy, is the very condition necessary to its existence as regards the relative motions of the bodies as wholes.

From a remark Newton makes in his illustrations of the third law of motion, it seems that Huyghens and Wren held this idea concerning rigid bodies, but since their time it seems to have fallen completely out of view.

The greatest change of form always occurs when relative motion is destroyed. Is it natural to suppose that where no change of form occurs the same result would follow. And yet this has always been assumed.

This conclusion as to rigid bodies is the very foundation of the action by contact theory, without which it would only result in absurdities.

We now proceed to discuss some cases of collision of rigid bodies, but first it will be necessary to gain perfectly clear ideas respecting space, time and motion. What is the difference between the following terms: "A geometrical point," "an indefinitely short line," "an indefinitely small surface," "an indefinitely small solid." It is a difference of kind—they are not homogeneous. No amount of multiplication or division of any one of these will change its kind. An infinite number of geometrical points cannot occupy the smallest part of space of any dimensions; they cannot constitute a line, a surface, or a solid.

The summation of indefinitely short lines, indefinitely small surfaces or solids will produce lines, surfaces and solids respectively, and nothing else. So with time. An instant, in the sense in which we shall use it, corresponds to a geometrical point, separating two parts of a line.

It has no duration, and differs totally from an indefinitely short period of time. An infinite number of instants thus defined can occupy no time.

What is meant by the motion of a moving point at a given instant? Properly speaking, there is no such thing; but what we mean in speaking thus is the motion which takes place in an indefinitely short time in which that instant lies.

Similarly the motion of a moving point, at a given point in space, is understood to mean the motion which takes place through an indefinitely small space in which the fixed point lies.

Having now gained some definite notions, we are ready to answer some objections which have been made to the law of conservation on the contact theory.

It has been objected that when two rigid atoms rebound from each other, the motion of each must have been totally destroyed when impact took place, and immediately recreated.

We may reply thus: If the motion had been destroyed, there must at least have been an indefinitely short time during which there was no motion, duration being absolutely necessary to motion; but the contact was instantaneous, it did not occupy time, hence the motion was never destroyed.

Again: the two atoms passed through no space while in contact, for the same reason, hence they cannot acquire a common motion. If this were not so, what would the result be? If adjacent surfaces of two atoms were in contact, that is, coincided, and they had no relative motion, there would be no real division between them. In passing from the interior of one atom to the interior of the other, we should come across nothing whereby we could assert that they were not continuous; in fact, they would form one rigid atom. But if we consider the matter, we shall see that it would be perfectly impossible, by any force, however great, to press the atoms together so that they can form one continuous atom. The only forces with which we are acquainted being blows or collisions, we should have to strike the atoms together; they would rebound; and no matter how hard or how fast we struck them, they would rebound at every blow. All pressures consist of a rapid succession of minute blows. We recognize no such thing as dead pressure, or a force acting without being the result of motion. That pressure is possible between two surfaces which are not constantly striking and rebounding is, from our point of view, absolutely inconceivable. All our forces are the result of relative motion in the direction of the space between the bodies considered.

A tangential motion between two surfaces is impossible, if the surfaces are in contact, since the matter would be continuous in passing from one side of the surface to the other, and continuous matter is rigid by our assumption. Tangential motion can only take place between two surfaces when they are really divided, that is, when there is a vacuum space, no matter how thin, between them.

Suppose a smooth rigid particle falling down a smooth curved tube nnder the action of gravity, what is the nature of the reaction of the tube, which is supposed to consist of continuous matter, and consequently to be rigid?

The motion conferred by gravity on the particle may be resolved into a component at right angles to the tube, and one tangential to it. The reaction is due to the rapid impacts which arise from the former motion, and the velocity is due to the latter motion. The particle never remains in contact with the tube. Its contacts are instantaneous, that is to say, occupy no time. It is always in the air, so to speak.

Thus no forces can be exerted between the parts of a rigid body, simply because no motion can take place between them. It will be observed that our definition of force is based upon rectilinear motion; but there is another kind of motion which gives rise to actions between the parts of bodies. This is angular motion. If a body be set spinning about an axis, we know that a strain takes place in it, and if the angular motion is very great, the body may fly to pieces.

Is there no strain between the parts of a rigid body when thus set spinning? We answer, No. We can explain all strains in ordinary bodies by our definition of force, but the idea of rigidity is utterly incompatible with the idea of forces acting between the parts of the rigid body. We are thus relieved from the necessity of attempting to pursue the idea of force through a never-ending division of matter, to which those are subjected who hold the idea that the conservation of relative motion depends upon resilience.

Rigidity is an elementary idea, which can be defined but is incapable of being analyzed or accounted for.

It will be observed that we do not assert that a body necessarily moves when forces act on it. Thus a rigid body, struck by equal blows on opposite sides at the same instant, will not move. The whole motion in this case will be confined to the striking bodies.

In confirmation of these ideas as regards pressure, is the explanation of the pressure and elasticity of gases given by Professors Clausius, Ioule and others. Their investigations go to prove that these properties are owing to the molecules of the gases moving in all directions with great velocities, pressure being due to the momenta, masses and number of molecules within a given space, and elasticity to the *vis viva* or energy of the molecules within the same space.

A similar mode of action must be assumed for the luminiferous ether; that is to say, in still ether, as in still air, the constituent particles are moving in straight lines with immense velocities, subject to no actions except their impacts on each other and the atoms of gross matter. These motions are to be carefully distinguished from the ethereal waves, which correspond to the sound waves in air.

We can now explain forces of cohesion, and all kinds of tensile forces. Without the assumption of the existence of ether, constituted as above, such forces could not be explained.

How these forces are produced, may be illustrated by the various pneumatic phenomena, which may be classed under the popular idea of suction.

When the air in a receiver is rarified, the particles, having greater space to move in, do not impinge the same number of times in a unit of time against each other, nor against the sides of the vessel, their velocity being supposed to remain unaltered; hence the pressure is less on the inside than on the outside, and there results an apparent tension or attraction of the parts of the receiver towards the inside. Similarly, if two flat surfaces are pressed together, the same phenomena are witnessed; in this case, it perhaps is possible that the air, instead of being rarified, may be condensed; in which case, the results would be accounted for by supposing the velocities of the particles of confined air to have been lessened to some extent. If the velocities of the particles are unaltered, the elasticity is proportional to the density; if otherwise, it is not.

Now, substitute for air the luminiferous ether, and for the flat plates the sides of two atoms, and it becomes evident how they may cohere. If this be the explanation of cohesion, we must assume all atoms that are known to unite with others to have flat faces. The luminiferous ether alone, in the present state of our knowledge, can be supposed to consist of spherical atoms.

It must be remembered that a pair of atoms thus connected may be in a constant state of minute vibration, so to speak, even in still ether, since the ether pressure really consists of rapid impulses.

All the different degrees of chemical affinity may be accounted for by differences between the masses of the atoms, the extents of the faces which can possibly come in contact, the number of faces, and the different degrees of elasticity of the intermediate ether.

It may be objected that the vibrations of the ether are transversal, and those of common air longitudinal, so that the two cannot be analogous.

The undulations of common air consist both of longitudinal and transversal components; so do those of the ether. The ear is so constructed as to be sensible only to longitudinal vibrations, and the eys so that the transverse vibrations alone affect it. An objection of much greater force is the following. Experience shows that radiant heat is capable of evincing all the phenomena of polarization, which can only be explained by the transverse vibrations. How is it then that the thermo-electric pile is affected in the same way as the eye. Similarity of construction would scarcely to taken as a satisfactory explanation in this case.

Prof. Challis, in his "Principles of Mathematics and Physics," shows, on the hypothesis of an ether constituted as above, that in certain cases of polarization the direct vibrations become very much reduced in intensity compared with the transverse vibrations. If this should be found to be the case, wherever the polarization of heat corresponds with that of light, the objection would be answered.

One great difficulty which the action by contact theory has yet to solve, is the attraction of gravitation. Astronomical observations, so far, have not shown that gravity has a sensible aberration like light. The inference is, that the velocity of the gravity impulses must be extremely great compared with the velocity of the earth, and much greater than that of light. What is there in the nature of a universe, constructed as we have supposed, to render it self-contained? We must answer, Nothing. We are obliged on the contact theory either to suppose matter to be coextensive with space, or else, if we consider only our own portion of the universe, we may suppose its boundaries to be indefinitely distant, in which case any changes going on at the limits of the universe would be inappreciable to us.

We have thus noticed some of the chief objections to the contact theory, merely to show that there are no evident inconsistencies between this theory and observation. The mechanical explanation of natural phenomena must depend to a great extent upon the advances to be made in hydrodynamics and its cognate sciences.

We shall now show that potential energy can be predicated of a system of bodies only in a few instances.

(1.) One case is that in which there are only two bodies in the system, whatever be the law of attraction, provided it be a function of the distance. The distance between the bodies at any instant is that due to their potential energy. Thus in a falling body, its distance at any instant above the earth's surface is that due to its potential energy.

(2.) When there are any number of bodies in the system, provided that the law of attraction is that of the direct distance. In this case, the point to which potential energy can be referred is the common centre of gravity of the system.

Besides these two general cases, there are many what may be called solitary cases, in which a system may have potential energy, but which cannot be classed under any general head.

To illustrate this still further. Suppose a system of say six bodies attracting according to the law of gravitation, and let them move from rest at a given instant. Will they fall together? No; in such a system there is no point, line or surface to which potential energy can be referred. If such a system has no potential energy, can the principle of conservation be affirmed of its actual energy? No; its actual energy is constantly changing. Can it even be asserted that the actual energy will periodically go through the same changes? No; to assert this we should have to calculate the motions, and the problem is so complex in its general form, that it is beyond the power of mathematical analysis to solve it. What assertion can be made then with regard to its energy? We can only say that the chances are almost infinite against a periodic restoration of energy.

Again, there are no instances of case two in nature, as far as we know, nor of case one. We know of no instances in nature of a system of two bodies entirely unaffected by the presence of other bodies; that is to say, all systems of two bodies really form parts of a larger system, and thus cannot have a common point to which potential energy can be referred. All the instances which we have of potential energy, are instances in which the word is used in an approximate sense. Thus, in the illustration given in case one of the falling weight, it is possible to call its distance from the earth's surface that due to potential energy, simply because the influence of all other bodies in the universe, on the motion of the falling body, is inappreciable; but strictly speaking, they influence its motion, and it is falling towards the same point of the earth's surface at no two successive instants of time.

We see thus that this term potential energy, which can only be used under conditions which do not obtain generally in nature, and which obtain with only an approach to strictness in a very few cases, has no right to be included in the expression of a law which professes to represent not an approximate, but an absolute truth of nature.

We have also seen, by the foregoing example of six bodies whose motions are governed by a law which actually holds in nature, that the chances are almost infinitely great against the conservation of actual energy, even in the sense of periodic restorations.

What must our conclusion be? Is it not that the principle of conservation cannot be predicated of the material universe if the observed laws of force are laws of action at a distance? On the other hand, the conservation of dynamic or actual energy is a necessary result of the action by contact theory, if we admit the rigidity of the atom.

It may be asked, How are the phenomena of latent heat, of liquefaction and evaporation, to be explained on these principles. We have not to go far for an answer. Liquidity and gaseity are modes of motion of matter as well as heat. We do not expect the sensible vibrations of an elastic ball to affect the thermometer, neither should we expect the motions of liquidity and gaseity to do so. In a liquid the molecules are gliding around each other in all directions. In a gas the molecules are flying about in straight lines in all directions. To these motions is due the pressure in both cases. Since the pressure is equal in all directions at a given point, the inference is that the molecules are moving in all directions.

Whenever a motion appears in a heated body which itself is not such a motion as would affect the thermometer, a corresponding amount of heat necessarily disappears. Just as in a steam engine, heat disappears as the motions of the parts of the engine and the attached machinery increase. If the machinery be applied to doing work, that is, to setting other bodies in motion, a corresponding amount of heat disappears.

So in the case of liquefaction or evaporation, besides the heat which has its equivalent in the motions of liquidity and gaseity, an amount has also disappeared in working against the ether pressure which exists in the states of solidity and liquidity—that is to say, it has disappeared in setting the ether in motion.

When the source of heat is removed the motion of the molecules is gradually communicated to the ether and to surrounding bodies; in other words, the heated body loses heat by radiation and conduction, while at the same time the pressure of the ether—consisting, be it remembered, really of blows of the ether atoms—is driving the molecules back into their original positions. How this pressure can be exerted so as always to force the molecules back into positions similar to what they occupied before heat was applied, we do not profess to explain; but it seems just as possible as that sounds should be conveyed in all directions without intermingling by means of a medium, whose action is acknowledged not to depend on any mysterious forces of cohesion or repulsion, but simply on the number, masses, velocities and collisions of its particles.

It will be observed that what is usually termed the conversion of actual into potential energy in explaining the above phenomena, is considered in the contact theory as consisting partly of the transfer of actual energy to the molecules in the form of motions of liquidity or gaseity, and partly of the transfer of the same kind of energy to the ether, the pressure of which resisted the separation of the molecules.

It is no more necessary to consider that the actual energy thus transferred to the ether should consist of motions capable of affecting the thermometer, than that the act of drawing a piston in an air-tight tube against the pressure of the atmosphere, should cause a sound wave.

Why we object to retaining the term potential energy in the case of a body which has been moved through a certain space against a certain pressure, as in the instance considered above, is this. The term would imply that the pressure was always in existence, and ready to move the body back again as soon as the prime mover was removed; now this may be so, or may not. It is a mere accidental circumstance that has nothing to do with the doctrine of conservation of energy. This principle simply asserts that the energy of the prime mover was transferred to the body moved, which in turn transferred it to the bodies which caused the resisting pressure, they in turn to other bodies, and so on. It does not assert that when the prime mover ceases to act, the bodies which resisted the motion will then drive the body back to its original position.

Take for instance the illustration just mentioned, of drawing a piston in an air-tight tube against the pressure of the atmosphere. If we draw the piston partly up the tube, we communicate a certain amount of actual energy to the air, which energy becomes diffused through the atmosphere. If we let go the piston the pressure of the atmosphere will drive it to the bottom of the tube, but this is not in consequence of the energy which had been previously communicated to the atmosphere; that energy is by this time diffused through space, and the principle of conservation asserts that it is still in existence and never can be destroyed. It cannot assert that when the piston is let go it will be forced to the bottom of the tube. That depends upon the pressure of the air being continued, about which we do not necessarily know anything. It happens that it does so in this instance, and we have a case of so-called potential energy. In boring a hole with an auger, we do not expect that when we let go the handle of the auger it will be immediately turned round and worked out of the hole, acquiring an amount of energy equal to that which had been expended. Why is not energy restored in this case as well as the other. It is plainly owing to circumstances that the principle had nothing to do with. What the principle does assert is, that in both cases a definite amount of actual energy has been imparted to the resisting parts, and that this energy is always in existence somewhere as actual energy. So if it were possible for the molecules of bodies in cooling to remain apart, the principle of conservation would be in nowise affected thereby.

Thus the convertibility of natural forces can only be taken to mean the transferences of actual energy from one portion of matter to another which are incessantly going on.

In conclusion, we may sum up our results as follows:

On the theory of action at a distance—

(*a*) The principle of conservation cannot hold in nature.

(*b*) The term potential energy, from its definition, is incapable of strict application to any natural system of bodies.

(*c*) The principle of conservation, regarded merely as expressing periodical restorations of actual energy, cannot hold in nature.

On the theory of action by contact—

(*d*) The principle of conservation of *actual* energy depends on the nature of the atoms.

(*e*) The conservation of relative motion after impact can only hold in the collision of rigid bodies.

(*f*) The assumption of rigid atoms is therefore necessary to the conservation of actual energy, which assumption may be made, as it involves nothing inconsistent with nature; but, on the contrary, makes possible the explanation of a wide range of natural phenomena, otherwise inexplicable.

(*g*) There is no such thing as dead pressure. All forces, pulls, thrusts, frictions, attractions, repulsions, etc., etc., consist of collisions. That there should be action between two bodies without relative motion is inconceivable.

(*h*) The use of the term potential energy, even when the forces are of the above kind, is inadmissible, since it implies results with regard to which the principle of conservation makes no assertion, and thus leads to false ideas regarding the principle.

ON THE NATURE OF ROOTS AND WORDS.

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The fact that Glottology is still a young science is nowhere more strikingly illustrated than in that branch of it which treats of the nature of primitive language and its sources. The student, standing on the threshold, and approaching this subject free from all preconceived opinions, cannot fail to observe that in this particular at least the inductive stage has not yet been reached. Here facts are rarest and theories most abundant; here disputes are hottest and loudest, and the angry disputants frequently forget the courtesy of scientific discussion, as was the case in the late attack of Professors Steinthal and Max Müller on Professor Whitney. So unsatisfactory indeed have been the results of the discussion hitherto, that many of the most eminent glottologists have given up the enigma in despair, and become thoroughly sceptical as to the possibility of our ever arriving at any definite or positive knowledge on the subject of the origin of language. Bopp, Pott, Lepsius, and many others consider the veil of mystery hanging over this question as absolutely and inexorably impenetrable. Benfey and Schleicher would remove the consideration of this question from the jurisdiction of linguistic science altogether: the former handing it over to Psychology, the latter to Anthropology;* while the Société de Linguistique de Paris absolutely forbids the admission of any communication on this subject by its statutes.

Of late, however, a more hopeful tone has prevailed, owing largely, no doubt, to the increased study of the languages of savage nations, and the philosophic consideration of the phenomena presented by them. For it is here we approach most nearly to primitive man in the matter of language, as in point of every department of culture, and from such facts as we can here gather we must make our inductions as to the nature of primitive language.

* Geiger, Ursprung der Sprache, p. 37, *et seqq.*

It is the object of this paper not to attempt to penetrate any mystery, or to go behind the veil, but rather to show that there is no veil to go behind, no mystery to penetrate; and to point out the fact that in the known phenomena of existing speech we have ample materials for deciding on the nature of primitive language; for I firmly believe that the greater part, if not the whole, of the obscurity in which this subject is shrouded, or supposed to be shrouded, has been created by the dust raised by the disputants battling in behalf of their respective theories, and from their failure to perceive that while, on the one hand, no one theory is sufficient to account for all the phenomena of speech, yet, on the other, all the theories advanced contain a large amount of truth; and error commences in each case at the point where any disputant endeavours to establish his own theory as the only true rule of faith, to the exclusion of all others.

I shall also try to point out that there is no necessity to have recourse to miraculous phenomena of any sort in this inquiry. Those who support the theory of the directly divine origin of language are not the only ones to call the miraculous to their assistance. To my thinking, at least, Bleek's theory of the evolution of language is the most miraculous of all; and not far behind it in this respect is Professor Max Müller's attribution of the power of abstraction to man in his primitive state: of both of which theories, more hereafter.

Before inquiring, however, into the nature of primitive language, it will be necessary to define language itself, more especially in its relation to the first language makers. Language and its object may be defined as "the *intelligible expression of thought in articulate sound as a means of communication between man and man.*"

Some writers define language as being the expression of thought *and feeling*, but I would reply with Schleicher,* that the immediate expression of feeling is not one of the primary objects of language, and that language expresses feeling only in the form of an idea or a thought.†

Having now defined what language is, let us next determine where our inquiries are to commence—at what stage of human progress. There are extreme evolutionists, in linguistic as in biological science,

* Die deutsche Sprache, p. 4.

† The interjections, of course, are the direct expression of feeling, and as such must be excepted from this statement in so far as they are to be considered as a constituent element of language; a point which will be subsequently discussed.

who would trace the origin of speech to the inarticulate cries of the anthropoid ape or pithecoid man, I do not know which. Let Wilhelm Bleek, cousin of the archievolutionist Haeckel, state his own case.

"The fact," he says,* "that conditions similar to those of humanity can no longer develop themselves from animal speechlessness, proves nothing; just as the fact that the progress of a language like that of the Hottentots to the stage of development reached by its no very distant Indogermanic relatives is now impossible, proves nothing."

But if this fact proves nothing, we may at least require that the evolutionist should prove something. I do not, of course, demand that he should develop language from animal cries by actual experiment; but I do most emphatically demand that he should prove the possibility of such development, or of the capacity for such development in the lower orders.

The substance of his argument on this point is contained in a note to the passage above quoted, which reads as follows: "Those classes of animals that stand next to man are, if not externally at least internally, in a different condition from that in which they were at the period when humanity arose. Being as yet hardly formed, they were then not only more susceptible of change, but there also lay in them a stronger impulse toward further progress, and the attainment of a higher stage. This impulse had to be satisfied, as was done in the case of human beings; or, if it remained long without satisfaction, it would necessarily be extinguished, and therewith ceased the possibility of their freeing themselves from the condition in which they were. This condition became all the while more and more confirmed; and what at first was the uncertain advance of a forward impulse toward formation, and, at the same time, the first steps towards a further development of this power, forms now the petrified, stereotyped forms of a species of animals which seems to have long ago been deprived of the possibility of internal change."†

Here, in order to prove something, two groundless assumptions are made to fill the gaps in the logic of facts, to supply the "missing link" in the evolutionary chain, viz.: first, a miraculous impulse of which no proof is given; and, secondly, an equally miraculous capa-

* Origin of Language: American Translation, p. 46.

† I regret exceedingly that the original was not accessible, as the carelessness of the American translator has made the translation barely intelligible.

city for developing that impulse which rests on a similar foundation. In other words, the capacity for development, the *onus probandi* of which lies with the advocate of this view, is taken for granted.

Let us attempt to follow Bleek, however, in the further development of his theory. "Sound," he says,* "is a mere accessory to feeling. Not only is there feeling without it, but it is comparatively seldom that feeling is made perceptible to the ear." Precisely so; and yet from this comparatively rare manifestation of feeling he would derive all language. But the converse of this is also true, viz., that "it is comparatively seldom" that speech is the manifestation of feeling, though perhaps somewhat less seldom with primitive than with civilized man. The object of the first communication between man and man was not to convey feeling, but to satisfy immediate and pressing wants, as we shall see again further on; and to indicate these wants, it was necessary to give names to the things that would satisfy them. If I should have an opportunity at some future time of treating, as I propose to do, of the sources of language, I shall give Bleek's synopsis of his own theory in full, that my readers may judge of it for themselves. For the present, however, I shall content myself with stating that he proceeds to develop interjections from animal cries by the awakening of consciousness, and then to develop all articulate speech from these latter, by a process which I frankly confess my inability to understand.

If this evolutionary theory be the true one, Schleicher is no doubt perfectly justified in relegating the consideration of this question to the domain of other sciences. But comparative lexicography has given the death-blow to the theory that interjections are the only source of language, and has demonstrated the impossibility of such origin for the great majority of Aryan roots at least.

As long, however, as no more positive evidence than this can be adduced in support of the development of speech from the inarticulate cries of animals, the glottologist who desires to avoid the imputation of mere theorizing, and to rely on facts alone, must look elsewhere for the sources of language, and may reasonably refuse to carry back his researches further than to the earliest period at which we have positive evidence of the existence of man *as man;* that is, as a creature endowed with higher attributes than the apes. The startling discoveries made within the last forty years, by the explorations of geologists

* Origin of Language: American Translation, p. 56.

and archæologists, have been assumed to relegate the earliest traces of the existence of our race to a period so immensely remote, as to startle and confound the boldest imagination; an antiquity of hundreds, nay, thousands of centuries being demanded for man. These discoveries have at least proved beyond a doubt that man was an inhabitant of Europe, not only when the mammoth, the woolly rhinoceros, the reindeer and other arctic fauna inhabited the south of France, but also when the lion, the hyæna, the hippopotamus and other animals now peculiar to tropical countries, ranged as far north as Great Britain.

This question of the antiquity of man is, however, of no direct interest to the glottologist, except in so far as it gives a greater lapse of time for the great changes which language must have undergone since its birth. He is more concerned in inquiring whether there be any evidence as to the intellectual capacity of the first of our race, to whose existence these records bear witness.

What manner of men were they, then, of whom we have the earliest traces; the contemporaries of the mammoth and other extinct animals? The river-drift gravel-beds of the Somme, the subterranean cave-dwellings of Germany, France and Great Britain, the older among the lake-dwellings of Switzerland, the shell-mounds of Denmark, all give the same answer: the first men were tool-makers and tool-users. Their tools were, to be sure, of the rudest description; but they have outlasted the remains of the men themselves. The direct evidence as to the personal structure of primeval man is confined to a few remains of bones, more particularly to two portions of skulls. Of the more ancient of the two, the Engis skull, considered by Sir Charles Lyell to be undoubtedly coëval with the mammoth and other pleistocene mammalia, Prof. Huxley* says: "It is, in fact, a fair average human skull, which might have belonged to a philosopher, or might have contained the thoughtless brain of a savage."†

The nature of the stone axes and arrow-heads, the flint-flakes, the bone awls, &c., unearthed by these discoveries, is sufficiently familiar to the general reader, and it is only necessary to state that the earliest specimens consist of unpolished stones, rudely chipped to the required

* Man's Place in Nature, p. 156.

† The antiquity of the other relic, the Neanderthal skull, which is "the most pithecoid" of known human crania, is not so well established; and Prof. Huxley himself says (Man's Place in Nature, p. 159), that "the fossil remains of man hitherto discovered do not seem to take us appreciably nearer to the lower pithecoid form."

shape, and bearing what are known as palæolithic characteristics, and that they greatly exceed, in number at least, and probably also in antiquity, any remains of human bones yet discovered. These data may seem very meagre ones from which to draw any valid conclusion as to the intellectual, moral and social condition of these first tool-makers. But it is in the solution of this problem that the science of primitive culture, in the hands of such men as Sir John Lubbock and Professor Wilson, has achieved its greatest triumphs, and been raised to the rank of an inductive science. The archæologists have pointed out that primitive man, so far from being extinct, and known only by his remains, still occupies a considerable portion of the habitable globe, and that "primitive" is synonymous with "savage." They have applied the comparative method, which has produced such wonderful results in the study of language, to their own science, and have inferred the condition of the first men from the phenomena actually observable among existing savage races, many of them still in the palæolithic stage, manufacturing and using tools which are exact reproductions for the most part of those found with the remains of extinct mammalia. Sir John Lubbock* pictures primeval man as ignorant of pottery, spinning and agriculture, having no domestic animals, perhaps not even the dog, unable to count to ten, "his weapons of the rudest character, and his houses scarcely worthy of the name." As to his moral condition, we may add that he was probably destitute of all religious ideas, or of any conception of a future state, and that he was in some cases, though exceptionally, a cannibal. As to his social state, he was certainly gregarious, living in communities of greater or less extent. In fact, he was a savage, wretched indeed, clad in skins and living by the uncultivated products of the earth and the spoils of the chase, hunting the lower animals with most rudimentary weapons of stone, bone, flint, &c.; his wants few, but pressing, and dictated by hunger, thirst and cold.

The picture is dark enough, yet not too dark to be a faithful representation of many savage races at the present day: The Hottentots and Bushmen of Africa, the Veddahs and Andaman Islanders of Asia, the Australians and Feejeeans of Australasia, the Esquimaux and Nootka-Columbians of our own northern half-continent, the Brazilians, Patagonians and Fuegians of South America. Of this any one may satisfy himself by a glance at Sir John Lubbock's most

* Prehistoric Times, 2nd ed., ch. xvi.

interesting sketch of the manners and customs of modern savages, contained in chapters xiv.–xvi. of his "Prehistoric Times."

What then are the characteristics which separate modern savages from the lower animals? They are three in number, viz.: the faculty of making and using tools, the use of fire,* and last, but not least, articulate speech. We have already seen that the earliest human beings of whose existence we have positive evidence, the contemporaries of the mammoth, were, like the lowest of modern savages, tool-makers and tool-users. Traces of their use of fire have been discovered at the lowest depths and in conjunction with some of the most ancient remains in many caves of Great Britain, according to Mr. W. Boyd Dawkins.† How stands the case then with regard to the third point, the capacity for articulate speech? Leaving the use of fire out of the question, and confining ourselves to the first and third points, the argument may be stated in syllogistic form as follows:—

(i) All tool-makers and tool-users are capable of articulate speech;
(ii) The first men of whom we have remains were tool-makers and tool-users; therefore
(iii) The first men were capable of articulate speech.

As, however, we know of no case of the direct invention of language, it remains to be seen whether there is anything in the nature of language to make its direct invention by creatures of such limited mental capacity, as the first men may be assumed to have been, an impossibility or even improbability.

Before, however, we enter upon the discussion of this question, there is another to be answered. We have already seen what manner of men the primitive language-makers, in all probability, were. Let us next inquire *why* they spoke at all—what interests gave them the first impulse to the invention of speech.

This motive is contained in the definition of language given above, as "the intelligible expression of thought in articulate sound *as a*

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* Alvaro de Saavedra, as quoted by Lubbock, *op. cit.*, p. 547, mentions a race of savages who were ignorant of fire; and Captain Wilkes, U. S. N., made the same statement of the inhabitants of the island of Fakaafo. The latter statement, however, is questioned by Mr. Taylor (Early History of Mankind, p. 230), on the ground that their language contains a word for "fire." It should be added that some Australian tribes are unable to produce fire, though not ignorant of its use.

† Cave-Hunting, chap. viii.

means of communication between man and man." In other words, the primary purpose of language, or the reason that man talked at all, was that he wanted something, and wanted some one else to know it and to help him in supplying his wants. His motive in using articulate sounds was not the communication of his feelings; his emotions of pain, anger, &c., could have been made known readily and completely enough by inarticulate cries, groans, howls and growls. The motive was the pressing want of the moment. His wants may be summed up in two words: nourishment and warmth. The natural objects which supplied the means of satisfying these were at once the primary cause and object of his first words. These would be edible roots, the fruits of the earth, the earth in which they grew, the plants which bore them; further, the animals he hunted, their skins, bones, &c., and the implements with which he hunted and worked—natural and artificial—sticks and stones, bows and arrows, axes, awls, &c. As man is a social animal, and the unit of society is, as Sir Henry Maine* has pointed out, not the individual but the family, we must add himself, his relations and friends. The sun, moon and stars, the sea and the sky, were all objects of less primary importance to him. From the nature, then, of the names given to himself, his relations and allies, to the edible products of the earth and the plants producing them, to the beasts and implements of the chase, we should be able to infer the principles on which primitive language was formed; and, as we have disposed of the why, we now come to the consideration of the question: What manner of language was it that primitive man made use of?

The answer to this question must be obtained in the same way as we arrive at the determination of primitive man's intellectual, moral and social condition, viz., by the comparative method, by an inquiry into the nature of language as we find it spoken at the present day. Nor will it be necessary to have recourse for this purpose to the languages of savage nations, since the qualities most essential towards the determination of the present problem are, as we shall see, inherent in all language by its very nature, and are intensified in proportion to the degradation of the users of language in the scale of culture. In illustrating the following argument, I shall confine myself almost entirely to ground familiar, more than any other, to the general student of language, viz., the Aryan roots.

* Early Village Communities, Lecture iii.

L. Geiger, in his "Ursprung der Sprache," has shown, with equal force and clearness, that the great distinguishing characteristic of these roots is infinite variability. I shall endeavour to illustrate this fact by examples, drawn partly from his work, and partly from other sources.

If any one will glance at a dictionary of Aryan roots, and the meanings attributed to them, he can scarcely fail to be struck by the fact that here confusion seems to be the order of the day; that, in fact, the state of primitive language answers, to speak with Geiger,* to Ovid's description of Chaos:

> "Prima fuit rerum confusa sine ordine moles
> Unaque erant facies, sidera, terra, fretum."

This confusion arose from two causes: 1st, that one and the same root was used to name totally different actions or objects, sometimes entirely unconnected with, sometimes remotely akin to each other; and 2nd, that the same action or object was indicated by a number of different roots; so that, in reality, any combination of sounds might be used to indicate any action or object, and conversely the same object or action might be indicated by any number of different combinations of sounds.†

The examples illustrative of these variations may be arranged under the following four categories:

I. Variations of meaning in roots identical in sound.
II. Variations of meaning in different words derived from the same root, or from different roots identical in meaning.
III. Variations of meaning in the same word (as distinguished from a root).
IV. Various roots or words expressing the same idea.

I.—Variations of Meaning in Roots Identical in Sound.

On referring to Leo Meyer's Lexicon of Indogermanic Roots (the partial Italian translation is the only shape in which the work is accessible to me‡), I find that of the first fifty-four roots (beginning with the simplest in form) exactly one-half have two or more meanings assigned to them. Of these twenty-seven, fifteen have double mean-

* *Op. cit.*, p. 153.

† *Ibid.*, p. 89, *et seqq.*

‡ Compendio di Gram. Comp. d. antico, Indiano, Greco ed Italico di A. Schleicher, e Lessico d. radici Indo-Italo-Greche di L. Meyer, recati in Italiano da D. Pezzi. Torino e Firenze, 1869.

ings, and five treble; single instances occurring of four, five, seven, eight, and even nine meanings attached to roots identical in sound. It will only be necessary to give the few following examples:—

PA="drink;" whence Skr. *pi-bâ-mi*="I drink;" Gr. *pe-pô-ka, po-sis* (="drink"), &c.; Lat. *po-tus, po-to, po-culum,* &c.

PA="protect," "maintain," "rule;" whence Skr. *pâ-mi*="I protect;" Gr. *po-sis* (="husband"), *des-poi-na, des-po-tês, po-tnia, pa-têr;* Lat. *pa-ter, po-tis, po-tens, po-tiri, pa-sco, pā-bulum,* &c.*

DA="give," "divide," "bind."

AD (a variety of DA?)="eat," "smell," "hate."

KAR, or KAL (*r* and *l* being interchangeable)="call," "do," "move," "curl," "divide," "conceal," "cook," "gladden."

II.—Variations of Meaning in Different Words Derived from the Same Root, or from Different Roots Identical in Meaning.

My illustrations under this head will be taken from Geiger's work,† already so frequently referred to, and will be confined to derivatives traceable to the single idea of "binding," as represented by different roots, all containing that meaning. The root DA="bind," mentioned above, which occurs in the Gr. *deô* (whence *diadem,* and perhaps *dei,* implying necessity), is referred by Geiger to an older form, *dja.* With this is closely connected the root *dam*="tame," whence, in this signification, Lat. *domare, dominus,* &c. The primary signification was doubtless "bind," "join," &c., whence Gr. *demas,* "body," "frame;" *dêmos,* "community," "people;" *damar,* "wife" (*con*-JUX); *demô,* "build," and *domos,* "house;" Lat. *domus.* Corresponding to this root *dam*="tame," we have the Skr. *jam,* with the same signification. Then we have the root *ju*="unite," "bind," to which the same authority refers *zônnumi,* and to which may also be referred the Lat. *jus,* and Engl. *justice, jury,* &c. Closely akin to this in sound and meaning is the root *jug,* or *jung,* Lat. *jungo,* Gr. *zeugnumi,* to yoke or harness, Lat. *jugum* (and *con-jux*), Germ. *joch,* Eng. *yoke.* To *dam* and *jam* Geiger adds another root, *gam.* Skr. *dampatî* and *gampatî*="husband and wife;" *jama*="twin" and *gami*="brothers and sisters" (*Geschwister*), Lat. *gemini.* Skr. *jâmi*="sister" and "daughter-in-law;" for the latter we have also *gâmâ; gâmâtri* and *jâmâtri*="son-in-law." With this are connected Gr. *gambros,* Lat.

* I only give derivatives with the first examples, as they are sufficiently well known to the general student.

† *Op. cit.*, p. 80, *et seqq.*

gener, "son-in-law, and Gr. *gamos*, wedlock." By the side of this word *gambros* we may place *pentheros*, the Greek word for a father-in-law (from the root *bandh*, whence also Eng. *bind*, and Gr. *penthos* ="grief"), with the passing remark that Euripides and Sophocles invert these significations, the former using *gambros* for "father-in-law," the latter *pentheros* for "son-in-law. From other various roots of similar signification are derivable the Germ. *Schwager*, *Schwäher*, *Schwieger*, all indicating relations by marriage; the Lat. *socius*; the various Indogerm. names for *sister;* the Lat. *nepos*, Gr. *anepsios*, our *nephew*, *niece*, Germ. *Neffe*, *Nichte*, Old Norse *nift*="sister" or "bride," Old-High-Germ. *nift*="granddaughter," "niece," "step-daughter." Beside the Lat. *jus* from *ju*, as given above, we may place *lex*, from *lig* (whence *lig-are*), with the same meaning of binding. This by no means exhausts the illustrations that might be drawn from the same source; but quite sufficient has been said to show over what an immense field this one idea ranges, and I must refer my readers for further illustration to Professor Max Müller's interesting treatment of several Aryan roots in his "Lectures on the Science of Language."* The four words *house*, *wife*, *justice* and *yoke* are far enough apart, in fact, to show this, almost without further amplification. Nor do I hold myself responsible for the correctness of all Geiger's derivations: a sufficient number are beyond doubt to fully illustrate the point under consideration.

III.—Variations of Meaning in the Same Word.

These variations must of course be distinguished, on the one hand, from those which are the result of metaphor, or of application extended from one object to others on account of a real or fancied resemblance (*e.g.* the use of the word *beam* for the rays of light, &c.); and on the other, from words of different derivation, that have accidentally assumed the same form (*e.g.* *cleave*="to adhere;" Germ. *kleben;* and *cleave*="to split;" Germ. *klaffen*). The variations here meant are such as arise from mere indefiniteness of application, from failure or disinclination to invent a new word for the varying conception. As examples of the occurrence of this variation of the same word in different languages, I may mention the English *bell*=*tintinnabulum*, and the German *bellen*="to bark;" Engl. *dumb*="mute;" Germ. *dumm*="stupid" (the word "dumb" being commonly used in the

* First Series, Lectures vi., vii.; Second Series, Lecture vii.

United States in the latter signification, a use not unknown even in this country); Engl. *mist*=*nebula ;* Germ. *Mist*="dung," &c. But we need not go beyond the limits of one and the same language for our illustrations. I have already referred to the change of meaning in the Greek *gambros* and *pentheros,* and the Skr. *gâmi.* In the common usage of Southern Germany, *Vetter* means, indifferently, "uncle," "cousin" and "nephew;" and the fem. *Base,* similarly, means "aunt," "cousin" and "niece." So the Skr. *varcas*="brightness" and "dirt,"* and the German *Lohe*="flame" and "tan-bark;"† the Lat. *nepos*="grandchild" and "nephew;" the Greek *kuanos* indicates shades as varying as blue and black. So the Engl. *black* and *bleach* are the same word originally; *fond* means "affectionate" and "foolish." To these might be added words the signification of which has gradually changed in course of time, such as *silly, slight* (German *selig*="happy;" ‡ *schlecht*="bad," formerly "straight" or "level,") &c.; but I have preferred to confine myself to varying meanings in use at the same time, and in the mouths of the same people. This variation of meaning is sometimes indicated by a slight change of sound, as Engl. *band, bond, bound.*

IV.—Various Roots or Words Expressing the Same Idea.

Turning again to the Lexicon of Roots, we find the conception of "binding" indicated by the five roots *da, sar, bandh, ju, dja,* if not by more; that of "rubbing," or "crushing," by *tar* (whence *tero,* &c.), and *kar;* that of "going," by *ga, ki* (Gr. *kinein;* Lat. *ci-ere*), *ar* (Lat. *oriri*), *par* (Gr. *poreuein*), *sar* (Gr. *hormân*), and others. Of various words in the same language expressing the same idea, we may instance the Engl. *sea* and *ocean,* with the corresponding Germ. *See* (fem.) and *Meer;* the Germ. *dunkel* and *finster;* the Engl. *room, chamber, apartment;* the German *Zimmer* and *Stube.* These examples might also be multiplied to a much greater extent; but those given are sufficient for our present purpose.

So much as to variability in the content, or meaning, of words and roots. If we consider next their phonetic form, we shall find the same characteristic of infinite variability equally developed.

Roots have been treated by grammarians as things fixed and invariable by their very essence; but many of them are admitted to

* Geiger. Urspr. d. Spr., p. 150.

† Geiger considers them to be the same word.—*Ibid.*

‡ The German *selig,* like the Engl. *happy,* is used in slang as equivalent to "intoxicated."

have phonetic forms primarily different. Thus *ga*="go" is referred to a primitive form *gva*, whence are derived Skr. *ji-gâmi*, "I go;" *a-gât*, "he went;" as well as Gr. *ebê*, *bai-nô*, *bi-bas*, &c., and Lat. *ve-nire; da, dja, ju*="bind," are mere variations of the same form; *kar* and *kal* have already been referred to as admittedly identical, and the same is the case with *tar* and *tal; va* and *vap*="weave;" *dvi* and *chi*="fear;" *ksi*, *ski*, *ska*="destroy;" *kru* and *klu*="hear;" *gal* and *gla*="shine" (as also *ghar*, which is surely only a variety of form). The roots might be greatly reduced in number by considering the variations of form and meaning, and classifying them accordingly. Thus *kar* and *kal*="curl," also "rub," "crush," may be reasonably regarded as mere arbitrary variations of *tar* and *tal*="rub," "crush," &c., if we take into account the inability of primitive man to distinguish different sounds.* So with *ar*, *par*, *sar*="go;" also *tar*="tremble," "move rapidly."

We must of course allow to primitive language an infinitely greater latitude in its phonetic changes than takes place in a speech more or less fixed by the introduction of writing, and we do, as a matter of fact, find that phonetic changes, as well as changes of signification, are much more rapid with savage than with civilized nations.

"The dialects of barbarian tribes," says Professor Sayce,† "are perpetually altering. There is nothing to preserve them—neither traditions, nor ritual, nor literature. The savage has the delight of a child in uttering new sounds, and exhibiting his power and inventiveness in this manner, with none of the restraints by which civilization confines the invention of slang to the schoolboy and the mob. . . . The barbarian is especially open to all the influences of external nature, climate, food, and so forth, with nothing to check the disintegrating effect these may have upon the combination of sounds." Further on ‡ the same authority says: "Nothing is really harder than to keep a language from changing where it is not protected by the habits of settled life." So Max Müller tells us that among the wild tribes of Siberia, Africa and Siam, "two or three generations are sufficient to change the whole aspect of their dialects."§ Nay, more than this, he quotes the statement of Moffat, the African

* Mr. Henry Sweet, as quoted by Sayce, "Principles of Comparative Philology," 2nd edition, p. 246.

† *Op. cit.*, p. 83.

‡ *Ibid.*, p. 85.

§ Lectures, First Series, p. 35.

missionary, that in that country "*in the course of one generation the entire character of the language is changed;*" * and also tells us of "missionaries in Central America who attempted to write down the language of savage tribes, and who compiled with great care a dictionary of all the words they could lay hold of. Returning to the same tribe after the lapse of *only ten years*, they found that this dictionary had become antiquated and useless. Old words had sunk to the ground, and new ones had risen to the surface; and to all outward appearance the language was completely changed."†

The multiplicity of barbarian dialects is another proof of this rapidity of change. Gabriel Sagard, missionary to the Hurons in 1626, as quoted by the same author, ‡"states that among these North American tribes hardly one village speaks the same language as another; nay, that two families of the same village do not speak the same language." Again: § "In the neighbourhood of Manipura [near the Irawaddy] alone, Captain Gordon collected no less than twelve dialects. 'Some of them,' he says, 'are spoken by no more than thirty or forty families, yet so different from the rest as to be unintelligible to the nearest neighbourhood.'"

After this digression, let us return again to the changes of outward form. If we begin comparing the varying forms which the same roots have assumed in different derivatives, the examples crowd upon us to such an extent that it is hard to say which we should take first. What can be more unlike in form than Lat. *semetipsissimus* and Fr. *même*; Lat. *canis* and Germ. *Hund*; Germ. *Zahn*, Lat. *dens*, Eng. *tooth* (the last of which has not a single letter in common with either of its foreign relatives)? But few words in an extract from Chaucer would remain unchanged in a modernized version, after the lapse of only a few centuries, which we are now taught to regard as a very trifling portion of the history of the human race. Nor should it be forgotten that phonetic laws originated and came into force, in the Aryan languages for instance, at a period much later than the existence of the language which consisted chiefly of the Aryan roots in the form which is assigned to them by comparative lexicography, when what afterwards developed into a phonetic *law* was merely a phonetic *habit* or *usage*, but still variable, and not prevalent to such

* Lectures. First Series, p. 56.

† *Ibid.*, p. 53. The italics are my own.

‡ *Ibid.*, p. 53.

§ *Ibid.*, p. 54.

an extent as to constitute any departure from it an anomaly, or even irregularity.*

Variations of form in the same word, within the limits of one and the same language, have of course been greatly reduced in number by the stereotyped character of written speech, and its diffusion in this form by the printing press. Still such duplicate forms are by no means rare. We write *i*nquiry or *e*nquiry ; a few years ago we called a telegraphic message a telegra*ph* or telegra*m* ; and English lexicographers differ widely as to the spelling of a large number of words. Vulgar spelling is, of course, infinitely more fluctuating. If we turn to an older language, such as Latin, for examples, we have scores of such duplicate forms as *adfero* and *affero*, *adlatum* and *allatum*, &c., &c. *Nicknames* constitute another variation of form of the same word. The English language is particularly rich in nicknames that differ widely from the original, *e.g.*, Dick or Dickon for Richard; Harry, Hal, Hank, for Henry ; Robin and Bob for Robert ; Jennie, Jeannie, Jane, for Johanna, &c., &c. The German furnishes *Hinz* for *Heinrich* and *Kunz* for *Conrad*, and in the southern dialects *Seppi* for *Joseph*, *Nazerl* for *Ignatius*, and a host of others. To these may be added varieties of surnames, *e.g.*, *Robinson*, *Robertson*, *Robison*, *Robeson* and *Robson ; Boyce* and *Boys*, &c. In point of pronunciation and accentuation, usage is equally fluctuating. So we still hesitate between *eīther* and *ēither*, and within a short time great variations occur. Similarly accent varies in a short time, and in individual usage. *Bálcony*† seemed barbarous a few decades ago ; and with regard to another word, I may say (almost) with Ingoldsby :

> " Re-*main*-der some style it ; while others revile it
> As bad, and say *re*-mainder—'tisn't worth while, it
> Would seem, to dispute, when we know the result immaterial—I accent, myself, the penultimate."

The variations of pronunciation, both of vowels and consonants, in different dialects of the same language, are too familiar to require illustration. The South German and the Saxon are notoriously incapable of distinguishing *p* from *b*, or *t* from *d ;* the Alsatian makes his *b*, when between two vowels, into a *v*, and says *aver* for *aber ;* as the Spaniard makes his *d* into *dh*, or even *l* (*Madrid* pronounced *Madridh*, or *Madril*, whence *Madrileño*, " a citizen of Madrid") ; and the Cockney scatters his *h*'s about most recklessly.

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* Cf Geiger, Urspr. d. Spr. p. 78, *et seqq.*

† Max Müller, Lectures, &c., First Series, p. 36.

Precisely similar results may be obtained from an examination of the component parts of words, the formative affixes; results which may be arranged under similar categories, viz.: various affixes with the same meaning, various meanings of the same affix, and various forms of the same affix. Under the first head, we have the affixes *-dom*, *-hood* or *-head*, *-ric*, Germ. *-thum* (Norse *-domr*), *-heit*, or *-keit*, *-reich*, all identical, or nearly so, in meaning, when considered as affixes merely, and without reference to their derivation; as to the second, the prefix *dis-*, for instance, cannot be said to have precisely the same significance in *dis-cover*, *dis-tend*, *dis-hearten*, nor the suffix *-dom* in *wis-dom* and *king-dom;* and the series of Teutonic suffixes above mentioned will furnish with abundant illustrations under the third category. Thus *-head* and *-hood* are mere arbitrary variations of the same suffix, which is in German *-heit:* we say child-*hood*, but God-*head;* the Eng. child-*hood* corresponds to Germ. kind-*heit*, and Norse, barn-*domr;* the Eng. wis-*dom* to Germ. Weis-*heit* (Weis-*thum* has a different meaning); Eng. king-*dom*=Germ. König-*reich*; bishop-*ric*= Bis-*thum;* and so on, *ad infinitum.*

.Such, then, is the material, the outward form of language, even as spoken by the most highly civilized nations, and fixed, as far as language can be fixed, by the diffusion of the written and printed word. The great characteristic of articulate speech, as we know and use it, is infinite variability of meaning and of form, so that, on the one hand, the same word may, in course of time, be at the opposite poles of signification (*e.g. kuanos*="blue," or "black;" *candidus*="white"); and, on the other, words identical in meaning and derivation are as far apart as possible in form (*e.g.* Fr. *larme*, and Eng. *tear*). The ruder and more uncultivated the language, the more fluctuating its forms and the meanings attached to them; and most fluctuating and unstable of all the speech of the primitive language-makers.

How, then, is this infinite variability and fluctuation, this "confusion of everything with everything else," as Geiger calls it, consistent with our definition of language, as a means of *intelligible* communication between man and man? What power was it that brought order out of this chaos? The answer has been hinted at already: this agent is *habit*, or *usage.* The case cannot be better stated than in the words of Geiger:*

* *Op. cit.*, p. 58.

"In the development of particular meanings, a great number of external circumstances have a share; in general, however, LINGUISTIC USAGE (*Sprachgebrauch*) may be regarded as the combining cause of the particular meaning attached to a word. Linguistic usage is *the habit of using a word in a particular sense.*"

Both the significance and the form of a word are first changed by habit, then fixed by usage. These changes may, in fact, be defined as *differentiation by the usage of the majority in a majority of cases of application.* The habit of using a word alone keeps it in existence; lose the habit, and you lose the word.

These variations, however, must not be regarded as the result of *conscious* change on the part of the language-makers, for all *habit* is *unconscious.* Primitive language, the creature of unconscious habit, is incapable of metaphorical application. When a word became the arbitrary sign of an action, object or idea, its original meaning and derivation was lost sight of, and ceased to be present to the mind of the speaker. The meanings of words change in a regular succession as determined by habit and usage, "the last link of the series having no clear connection with the first."* We have seen that the Gr. *damar,* "wife," is connected with *damao,* "to tame;" yet the idea of taming (or of binding, which is the root meaning) was of course never present to a Greek when he used the word; nor did he think of *penthos,* "grief," when he spoke of his *pentheros,* "father-in-law." So it is only by a conscious effort of thought that we connect *wedlock* with bolts and locks. Of course the fundamental idea contained in the root was the reason of its *original* application in the particular sense; but once *habitually* used in this sense, consciousness ceased, and the fundamental meaning was completely forgotten.

Having determined then that primitive man often indicated the same idea or object by different names, and widely different and even contradictory ideas by the same name, let us inquire why and how he as a general thing indicated similar objects by similar names. This inquiry is, in fact, identical with the vexed question as to the capacity of the primitive language-makers to form general ideas, and with that of the priority of general or particular names. Prof. Max Müller is one of the chief upholders of the priority of general ideas, and of primitive man's capacity for forming them. His argument may be best stated in his own language, as follows: "Man," he says,†

* *Op. cit.*, p. 58.

† Lectures on Science of Language, Second Series, p. 64.

could not name a tree . . . or any object . . . without discovering first some general quality that seemed at the time most characteristic of the object to be named." To this we answer that such abstraction is totally incompatible, not only with the intellectual capacity of primitive man, but with intelligibility, which was postulated as an attribute essential to constitute language a means of communication between man and man. "We have only to state the proposition," says Professor Sayce,* very truly, "to see how absurd it is. . . . There is no common bond of intelligibility between such universal ideas. . . . These abstract ideas must either be the last result of reflection, the universals arrived at after a long course of education, or else must be of the vaguest and most unmeaning character. In the first case, we are ascribing to the barbarian the mind of the civilized man; in the second case, any language at all would be out of the question. Two persons could not talk together in vague generalities, more especially when their conversation would be mostly confined to the bare necessities of life."

Man, to be intelligible to his fellow-man, must have named objects, not from a *general*, but from a *particular*, quality. For his name was first applied to an *individual* tree or other object, in which some *particular* quality struck him as its most prominent characteristic; and it was then applied to all individuals which bore a *general resemblance* to the first individual tree or other object named, though the difference might be wide indeed, and the *particular* quality which was the cause of the original name entirely absent. Thus general names, as used in primitive speech, arose from confusion, from inability to distinguish differences or failure to notice them, not from any miraculous power of abstraction and generalization, a power utterly wanting in the savage, *i.e.* in the primitive man of the present day. So a child will call a butterfly a bird, as it was originally called a fly, on account of the *particular* quality of flying common to both; and a leech a fish, because both swim; and most people call a whale a fish, because they are ignorant of the difference. So the South Sea Islanders called the horse a "man-carrying pig," according to the Rev. William Ellis, "the hog being the quadruped with which they were most familiar, and the name serving in their limited vocabulary as the generic designation for every other four-footed beast."† Now,

* *Op. cit.*, p. 220.
† Life of W. Ellis, p. 38.

surely there is no *general* resemblance between a pig and a horse; the name was given, on the contrary, from the *particular resemblance* of four-footedness, to which was added the *particular difference* "man-carrying." I have no access to any Polynesian vocabulary, but I very much doubt whether these savages had a word to indicate the abstract word "quadruped;" and it should be particularly observed that they did not call the horse a man-carrying *quadruped*, but a "man-carrying *pig*." The Oxford professor himself * quotes a similar story of the naming of the dog by other savages in the same way from the pig. This, I suppose, he would attribute to a general resemblance; and he goes on to say: "It would, however, very soon be felt as an inconvenience not to be able to distinguish between a dog and a pig. . . . How could that be effected?" The answer is contained in the instance given above, viz.: that a *particular resemblance* caused both animals to be at first designated by the same name; and when it was desired to distinguish them from each other, a *particular difference* was used to mark the distinction.

Indeed, all the phenomena of savage languages go to prove the incapacity of the savage to form abstract ideas. As Professor Sayce well says: † "In fact, the notion is absolutely contradicted by what we observe among modern savages. Here the individual objects have names enough, while general terms are very rare. The Mohicans have words for cutting various objects, but none to signify cutting simply; and the Society Islanders can talk of a dog's tail, a sheep's tail, or a man's tail, but not of tail itself. 'The dialect of the Zulus is rich in nouns denoting different objects of the same genus, according to some variety of colour, redundancy or deficiency of members, or some other peculiarity,' such as 'red cow,' 'white cow,' 'brown cow.'"

Again, Professor Max Müller says: ‡ "All naming is classification, bringing the individual under the general; and whatever we know, whether empirically or scientifically, we know it only by means of our general ideas."

To this I reply that we acquire our general ideas of objects by the cumulative process of making the acquaintance of many different individuals, and of the *particular* attributes common to all of them. "It is the *particular*," says Geiger, § "not the *individual*, that is the

* Life of W. Ellis, p. 311.

† Principles of Comparative Philology, p. 221.

‡ Lectures on Science of Language, Second Series, p. 385.

§ *Op. cit.*, p. 107.

opposite of the general. Only the individual has a real existence, but each individual combines within itself the particular and the general. The *general* is only what is common to several individuals" (and is therefore synthetic by nature, and of later growth), "the *particular* is what distinguishes individuals."

What has hitherto been said may be summed up in the following statements:—

I. (*a*) That the grounds on which the possibility of the evolution of articulate speech from the inarticulate cries of the lower animals has been advocated are insufficient and untenable.

(*b*) That our inquiries as to primitive language should commence with primitive man, *i.e*, with the first men of whose existence as men we have positive evidence.

II. (*a*) That the earliest human beings of whose existence we have such evidence were tool-makers and tool-users, and that their tools were of the same kind as those used by savage races now in existence, *i.e.*, by the primitive man of the present day.

(*b*) That all tool-makers and tool-users known to us are capable of articulate speech, and actually use it; and that therefore

(*c*) The earliest human beings of whose existence we have evidence were capable of using, and probably did use, articulate speech.

III. That the phenomena of language, as spoken at the present day, and as it has been spoken within the period of which we have historical evidence, furnish us with data amply sufficient to enable us to draw, by a process of inductive reasoning, the following conclusions as to the nature of primitive words:

1°. That the most prominent general characteristic of all language is its infinite variability and constant fluctuation, and that in two respects, viz.:

(I.) In respect to content or significance.

(*a*) The same sounds were used to name different objects; and, *vice versa*,

(*b*) The same ideas were named by different sounds; and therefore

(*c*) Primitive names were infinitely variable in meaning.

(II.) In respect to form the variability was equally great.

2°. That in respect both to meaning and form, the determinative cause of the preferential use of a particular meaning, or form, was individual habit developed into general usage, which caused similar objects, in course of time, to be indicated, as a rule, by similar sounds, in the same community, and gave greater stability, and therefore greater intelligibility, to language.

3°. That the variation of meaning, the application of the same names to different objects or ideas, could only take place when the idea which was the primary cause of the use of the particular name had been entirely forgotten, and had become a mere arbitrary outward sign.

4°. That primitive language, in order to be an *intelligible* means of communication between man and man, must have dealt only in concrete or individual names and in particular ideas, and that abstract names and general ideas were the result of a subsequent process of comparison between the different individuals, with regard to a number of *particular* attributes common to many, which caused the general resemblance to be perceived.

Surely there is nothing miraculous in the direct invention of a vehicle of communication, an engine of thought, so unstable, so variable, so fluctuating as this, and yet so easily fixed by means so natural and unconscious as habit and usage, and at the same time so perfectly answering the purpose for which it was created or invented.

We have, however, considered language only in one aspect—with regard to the isolated word and its content. Now Professor Sayce, in his very ingenious and interesting work on the "Principles of Comparative Philology," has lately pointed out, with great force and clearness, that language consists not only of words but of sentences. The word bears the same relation to the sentence that letters do to words. A letter is nothing by itself, nor can a word express thought, except as a member of a sentence. The interjection can express emotion, not thought; and to this the imperative of the verb is akin in usage, though not in origin.

We have, therefore, as yet only completed half the task proposed; we have described the nature of primitive words as abstract and isolated things, incapable of conveying thought. We have still to consider the nature of primitive words in relation to each other; in other words, the nature of primitive grammar.

With regard also to the other task which we set ourselves, namely, to prove that the direct invention of language was a thing within the capacity of the lowest savage, or, in other words, of primitive man, one-half still remains to be done. We have attempted to show that *general* names could *not* be primarily intelligible; we have still to show how *individual* names could be made so. In other words, we have to determine the sources of primitive language.

As, however, this paper has already greatly exceeded the limits originally proposed, these subjects must be left for future discussion.

LEAVES THEY HAVE TOUCHED.

BY HENRY SCADDING, D.D.

(*Continued from page 160.*)

FURTHER SUPPLEMENT.

As a further supplement to the collection of brief inedited auto graph documents laid by me from time to time before the Canadian Institute, I desire to add the following, which will close the series.

I. In the Canadian subdivision I insert (1) a royal warrant bearing the sign-manual of George III., authorizing the payment of a sum of money for the purchase of hemp-seed to be sent to the Province of Quebec, in 1789.

"GEORGE R.—Our will and pleasure is that by virtue of our general letters of Privy Seal, bearing date the 5th day of November, 1760, you do issue and pay, or cause to be issued and paid, out of our Treasury, or any Revenue in the receipt of the Exchequer applicable to the uses of our Civil Government, unto Alexander Davison, Esq., or his assigns, the sum of one hundred and fifty-two pounds, eighteen shillings and tenpence, without account, for the purposes following, that is to say: To reimburse him the charges attending the purchasing of 200 bushels of hemp-seed to be sent to Quebec to be distributed among the inhabitants of the different parts of that Province, £137 8*s.* 10*d.*: To pay the fees and charges attending the receipt thereof, £15 10*s.*: (together) £152 18*s.* 10*d.* And for so doing this shall be your Warrant. Given at our Court of St. James's, this 30th day of July, 1789, in the Twenty-ninth year of our Reign. To the Commissioner of our Treasury. By His Majesty's command: W. PITT. GRAHAM. ED. J. ELIOT." (A document bearing the signature of the younger Pitt has been given before.) (2). A letter written by Captain Bateman, commander of a sloop-of-war stationed at Halifax during the winter of 1760, in which the cold of the season is referred to, and the probable sufferings of brother-officers up the river, at Quebec. It is addressed to Richard Kee, Esq., in Savage

Garden, Tower Hill. "I have no news at present," the writer says, "or you might depend on having it; only I am heaving down, with expectation to go with the squadron early in the spring to Quebec. It is extream cold here: my pen and ink is ice. How poor Mackerly finds it at Quebec I shall hear in about May. Our squadron is in good health at present. Not the least sign of having Post. I shall be glad to have all the news you can furnish me with by the first ships, and to know if you can receive my pay: or the *Neptune*, if you'll mention it to Captain Hentwell: anything that's in his power, he will be so kind as to do it, I know. By this same opportunity I have writ to Captain Jervis and my friend Denham. I am in great hopes if they should come here, they will bring what beer and wine with bottles they can for—Dear Sir, your most sincere friend and humble servant to command, NATH'L BATEMAN." (3) A document written and signed by Gen. Carleton at Quebec in 1774, addressed to Benjamin Rumsey, Esq., Ordnance Store-keeper. "Quebec, 24th Sept. 1774. Sir: You are hereby ordered and directed to issue out from his Majesty's Ordnance-Stores in this Garrison, to Mr. Wilkinson, Quarter Master to the 52nd Regiment of foot, the undermentioned, they being for the service of the said regiment; and for so doing, this shall be your sufficient justification: Flints, musquet: 1000: Flints, carbine: 200: Musquet ball-cartridges made up :9144. —GUY CARLETON." (4) A receipt signed by Geo. Pownall, Secretary and Registrar of the Province of Quebec, in 1786. "Quebec, 2nd May, 1786. Received from Henry Caldwell, Esq., Acting Receiver General for the Province of Quebec, the sum of thirty-nine pounds, fifteen shillings, sterling, being the amount of my account for disbursements and contingencies as Secretary and Register of the Province from 11th October to 10th April, 1786, pursuant to His Honor Lieut.-Governor Hope's warrant, dated the 1st May, 1786, for which I have signed three receipts all of this tenor and date.—GEO. POWNALL." (5) Captain Jean Baptiste Bouchette's "Account of Expenses incurred in getting Intelligence," &c., in 1778, with his receipt attached, dated Quebec, 2nd April, 1779. "1778, Nov. 25. To paid Post hire to Ustette and back to get information of a large ship reported to have been seen from thence, by order of Lieut.-Governor Cramahé, £2. 1779. March 1. To ditto to Kamouraska and back, to deliver the Commissions of the Captains of Militia, &c., £3. To paid ditto with ditto, for the villages and back settlements,

£1. March 10. To paid ditto on a second journey to get intelligence of seditious letters that had been distributed in the lower parts of the Province, £3 10*s*. March 10. To paid to two persons who assisted in getting him said letters, by order of Lieut.-Governor Cramahé, £3 10*s*. March 10. To paid sundry expenses during the above journeys, £3. Total, £16.—Quebec, 2nd April, 1779. Received from Thomas Dunn, Esq., Paymaster-General of the Marine Department, sixteen pounds, currency, in full of the above account.—J. B. Bouchette." (6) A receipt in the handwriting of Mr. Dunn, for a gratuity to Firmain d'Aigre, a French Canadian volunteer, made prisoner on the occasion of Burgoyne's surrender. "J'ai reçu de Mons. Thomas Dunn, Ecuyer, par les mains de Mons. le lieutenant Gouverneur Cramahé la somme de quarante piastres d'Espagne pour mes frais et depense d'Halifax à Quebec, et recompense pour moi captivité, ayant été fait prisonnier avec l'armée du Général Burgoyne, ètant pourlors voluntaire.—Firmain d'Aigre. á Quebeck, 29e Mars, 1779. Branard, temoin." (7) Col. F. Smith's order for ammunition to be used in firing a salute on the departure of General Carleton from Quebec. It is addressed to the respective Officers of His Majesty's Ordnance, Quebec. "Gentlemen : You are hereby ordered and directed to issue from out of His Majesty's Ordnance stores in this Garrison, to Capt.-Lieut. Agar Weetman, the undermentioned particulars, the same being to salute His Excellency Brigadier-General Guy Carleton, at his departure from hence, and for so doing this shall be your justification : Corned powder : lbs : Twenty-two and a half. Flannel cartridges, 6-pounders, fifteen. Tin tubes, 6-pounders, nineteen. Port-fires, two. Slow-match, lb : one.—F. Smith, Lt.-Col." (8) A letter written by the Right Hon. Henry Dundas, when Secretary at War, in 1794. It relates indeed in no way to Canadian affairs ; but I insert it here as an authentic relic of one whose name has been recorded again and again on the map of Canada. It was in honour of this Henry Dundas, that the flourishing Town of Dundas, the County of Dundas, and the original "grand trunk" highway, cut out through the forest from Detroit to the confluence of the Ottawa and the St. Lawrence, denominated on the early maps throughout its whole length, Dundas Street, received their respective names. The letter referred to is addressed to the Governor of the Island of Jersey, Gen. Hall, during the troublous times of the Revolution in France. It appears that the island had been made a convenience of by persons engaged in the manufacture and circulation of forged assignats. The Secretary-at-War thus addresses the Governor, from the Horse Guards, 26th October, 1794. "Sir: Some unpleasant occurrences which have lately happened on that part of the coast of Brittany on which persons sent from Jersey have been landed, with a view of establishing a communication with the Royalists in the interior of France, render it absolutely necessary that you should not permit or authorize any person whatever to embark from Jersey with a design of proceeding to France, and particularly to that part of the coast which I have described, unless you shall hereafter receive from me directions contrary to those of this dispatch, to which in the present state of affairs I must request you will pay immediate and particular attention. One reason in particular which induces me to urge this precaution is, that I have reason to believe an intercourse has lately been established between Jersey and the coast for the sale and distribution of forged Assignats. The parties concerned in this speculation will of course make every exertion to prevent its failure, and it will therefore be necessary that any person supposed to have taken a share in it should be carefully watched. * * * I am, etc.:—HENRY DUNDAS." This signature is all the more interesting, as a few years later it became merged and lost in that of MELVILLE, Mr. Dundas having been in 1802 created Viscount Melville. (For a transcript from a document wholly in the handwriting of Sir George Yonge, after whom the other great highway of Ontario, Yonge Street, was named, *vide supra.*)

To the literary relics connected with the United States, I add (1) a volume from the press of Dr. Franklin, the sheets of which may have been worked off by his own hand. It is a small German treatise, entitled "Einige zu dieser Zeit nicht unnûtze Fragen," &c., dated at Philadelphia, 21st April, 1741. The imprint at the foot of the title-page reads as follows: "Gedruckt und zu haben bey B. FRANKLIN." (2) A book once the property of Washington Irving. It is a Spanish work—the Leon Prodigioso of Cosmo Gomez Texada de los Reyes, printed at Madrid in 1670, by Bernardino de Villa-Diego. On the first fly-leaf are the interesting words, in the handwriting of the former owner: W. IRVING, *Seville, May 16th, 1828.*

II. In the British division I insert now, (1) in the Court group, a letter which I copy from one written by William Henry, Duke of Gloucester, brother of George III. It is rather mysteriously worded, and has reference to some royal gift of jewellery about to be presented to his niece, on the occasion of her marriage. Thus it reads: "Sir: I forgot to mention to you yesterday that I have been commissioned, very privately, to find out if the jewels that are to be seen at the jeweller's you employed to set the H. P.'s picture, are bespoken; which, though not believed or certainly expected, as a future present; yet the Family would avoid giving duplicates, if that was the case. All the letters from Windsor to-day speak highly in praises of the H. P.; and it is only wished he may be as well pleased. Yours, W. H." The note is dated April 18, 1797. "H. P." denotes "Hereditary Prince," *i. e.* of Wirtemberg, Stutgardt. He was married with great pomp May 17, 1797, at the Chapel Royal, St. James', to Charlotte Augusta Matilda, Princess Royal of Great Britain, the Archbishops of Canterbury and York both officiating. The Duke of Gloucester, the writer of the preceding note, was present. (See Annual Register 1797; Chronicle, p .29.) Among the letters from which I selected the above note, was one written nineteen years later by the princess then married. She was now Queen of Wirtemberg, but a widow; and she speaks of her great affliction and of the unpleasant state of her monetary affairs; she owes, she says, the King's heirs four thousand pounds, which sum she is anxious that her brother, the Prince Regent of England, should assist her to pay. One more addendum to this group of "Leaves They Have Touched," is Queen Charlotte's copy of "Advice from a Lady of Quality to her Children"—the presentation copy from the translator. This book is further interesting as coming from the press of Robert Raikes, Gloucester, the memorable philanthropist. The date is 1778. (2) I add to the general literary and scientific relics, a volume once the property of Narcissus Luttrell, and containing his autograph. It is entitled, "The Magazine of Honour, or a Treatise on the Several Degrees of Nobility of this Kingdom, with their Rights and Privileges:" collected by Master Bird; but enlarged by Sir John Doderidge. London, 1642. Lord Macaulay has many references to Luttrell's "Brief Historical Relation of State Affairs from September, 1678, to April 1714:" in six octavo volumes. Narcissus Luttrell's collection of fugitive pieces, poetical satires, squibs, &c., on national occurrences and events in high and low life, from 1640 to 1688, bound up in eight folio volumes, fetched at auction in London, in 1820, the sum of £781. (3) A letter written by the seventh Earl of Elgin, father of our Canadian Lord

Elgin, and the famous collector of the Elgin Marbles. It was written at Milan in 1791, where he was at the time in an official capacity, and it is addressed to Lord Auckland, Ambassador at Paris, apprising him of current events and rumours. We find ourselves at once breathing the diplomatic atmosphere. Several distinguished European personages are named. I transcribe from the original autograph: "My dear Lord: I was really mortified to learn from my servant, who left London on the 24th May, that your Lordship was not then in England, as that persuasion had prevented me sending you, as I otherwise most certainly should have done, some direct notion of the progress of my present negotiations. It were totally superfluous in me to trouble your Lordship with any details of what has now been so long in London; and I am very sorry to say that, as yet, nothing positive has been further done. The minute of a Treaty formed at Sistovo, and containing eighteen articles, threatens an unfortunate delay and many unpleasant discussions. The Emperor has it in his power to prevent them. I don't think myself far wrong in my belief, that He wishes to do so. But we well know, that is not all that's requisite for its being done. At this moment He is in possession of answers from England and Berlin, on my communications from Florence. I delivered them to Him on Sunday. But unfortunately His decision is suspended, or rather his reply is suspended, till the arrival of a messenger, who is announced from Vienna. I am not sanguine in my expectations from the dispatches he may bring. The more so, as he has been detained by some proposals, or intelligence brought to Vienna, by Ct. Buhler, a confidential man with Potemkin. I have no other but general grounds, for auguring ill. But you'll allow, they are not fàvorable. When I adverted to the ratification of your Convention, I received for answer, *Cela s'arrangera*, and that the Archduchess was on her way with D. d'Albert to the Netherlands, where they were to receive the oath of allegiance. You may depend on my obeying the further instructions I have received on that head. But from what I can learn here, your neighbourhood is becoming a very interesting scene in other views. We are told here that the Ct. d'Artois is drawing nearer to Brusselles. All the French are following Him from Italy. The Prince Lambescq arrived here on Sunday, and proceeds towards the Rhine to-morrow. I have to acquaint you, on the authority of a French person of distinction, that we mean to take all the West India Islands; that fifty sail of line were never intended for the Baltick; and that, beyond a doubt, no first-rate can pass the Sound. This intelligence I got last night. However absurd, there are persons still more absurd by giving credit to such reports; and what's more astonishing, the effect of that belief is sensibly felt. I did not require fresh instances to convince me of your friendship. But I should be sorry to delay expressing my best thanks to your Lordship for the very kind manner in which, I understand, you have mentioned me in some letters lately written to England. Believe me to be, my dear Lord, most grateful for the obligations you confer on me; and with the utmost regard and esteem, your very faithful servant, ELGIN. I am just told that P. Lambescq has entered the Austrian service with the rank he held in the French army." The person spoken of in the postscript is a Charles Eugène de Loraine, Prince de Lambescq, a relative of Marie Antoinette, and Commander of the Royal German Regiment, with which force he charged the mob assembled at the Tuileries in 1789. The Count d'Artois was afterwards Louis XVIII. (4) A letter of William Hone's, transcribed from the original. Most people have consulted Hone's "Every Day Book," Hone's "Year Book," Hone's "Table Book," each of them filled with descriptions of old customs, old buildings, and the rural phenomena of England. Of the "Every Day Book," Charles Lamb took occasion thus to address its compiler:—

"Dan Phœbus loves your book: trust me, friend Hone;
The title only errs, he bids me say;
For while such art, wit, reading, there are shewn,
He swears 'tis not a *book of every day*."

My relic of this writer reads thus: "My Dear Sir,—From the time I came here until after the rain yesterday I was no better. I can make no effort with my pen, and very little orally, without pain. Yet your kind pencilling demanded more than apparent indifference. Can you stage yourself hither? Yours ever, W. HONE." It is addressed to Frederic Malcolm, Esq., from "Hampstead, at Mr. Hook's, Mount Vernon, Holly Bush Hill, 12th June, 1838." Hone died in 1842, æt. sixty-three. He was in his younger days a bold political pamphleteer, and was once tried for seditious libel, but acquitted. From being an erratic, unpractical revolutionist, he subsided at length into the literary antiquarian, and quiet law-abiding citizen.

(5) A volume, once the property of Leigh Hunt, another writer remarkable for a chequered literary and political career. He and his brother, during the Regency, established the *Examiner* newspaper; and three times they were prosecuted for their strictures on the government. On the third occasion, they were imprisoned for two years, and fined £500 each. This sentence caused Leigh Hunt to become very popular. In 1847 he received a pension of £200 per annum, which he enjoyed until 1859, when he died at the age of seventy-five. But it was not chiefly as a journalist that he was distinguished, but rather as an elegant English essayist, poet, dramatist, novelist, and translator from the Italian. He was the personal friend of Coleridge, Lamb, Keats, Shelley, Proctor, Moore and Byron. It was probably during his sojourn with the last-named in Italy, in 1823, that Leigh Hunt provided himself with the volume which is in my collection, which, besides having his autograph signature on the title page, is full of MS. annotations and reference-memoranda written by himself. It is a beautiful copy of Dante's "Amori è Rime," printed at Mantua in 1823; *co' tipi Virgiliani di L. Caranenti.* Brief fragments, that need not be transcribed, from the hands of (6) Sir Charles Lyell, (7) Sir Roderick Murchison, (8) Thackeray, and (9) Miss C. M. Yonge, (10) Miss Mary Russell Mitford's copy of Scott's "Lay of the Last Minstrel," and (11) Mark Anthony Lower's copy of Bowditch's "Suffolk Surnames," with the fine signature of the former owner, and an autograph letter of the author himself, inserted. As associated with the name of Sir Walter Scott, I place here (12) a copy of Smith's Translation of "Longinus on the Sublime," printed in London in 1756. It has fairly written on the title-page, in a hand of the last century, "E Libris. James Sanson." The Rev. Mr. James Sanson, of Leadhills, Lanarkshire, the former owner of the book, was a zealous bibliomaniac, well-known to Sir Walter; and it is held by Mr. Sanson's immediate family connexions in Scotland and here, that the novelist had him chiefly in his eye when he drew the world-famous "Dominie Sampson," venturing in the surname rather near that of his original.

Thackeray's relic, above referred to, is the following note, in which a too forward literary neophyte receives a rather stern rebuff. "My dear Sir: I cannot do what you have set your mind upon. Though I am always inclined to oblige, I at the same time am unable to do that which is utterly out of my power. You must not, young Sir, take advantage of my shaking hands with you at the Garrick Club a few weeks ago, nor must you trouble me with any more letters on the subject upon which you have 'set your mind.' Besides, you should have stated your views to the publishers—decidedly not to me.—Yours truly, W. M. THACKERAY."

To the Shakspearean group, I add volumes once the property of several distinguished Shakspearean commentators or editors, as shewing inscriptions from the hands of each of their former owners: (1) Joseph Ritson's copy of "Miscellaneous Pieces relating to the Chinese," collected by Thomas Percy, afterwards Bishop of Dromore. In his "Observations on the Ancient English Minstrels," Ritson coarsely criticised Percy's "Reliques;" but Ritson coarsely criticised everybody. Sir Walter Scott says of Ritson that he was "a man of acute observation, profound research, and great labour. These valuable attributes were unhappily combined with an eager irritability of temper which induced him to treat antiquarian trifles with the same seriousness which men of the world reserve for matters of importance." (Ritson died mad.) (2) Isaac Reed's copy of "Ozell's Translation of the Lutrin of Boileau." Reed edited Shakspeare twice: first in ten, and secondly in twenty-one volumes. At his death, in 1807, the sale of his library occupied thirty-nine days. (3) Alexander Dyce's copy of his own "Translation of Quintus Smyrnæus's continuation of the Iliad"—a presentation copy from himself "to his friend J. J. Eyton." Besides Shakspeare, Mr. Dyce edited the plays of the early English dramatists Peele, Greene and Webster. (4) Robert Chambers' copy of J. Payne Collier's edition of the "Notes and Emendations to the text of Shakspeare's Plays, from early manuscript corrections in a copy of the folio, 1632." Besides the autograph of R. CHAMBERS, in this volume, there is at the end a MS. note from the same hand on the word "flote," in scene 2, act 1, of the *Tempest*, corrected to "float" in the "Emendations," with the change of the preceding "all" into "are," making the passage read thus:

> "They all have met again,
> And all upon the Mediterranean float."

The editor of the "Emendations" remarks on this: "'Float' in fact is a verb, used by everybody, and not a substantive, used by no other English writer." To this R. Chambers in his MS. note rejoins: "'Flote' is used as a noun for 'fleet' in a letter of King James VI., October, 1589. See Documents relative to reception of the King, &c. Edinburgh, 1822." Robert Chambers' enlightened regard for the great dramatist is shewn by the room given him in the "Book of Days," the *Journal* (especially in the Tercentenary year), and the "Cyclopædia of English Literature;" and by an edition of the plays adapted to family reading. The stir made a few years since by Robert Chambers' "Vestiges of Creation" was a mild prelude to the widespread commotion raised, at a later time, by the same theories more explicitly unfolded. To the Shakspearean group of relics I finally add a note transcribed from the autograph of Mr. J. Payne Collier himself, on the subject of the received form of Shakspeare's name. It is known that some persons from time to time suffer from a craze for a change—an improvement—in the usual orthography of the poet's name. As was to be expected, Mr. Collier practically pronounces against them. "As to the spelling of the name of Shakespeare," he says in the MS. from which I copy, "I have never considered it a matter of any importance; but I have never put it on paper, either in print or in manuscript, but in this form—SHAKESPEARE. He seems to have spelt it in various ways, and nobody in his lifetime cared much how any name was spelt, as long as it sounded much in the same way. I have seen it, of old, as Shaksper, Shaxper, Shackspere, Shaxespere, Shaxspeare and Shackspeere, and in other fanciful modes, for there was then no uniformity or rule. I am so busy just now with my edition of his Plays, of which twenty-four are in type (only 50 copies 4to to subscribers), that I really have not time to enter more at large into the subject. I care much more about the accuracy of a single word of his text, however small, than about the mere orthography of his name." In 1842–44, Mr. Collier published an edition of Shakspeare in eight volumes 8vo; and in 1848, a work entitled "Shakespeare's Library," being a collection of the ancient romances, novels, legends, poems, and histories used by Shakspeare as the foundation of his dramas, printed in full. His "History of English Dramatic Poetry," in three volumes 8vo, published in 1831, is another standard work.

I augment the general European or Continental group (1) by a volume from the library of Ferdinand Philip, Duke of Orleans, eldest son of Louis Philippe, King of the French. It is an English work, entitled "A Dissertation on Parties, in several letters addressed to Caleb D'Anvers, Esq., and dedicated to Sir Robert Walpole; the seventh edition. London, R. Francklin, 1749." Caleb D'Anvers is a fictitious personage. The frontispiece is a curious composition; it shews Liberty prostrate, and weeping; an exasperated hydra between two opposing groups of men armed in various ways (some of them with *pens* only), and clamorous; above all in the air, Sir Robert Walpole, *à la Jove*, supported by Plutus, blind Fortune, and Subtlety, while a winged Messenger descends towards the crowd below, extending in one hand a purse and reserving in the other a large mitre. The volume is stamped within thus: "Bibliothèque de S. A. R. Mgr. le Duc d' Orleans." Within the oval border bearing this inscription are the initials "F. P. O.," surmounted by a French ducal coronet. It thus appears that the Duke of Orleans indicated is the son of Louis Philippe, so entitled, accidentally killed in Paris in 1842, the father of the present Count of Paris. By virtue of his evident sympathy with European civilization, I place here (2) an autograph letter of the King of Siam, reigning in 1850. It is in English, and is addressed to John Jarvis, Esq. He writes for a gold pen, to replace one that had been broken and rendered useless in the carriage; and he asks to have a mathematical instrument sent to him from Singapore. "Dear Sir," he says, "I have tried to use your golden pen in writing, and observed that its platinical point on one side has longly broken off; there is still remaining the point of platinum, but on the other side, which is longer than the other, so that the pen is of no use. I trust you will procure other, and send one from Chingapore. Allow me to ask for something of my purpose; can one of the small Ismouth compass (which is small as to be convenient to be carried by pocket, and which has the staying line and the arch or whole circle divided into 90 degrees on a square quarter, or into 360 degrees around whole circle, and has a hole for looking on observation of parallax of many thing at the way of road or bank of river, &c.) be procurable at Singapore or other place from your attention? Of which wanted article or instrument I shall be glad to pay for value which you would say of. Believe me your friend." [I regret that I do not accurately decipher the signature, nor the place of writing.] The following is added: "P. S.—Your pen was accompanied in the envelope."

III. I supplement the two groups representing the two ancient Universities of England, by adding (1) to the Oxford one, unimportant autograph fragments, which need not be transcribed, of (*a*) Dr.

Temple, the present Bishop of Exeter and late Master of Rugby : (*b*) Dr. Longley, Bishop of Ripon, afterwards, successively, Archbishop of York and Canterbury : (*c*) Sir George Cornewall Lewis, formerly of Christ Church, author of many classical, political and philological works : (*d*) John Henry Newman. I add (*e*) a relic of a distinguished Christ-Churchman of the last generation, Robert Nares : a small volume consisting of several classical pieces bound together. On the back of the first title is stamped the cipher of the former owner ; and a list of the contents of the book follows in his handwriting. The first item is "Poemata, Auctore Oxon.nuper Alumno, 1769," to which is appended this query, "At quo?" Mr. Nares was the author of the well-known "Glossary" of Elizabethan English. After these relics I place (*f*) an autograph letter of John Wesley, some time Fellow of Lincoln. It is addressed to Mr. W. Churchey, Brecon, and is dated August 8, 1789. It announces that he has collected for Mr. Churchey one hundred guineas from subscribers to a publication which that gentleman was about to put forth. Thus it reads : "My dear Brother : I came round by London from Leeds to settle my affairs here, and to set out for Bristol this evening by the Mail Coach. On Tuesday morning I purpose, God willing, to set out thence for the West. What remains of the month of August I hope to spend there. September is dedicated to Bristol. I suppose you will stray over thither. As to Henry Floyd's writings, from what I can find, they are vanished away. I never had them, and I cannot find who had. The 'Essay on Man' is wonderfully improved since I saw it many years ago. It is your masterpiece, and therefore fit to close the volume. But this will take more time than I imagined. I have procured One Hundred Guineas for you, and hope to procure Fifty more. —Your affectionate Brother, J. WESLEY." I find in Tyerman's "Life and Times of John Wesley" (iii. 579), that "Walter Churchey was an enthusiastic Welshman ; a lawyer with a large family, and a slender purse ; a good, earnest, conceited old Methodist, who, unfortunately for his wife and children, had more delight in writing poetry than he had employment in preparing briefs. * * * In 1786 Churchey wished," Mr. Tyerman informs us, "to enrich the world with his poetical productions ; and, among others, consulted Wesley and the poet Cowper. The latter, in reply, remarked : 'I find your versification smooth, your language correct and forcible, especially in your translation of the *Art of Printing*. But you ask me would I advise you to publish? I would advise every man to publish whose subjects are well chosen, whose sentiments are just, and who can afford to be a loser, if that should happen, by his publication.' "

I extract the following equally shrewd passage from a letter of Wesley's to the same Churchey, given in Tyerman, also having reference to the canvass for the sale of the proposed poems. "As you are not a stripling," Wesley says, "I wonder you have not yet learnt the difference between promise and performance. I allow, at least, five-and-twenty per cent.; and from this conviction, I say to each of my subscribers, what indeed *you* cannot say so decently to *yours*—'Down with your money.'"

(*g*) A letter of Canning's will not here be out of place, for he too was an Oxfordman. It has reference to the affairs of a pensioner, who has had some difficulty in receiving his allowance. I transcribe from the original, wholly in Canning's hand. It is dated at South Hill, near Bracknell, Berks, October 22, 1805, and is addressed to J. Smith, Esq., Chelsea Hospital. It reads as follows: "Sir: A poor out-pensioner of Kilmainham Hospital, who resides in my neighbourhood, has been accustomed to apply to me to pay him his half-year's pension as it became due, giving me his receipt for the same; and till this year I have found no difficulty in recovering the amount by application through my agent, at the Hospital near Dublin. This year the enclosed receipt for two payments advanced to Simon Hobson (that is the man's name) has been returned to me, with notice that I am to apply to you for repayment, for that by a new regulation all English pensioners belonging to Kilmainham are to be paid at Chelsea. I shall be obliged to you if you will remit to me the amount of the enclosed receipts, and if you will have the goodness at the same time to let me know, for the information of the poor man, whether Hobson is in future to address his half-yearly affidavit to Chelsea and to what officer there, instead of, as heretofore, to the Registrar of Kilmainham. I have the honour to be, &c., GEO. CANNING."

(2) To the Cambridge group I add (*a*) a third autograph relic, of the Rev. Charles Simeon, a note addressed by him apparently to his publisher. "I have sent all the remainder of the books," he says, "of which I desire your acceptance. I have enclosed 50 of The Evang. and Phar. Righ. compared, and 50 of The Fresh Cautions: 2nd edition. Pray put by the remainder of the first edition; and if without incon-

venience you can exchange those which Mr. Hatchard has, I will be much obliged to you. I am, &c., C. SIMEON, K. C. [King's College], Sept. 26, 1810." (*b*) A note from the hand of Professor Samuel Lee, a man of great note in the University in 1833, highly skilled, and in the first instance self-taught, in the Oriental languages; Professor, first, of Arabic, and then, Regius Professor of Hebrew in the University, author of a Hebrew, Chaldaic and English Lexicon, and many other learned productions. The note in question has reference apparently to an engraved illustration of a Biblical work: "I return the proof of the Plan of the Temple herewith," he says. "I like it much; it is a great improvement upon the drawing. As to the steps of which the Engraver inquires, they must be no more than seven in number. They will therefore occupy much less space than they do now. * * * In the Candlestick there should be seven branches; *i.e.* six, with the stem or trunk of it. No measure indeed is given, but a true representation of it is to be found on the Arch of Titus at Rome. Yours very truly, SAM'L LEE." (*c*) A brief and unimportant fragment in the handwriting of Connop Thirlwall, the associate of Julius Hare in the translation of Neibuhr's "Rome;" both formerly Fellows of Trinity College in Cambridge. It bears his signature, however, in the disguised form of C. ST. DAVIDS. After his appointment as Bishop of St. David's he perfectly mastered the Welsh language. Of his "History of Greece," Grote says: "Having studied, of course, the same evidence as Dr. Thirlwall, I am better enabled than others to bear testimony to the learning, the sagacity, and the candour which pervades his excellent work." On Thirlwall's monument in Westminster Abbey the words "SCHOLAR, HISTORIAN, THEOLOGIAN," inscribed after his name, sum up his claims to the regards of his fellow countrymen. (*d*) I subjoin here a note from the hand of the missionary Wolff, who though not a Cambridgeman, was, in his day, a well-known figure and character there. The little document is curious as mentioning "Lady Georgiana," his wife; the rest of it relates to the sale of his "Journals." It is addressed to Mr. Collins, Upper Sackville Street, Dublin, November 16, 1846. "My dear Mr. Collins!" it begins, "Lady Georgiana wrote to me that you were kind enough to send some money. Pray do not forget to send the two books of the names of the subscribers, and also any copies of the *Journal* remaining. I have no fear of not disposing of every one of them in England. I make you responsible for my subscription book.

Pray send me also my *Bokhara Journal.* I shall be happy to be enabled to be of use to you; for you have had a great deal of trouble with them. Yours affectionately, JOSEPH WOLFF." The maiden name of Lady Georgiana, was Walpole. She was a daughter of the second Earl of Orford. Somewhat eccentric herself, she became enamoured of the Rabbi's son, Joseph Wolff, whose exterior was not beautiful, nor by any means usually kept in trim order. The union proved happy. She accompanied her husband in his missionary excursions among the Jews and Mahommedans. In 1843 he was sent by the British Government to Bokhara, to ascertain the fate of Colonel Stoddart and Captain Conolly. This is one of the works referred to in the note. His missionary travels, he himself proclaimed in one of his books, surpassed those of St. Paul. "I, Joseph Wolff," he says, "also am an Israelite of the seed of Abraham, of the tribe of Levi, and I have preached the Gospel not only from Jerusalem round about Illyricum, but also from the Thames to the Oxus and the Ganges, and the New World." He was admitted to deacon's orders in the "New World," by Bishop Doane, of New Jersey. He in after years had the living of Isle-Brewers in Somersetshire, where he died in 1862.

SYNOPSIS OF THE FLORA OF THE VALLEY OF THE ST. LAWRENCE AND GREAT LAKES,

WITH DESCRIPTIONS OF THE RARER PLANTS.

BY JOHN MACOUN, M.A., *Botanist to the Geological Survey.*

(*Continued from page 435.*)

R. rotundifolium, Michx.

Indigenous. Rocky banks of rivers. Cape Rouge River (Brunet). Not very common at River du Loup (Thomas). Nonpareil (Maclagan). Common at Prescott (Billings).

R. lacustre, Poir.

Indigenous. Abundant in Cedar Swamps. New Brunswick (Fowler). Quebec and Point Levi (Brunet). River du Loup (Thomas). River Rouge (D'Urban). Abundant in swamps throughout Ontario, and extends by Lake Superior and the Dawson Route to Lake Winnipeg, thence through the wooded country to the Fraser in British Columbia (Macoun). West coast of Newfoundland (Dr. Bell). Labrador (Butler).

R. prostratum, L'Her.

Indigenous. Cold damp woods and rocks. New Brunswick (Dr. Fowler). Lotbinière (Brunet). Common on rocks, River Rouge (D'Urban). Very common at River du Loup (Thomas). Rocks west of Brockville and Chelsea, C. E. (Billings). Abundant on Laurentian rocks in the Counties of Addington, Hastings and Peterboro'. Shore of Lake Huron; Kaministiquia River and Thunder Bay; Dawson Route; on the slopes of Deer Mountains near Slave Lake (Macoun). Montreal and Kingston (Maclagan). Labrador (Butler). West coast of Newfoundland; Owen Sound and Gore Bay (Dr. Bell).

R. floridum, L.

Indigenous. Common in swamps and wet woods throughout the valley of the St. Lawrence and west to the Saskatchewan (Macoun).

R. rubrum, L.

Indigenous. Swamps and wet woods. New Brunswick (Mathews). Vicinity of Quebec, St. Joachim and Cape Tourmente (Brunet). Abundant around clearings, River Rouge (D'Urban). Very common at River du Loup (Thomas). Common at London (Saunders). Swamps, Niagara District (Maclagan). West coast of Newfoundland; Gore Bay and Hilton, Lake Huron (Dr. Bell). Cool damp woods, Central Canada, Owen Sound and Lake Huron, shore of Bruce Peninsula; common around Lake Superior and along the Dawson Route, and westward by the wooded country to Peace River and Upper British Columbia (Macoun). North to the mouth of the Mackenzie (Richardson).

PARNASSIA, Tourn. Grass of Parnassus.

P. parviflora, DC.

Indigenous. Wet rocky shores of lakes and rivers. Borders of the River St. Anne and River Jacques Cartier (Brunet). General around Lake Superior, also at Red Bay, Lake Huron; at Fort Edmonton on the Saskatchewan, and at the Canon on Peace River (Macoun). Labrador (Butler). Sandy banks of rivers in the Rocky Mountains (Drummond).

P. palustris, L.

Indigenous. Wet clay banks. Island of Anticosti (Brunet). Under the bank a Fort Francis, Dawson Route; Big Lake, west of Saskatchewan; west of the Arthabasca; shore of Little Slave Lake (Macoun). Saskatchewan Valley (Bourgeau).

P. Caroliniana, Michx.

Indigenous. Crevices of rocks along rivers. Vicinity of Quebec; Isle of Orleans (Brunet). Banks of the rocky Saugeen, Durham (Logie). Sandwich (Maclagan). Two miles south of London (Saunders). Crevices of rocks, Niagara Falls; Presqu' isle Point, Lake Ontario; Pott's Mill Dam, Brighton, Northumberland County; Red Bay, shore of Lake Huron (Macoun). McLeod's Harbour, Cockburn Island (Dr. Bell).

SAXIFRAGA, L. Saxifrage.

S. oppositifolia, L.

Indigenous. Moist rocks. Island of Anticosti (Goldie). Labrador (Butler). Cariboo Mountains (Macoun). Rocky Mountains (Bourgeau). Newfoundland and to the shores of the Arctic Sea and to Kotzebue Sound (Torr. & Gray).

S. aizoides, L.

Indigenous. Wet rocks and borders of streams. Newfoundland, Labrador, Greenland and the Island of Anticosti, and to the Arctic Sea (Torr. & Gray). Alpine Rivulets in the Rocky Mountains (Bourgeau). Labrador (Butler). Newfoundland (Dr. Bell).

S. tricuspidata, Retz.

Indigenous. Rocks along lakes and streams. North shore of Lake Superior (Agassiz). Rocks at the Peace River Canon; and on rocks at Stewart's Lake, Upper British Columbia (Macoun). Rocky Mountains (Bourgeau). Arctic and Sub-Arctic America; Hudson's Bay and Lake Winnipeg (Hooker).

S. caespitosa, L.

Indigenous. Perennial, caespitose; leaves glandular-pubescent, 3-5 cleft, the upper linear and entire, segments broadly linear, obtuse; flowering stems with a few scattered leaves, glandular 1-4 flowered; calyx-tube adherent to the ovary; petals white, obovate, 3-nerved, twice the length of the calyx.—*Hook. Fl. Bor.-Am. 1 p. 244.* On sandy places. Fortean Bay, Labrador (Butler). Arctic America from Greenland to Behring Strait. Vancouver Island (Macoun).

S. Aizoon, Jacq.

Indigenous. Moist rocks. Upper Falls on the River du Loup (Dr. Thomas). North shore of Lake Superior (Agassiz). Rocks four miles north of Michipicoten; also opposite Michipicoten Island, Lake Superior (Macoun). North shore of Lake Superior (Prof. Ellis).

S. stellaris, L.

Indigenous. Leaves rosulate, or a little scattered, obovate-cuneiform, almost sessile, dentate-serrate at the apex; scape corymbose at the summit, calyx free, reflexed; petals spreading, lanceolate, all attenuate into a claw.—*Pursh. Fl. 1 p. 310. Hook. Fl. Bor.-Am. 1 p. 250.* Canada (Pursh.) Labrador and Greenland (Torr. & Gray).

S. nivalis, L.

Indigenous. Perennial; leaves all radical, obovate or spatulate, attenuate into a petiole, unequally crenate-dentate; scape capitately or subcorymbosely several or many flowered, the half-adherent calyx erect, shorter than the oblong obtuse subunguiculate white petals; capsules purple, divergent.—*S. Watson in King's Explorations on the 40th parallel.* Canada (Pursh). Labrador, Melville Island, Arctic America and Greenland (Torrey & Gray).

S. rivularis, L.

Indigenous. The root usually granulate; plant glabrous or pubescent, stems weak, ascending 3-5-flowered; radical leaves somewhat reniform, crenately lobed, with the petioles dilated at the base; the cauline ones lanceolate, nearly entire; lobes of the calyx ovate, broad, as long as the tube or at length shorter; petals ovate, scarcely longer than the calyx; stigmas depressed-globose; capsule thick, much exceeding the calyx, crowned with the very short divergent styles; seeds minutely longitudinally rugose. Labrador, White Mountains and Rocky Mountains of Colorado. From Greenland to Behring Strait (Torrey & Gray). Cariboo Mountains, Vancouver Island (Macoun).

S. Virginiensis, Michx.

Indigenous. Exposed rocks. Cape Tourmente, Quebec (Brunet). Montreal, Kingston, Queenstown, Niagara Falls (Maclagan). River du Loup (Dr. Thomas). Common near London (Saunders). Top of the Mountain, near Hamilton (Logie). Brockville and Prescott, abundant (Billings). Rivers Moira and Trent, and the Rice Lake Plains; Pie and Michipicoten Islands, Lake Superior; New Portage, Dawson Route (Macoun). North-east coast of Lake Huron (Prof. Bell). Saskatchewan Plains (Bourgeau). Yale, British Columbia (Macoun).

S. Pennsylvanica, L.

Indigenous. Bogs. Canada and the Northern States (Torrey & Gray).

S. Sibirica, L.

Indigenous. Stem filiform, ascending, weak; radical leaves reniform, palmately 7-lobed, petiolate, a little hairy, the lobes ovate; those of the stem sessile; peduncles elongated, naked; segments of the calyx linear-ovate, striate, glabrous; petals cuneiform obovate; styles shorter than the ovary.—*Linn. Spec. (Ed. 2), p. 577. Sternb. rev. Saxifr. t. 25. Hook. & Arn. Bot. Beechey, p. 124.* Labrador and Newfoundland (Pursh.)

HEUCHERA, L. Alum-root.

H. villosa, Michx.

Indigenous. Rocks. Upper Canada (Douglas). Canada (Goldie). We suspect that this plant has been confounded with the *Tiarella cordifolia.*

H. Americana, L. Common Alum-root.

Indigenous. Rocky woodlands. Malden, Ontario. (Dr. Maclagan).

H. hispida, Pursh.

Indigenous. Rocky ground. Western end of Lake Shebandowan, within sixty miles of Lake Superior, and consequently in the valley of that lake. Westward from this point through the valleys of the Saskatchewan and Peace Rivers to the Rocky Mountains (Macoun).

MITELLA, Tourn. Mitre-wort. Bishop's Cap.

M. diphylla, L.

Indigenous. Hillsides in rich woods. Vicinity of Quebec and Cemetery of St. Charles (Brunet). River du Loup (Dr. Thomas). St. Valentin, Smith's Falls, Kingston, Chippawa and Malden (Maclagan). Common near Prescott (Billings). Common in Central Canada (Macoun). Common in Western Ontario (Logie, Ellis, Saunders, Gibson).

M. nuda, L.

Indigenous. Cedar swamps and moist woods in moss. Very common throughout Ontario and Quebec. New Brunswick (Mathews). River Rouge (D'Urban). Hillsides, Fortean Bay, Labrador (Butler). Manitoulin Islands (Dr. Bell). From Lake Superior, through the valleys of the Saskatchewan and Peace Rivers, to Quesnelle on the Fraser, in Upper British Columbia (Macoun).

TIARELLA, L. False Mitre-wort.

T. cordifolia, L.

Indigenous. Rich rocky woods. Very common throughout Ontario and Quebec. New Brunswick (Dr. Fowler).

CHRYSOSPLENIUM, Tourn. Golden Saxifrage.

C. Americanum, Schwein.

Indigenous. Cold wet places. Common throughout Ontario and Quebec. New Brunswick (Dr. Fowler).

CRASSULACEÆ.

PENTHORUM, Gronov. Ditch Stone-crop.

P. sedoides, L.

Indigenous. Open wet places. Lotbinière, Quebec (Brunet). River du Loup (Dr. Thomas). Everywhere (Maclagan). Common in Ontario, Hamilton, London, Owen Sound, Goderich, &c.

SEDUM, Tourn. Stone-crop.

S. acre, L. Mossy Stone-crop.

Introduced from Europe. Escaped to rocky banks and roadsides. Vicinity of Prescott and Brockville (Billings). New Brunswick (Dr. Fowler). On face of a rocky hill at Picton Harbour, Prince Edward County (Macoun). Niagara Falls (G. W. Clinton).

S. ternatum, Michx.

Indigenous. Rocky woods. Rocky banks of streams, Upper Canada (Torr. & Gray).

S. Telephium, L. Live-for-ever.

Introduced. Borders of fences, banks, &c. Escaped from cultivation in some places. Central Canada (Macoun). New Brunswick (Mathews).

S. Rhodiola, DC. Rose-Root.

Indigenous. Cliffs and crevices of rocks. Labrador (Brunet). Newfoundland (Torrey & Gray). Greenland to Behring Straits. Saskatchewan Plains (Bourgeau). Dunvegan, Peace River (Macoun).

HAMAMELACEÆ.

HAMAMELIS, L. Witch-Hazel.

H. Virginica, L.

Indigenous. Damp woods. New Brunswick (Dr. Fowler). Point Levi; Isle of Orleans (Brunet). Common near Prescott (Billings). Scarce in Central Canada (Macoun). Hamilton (Logie). London (Saunders). Kettle Point, Lake Huron (Gibson). Isle aux Noix, Wolfe Island, Chippawa and Malden (Maclagan). Toronto (Prof. Ellis).

HALORAGEÆ.

MYRIOPHYLLUM, Vaill. Water-milfoil.

M. spicatum, L.

Indigenous. Ponds, slow streams and margins of lakes. New Brunswick (Dr. Fowler). Lake Temiscouata, Montreal (Maclagan). St. Lawrence River, common (Billings). Bay of Quinté, Trent and Moira Rivers (Macoun). North shore of Lake Superior (Agassiz). Sandy Bay, Lake Huron (Dr. Bell). Georgian Bay, Lake Huron; Rat Creek, west of Portage Laprairie, in brackish lakes, to Edmonton on the Saskatchewan (Macoun). Great Bear Lake (Richardson). West coast of Newfoundland (Dr. Bell).

M. verticillatum, L.

Indigenous. In marshes along the Bay of Quinté (Macoun). Burlington Bay, Lake Ontario (Logie).

M. heterophyllum, L.

Indigenous. Lakes and rivers. River Trent, Heely Falls; North River above Round Lake; mouth of the Sydenham River, Owen Sound (Macoun). Niagara Falls (Maclagan). Vicinity of Hamilton (Logie).

M. ambiguum, Nutt. Var.

Indigenous. Ponds and ditches. New Brunswick (Dr. Fowler).

M. tenellum, Bigelow.

Indigenous. Borders of ponds and mouths of rivers. New Brunswick (Dr. Fowler). Saguenay River, Quebec (A. T. Drummond). Abundant at the mouth of the River Buck, Stanhope Township, Peterborough County, Ont. (Macoun). Newfoundland (La Pylaie).

Proserpinaca, L. Mermaid-weed.

P. palustris, L.

Indigenous. Wet swamps. Island of Montreal (Maclagan). Banks of the Nation River, Eastern Ontario (Billings). Marshes along Lakes Isaac and Sky, Bruce Peninsula, Lake Huron; also Fishing Islands, Lake Huron (Macoun).

Hippuris, L. Mare's Tail.

H. vulgaris, L.

Indigenous. Ponds and springs. Lotbinière, Malbaie, Labrador (Brunet). New Brunswick (Dr. Fowler). Lake Temiscouata, Quebec (Maclagan). Banks of the St. Lawrence, Eastern Ontario (Billings). Scarce in Central Canada; abundant on the Sydenham River, Owen Sound; Pic and Current Rivers, Lake Superior; Fort Edmonton on the Saskatchewan (Macoun). Gore Bay and Vermont Harbour, Lake Huron (Dr. Bell). Labrador, Greenland, Sub-Arctic America (Torr. & Gray). Little Slave Lake, Lake Arthabasca, and throughout the north-west to the Fraser in British Columbia (Macoun).

ONAGRACEÆ.

Circaea, Tourn. Enchanter's Nightshade.

C. Lutetiana, L.

Indigenous. Rich woods. Common throughout Ontario and Quebec. New Brunswick (Mathews). Island of Orleans (Dr. Thomas).

C. alpina, L.

Indigenous. Deep woods. Common throughout Ontario and Quebec. New Brunswick (Mathews). West coast of Newfoundland (Dr. Bell). Kaministiquia River, Dawson Route, Arthabasca River, Peace River and Rocky Mountains (Macoun).

Gaura, L.

G. biennis L.

Indigenous. Dry banks. Moffatt's Island, Montreal; Malden, Ontario (Maclagan).

Epilobium, L. Willow-Herb.

E. angustifolium, L. Great Willow-Herb.

Indigenous. Low grounds and newly-cleared lands. Common throughout Ontario and Quebec. Common, New Brunswick (Mathews). West coast of Newfoundland; Islands in Lake Huron (Dr. Bell). Cariboo Bay, Labrador (Butler). From Lake Superior westward to Quesnelle on the Fraser in Upper British Columbia (Macoun).

E. angustifolium, L. Var. canescens.

Indigenous. Marmora Village, Hastings County; Owen Sound, very rare? Cariboo, British Columbia (Macoun).

E. alpinum, L. Var. majus, Wahl.

Indigenous. Rocky ground and mountainous regions. Canada (Mrs. Percival). Sault Montmorency, Quebec; South coast of Labrador (Brunet). Deer Mountains, near Little Slave Lake (Macoun). Rocky Mountains, lat. 52° N. (Bourgeau). Upper British Columbia (Macoun).

E. palustre, L. Var. lineare, Gray.

Indigenous. Bogs. Nicolet, Montreal, Niagara Falls (Maclagan). In swamps in Eastern Ontario (Billings). Marshes and swamps, common, Central Canada (Macoun). Hamilton (Logie). London (Saunders). East coast of Lake Huron (Gibson). North shore of Lake Superior (Agassiz). New Brunswick (Dr. Fowler). Swamps, Labrador (Butler). Dawson Route, Loon Portage; Edmonton on the Saskatchewan; the Arthabasca; Little Slave Lake (Macoun). Plains of the Saskatchewan (Bourgeau). Rocky Mountains, and west to the Fraser at Fort George (Macoun).

E. molle, Torrey.

Indigenous. Bogs. Sphagnous marshes, Saint Croix (Brunet). Nicolet (Maclagan). Cedar swamp at the foot of the Oak Hills, Sidney, Hastings County (Macoun). Lake Medad, Ont. (Logie).

E. tetragonum, L.

Indigenous. Rocky ground. Vicinity of Quebec and Tadoussac (Brunet). Canada (Hooker). Canada to lat. 64° (Torrey & Gray). Saskatchewan Plains (Bourgeau). On Peace River, through the Rocky Mountains to McLeod's Lake, and down the Fraser to Vancouver Island (Macoun).

E. coloratum, Muhl.

Indigenous. Wet places. Common throughout Ontario and Quebec. New Brunswick (Dr. Fowler). Kaministiquia River, Lake Superior; Fort Edmonton on the Saskatchewan; shore of Little Slave Lake; Dunvegan on the Peace River, and westward to Upper British Columbia (Macoun). Saskatchewan Plains (Bourgeau). Cockburn Islands and Bruce Mines, Lake Huron; west coast of Newfoundland (Dr. Bell).

E. paniculatum, Nutt.

Indigenous. Glabrous or glandular-pubescent above; stem erect, slender, terete, dichotomous above; leaves narrowly linear, obscurely serrulate, acute; attenuate at the base, mostly alternate and fascicled; flowers few, terminating the spreading filiform and almost leafless branches; calyx tube infundibuliform; petals obcordate, nearly twice exceeding the calyx lobes; capsules short, acute at each end, straight or little curved, erect or spreading. Stems 3′–3° high; flowers 1–4″ long, light rose-colour; capsules ½-1′ in length; sometimes glabrous throughout. On newly cleared land at Oxendon, Colpoy's Bay, Georgian Bay, Lake Huron, abundant (Macoun).

E. latifolium, L.

Indigenous. Stem ascending, often branched, 9′–18′ high, glabrous or very minutely puberulent; leaves ovate or ovate-lanceolate, sessile, entire or nearly so, rather thick and rigid, 1′–1½′ long, the veins not apparent; flowers axillary and terminal, on short pedicels; style somewhat erect, glabrous, shorter than the stamens. Amour Bay, south coast of Labrador (Butler). West coast of Labrador (Dr. Bell).

Œnothera, L. Evening Primrose.

Œ. biennis, L. Var. muricata, Gray.

Indigenous. Fields and waste places. Gravel bars around Lake Superior (Macoun). East coast of Lake Huron (Gibson). Vicinity of Hamilton (Logie). Montreal Island (Dr. Holmes). Gravel bars of the Manitoulin Islands, Lake Huron; west coast of Newfoundland (Dr. Bell). Dawson Route; Fort Edmonton on the Saskatchewan and Fort Assinaboine on the Arthabasca (Macoun). Saskatchewan Plains (Bourgeau).

Œ. biennis, L. Var. grandiflora, Gray.

Apparently introduced. Cultivated grounds and waste places. Common throughout Ontario and Quebec. New Brunswick (Mathews). Lake Superior (Prof. Bell). On sandy shores, east coast of Lake Superior (Macoun).

Œ. biennis, L. Var. parviflora, Gray.

Indigenous. Open places in woods. Frequent in Central Canada (Macoun).

Œ. fruticosa, L. Sundrops.

Indigenous. Open places. Island of Montreal (Mr. Goldie).

Œ. chrysantha, Michx.

Indigenous. Banks, &c. Vicinity of Quebec and at the Quarantine Station (Brunet). New Brunswick (Mathews). St. Helen's Island, Quebec; Chippawa, Ont. (Maclagan). Twenty miles up the Kaministiquia River, Lake Superior (Macoun). Niagara Falls (John Carey). Hudson's Bay (Michaux). Dawson Route, near Lake Shebandowan (Macoun).

Œ. pumila, L.

Indigenous. Dry fields. Common near Quebec (Brunet). Beven's Lake, River Rouge (D'Urban). New Brunswick (Dr. Fowler). Island of Orleans and Ancient Lorette (Dr. Thomas). Nicolet (Dr. Maclagan). Counties of Addington and Victoria, Central Canada (Macoun). North coast of Lake Superior (Prof. Bell). Vicinity of Hamilton (Logie). Island of Montreal (Dr. Holmes). Mississagui Island, Lake Huron (Dr. Bell).

Ludwigia, L. False Loosestrife.

L. palustris, Ell.

Indigenous. Ditches and dried beds of ponds. Conway's Creek, and elsewhere in swamps, common (Billings). Nicolet and Malden (Maclagan). Ditches and ponds abundant in Central Canada and at Owen Sound (Macoun). Very common at London (Saunders). Saskatchewan River (Torr. & Gray).

L. alternifolia, L.

Indigenous. Swamps, especially near the coast. In swamps, Canada (Torr. & Gray).

MELASTOMACEÆ.

Rhexia, L. Deer-grass.

R. Virginica, L.

Indigenous. Sandy swamps very rare. Shores of Muskoka Lake.

LYTHRACEÆ.

LYTHRUM, L. Loosestrife.

L. alatum, Pursh.

Indigenous. Wet places. Malden (Maclagan).

L. Salicaria, L.

Indigenous. Wet meadows, Canada (Torr. & Gray). Moist meadows near the Quarantine Station, Quebec (Brunet).

NESÆA, Jurs. Swamp Loosestrife.

N. verticillata, K.B.K.

Indigenous. Muddy margins of lakes, rivers and ponds. Bank of the St. Lawrence, near Brockville; banks of the Rideau, near Ottawa (Billings). Bay of Quinté, at Belleville; Wellington Beach, Lake Ontario; River Trent, and many lakes and streams in North Hastings; Cameron's Lake at Fenelon Falls, Peterboro' County (Macoun). Burlington Beach, near the Water Works, and in the "Old Desjardin Canal," Burlington Heights (Logie). Montreal, Chippawa and Malden (Maclagan).

CUCURBITACEÆ.

SICYOS, L. One-seeded Cucumber.

S. angulatus, L.

Doubtfully indigenous. River banks and weed yards, and running over fences. Near M. Ross's house, Montreal (Brunet). St. John's, Quebec (Maclagan). Waste heaps and around dwellings, Belleville (Macoun). Vicinity of Hamilton (Logie).

ECHINOCYSTIS, Torr. & Gray. Wild Balsam Apple.

E. lobata, Torr. & Gray.

A very doubtful native. Rich soil along rivers, and climbing over fences and bushes around dwellings. New Brunswick (Fowler). Saint Laurent and Lotbinière (Brunet). Cayuga (Maclagan). Belleville, Hastings County, and Seymour, Northumberland County; also at Fort Francis, Dawson Route (Macoun). From the Saskatchewan River (Torr. & Gray).

UMBELLIFERÆ.

HYDROCOTYLE, Tourn. Water Penny-wort.

H. Americana, L.

Indigenous. Damp grassy places along streams or in woods. New Brunswick (C. F. Mathews). Saint Croix, common; border of the River Blanche in Somerset (Brunet). Moist woods, common (Billings). Grassy damp places three miles east of Belleville; Seymour, Northumberland County; Crevices of wet rocks, Sydenham Falls, Owen Sound (Macoun). Ancaster (Logie). Hilton, Cockburn Island, Lake Huron (Dr. Bell).

SANICULA, Tourn. Black Snake-root.

S. Canadensis, L.

Indigenous. Rich low woods. Woods west of Belleville, rare (Macoun). Woods west of Hamilton (Logie). Rich woods, common, London (Saunders). Malden (Maclagan).

S. Marilandica, L.

Indigenous. Woods and copses common. Newfoundland (Torr. & Gray). New Brunswick (Fowler). Abundant in Quebec (Brunet, Thomas, D'Urban). Very common in Ontario (Billings, Macoun, Logie, Saunders and Gibson). Kaministiquia River and Dawson Route; Fort Edmonton on the Saskatchewan; Fort Assinaboine on the Arthabasca; and in woods west of Little Slave Lake (Macoun).

DAUCUS, Tourn. Carrot.

D. Carota, L.

Introduced. By roadsides, and spontaneous in old fields and gardens. New Brunswick (Fowler). Wastes around Grand Trunk Railway Gravel Pit at Prescott (Billings). Along the Grand Trunk Railway and in gardens, Belleville (Macoun). Found at Galt by Miss Crooks (Logie). Montreal (Maclagan). Owen Sound (Dr. Bell).

HERACLEUM, L. Cow-Parsnip.

H. lanatum, Michx.

Indigenous. Moist rich ground. Common throughout Ontario and Quebec. Labrador (Brunet). New Brunswick (Dr. Fowler). West coast of Newfoundland (Dr. Bell). Manitoulin Islands, Lake Huron (Dr. Bell). Very common on the Kaministiquia River and Thunder Bay, Lake Superior; near Lake of the Woods, Dawson Route; south-west branch of the Peace River, west of the Rocky Mountains (Macoun). Saskatchewan Plains (Bourgeau). Sitcha (Bougard). Vancouver Island (Macoun).

PASTINACA, Tourn. Parsnip.

P. sativa, L. Common Parsnip.

Introduced from Europe. Fields, waste places and roadsides. New Brunswick (Mathews). Quebec (Brunet). Common in Central Canada; Owen Sound; Fort Francis, Rainy River (Macoun). Common in Eastern Ontario (Billings). Niagara and Malden (Maclagan). County Huron, Ont. (Gibson).

ARCHEMORA, DC. Cowbane.

A. rigida, DC.

Indigenous. Sandy swamps. Malden, Ontario (Maclagan).

ARCHANGELICA, Hoffm.

A. officinalis, Hoffm.

Indigenous. In Labrador, according to Torrey & Gray. In waste places and along fences in Central Canada. Evidently introduced.

A. atropurpurea, Hoffm. The Great Angelica.

Indigenous. Low river banks. Common in Ontario and Quebec. West coast of Newfoundland (Dr. Bell). New Brunswick (Dr. Fowler). Isle of Orleans, St. Lambert, Lotbinière (Brunet). North shore of Lake Superior (Agassiz). Kaministiquia River, Lake Superior, and Michipicoten Island (Macoun). Ravines, south coast of Labrador (Butler).

A. Gmelini, DC.

Indigenous. Rocky ground. In Upper Canada, according to Pursh.

CONIOSELINUM, Fischer. Hemlock-Parsley.

C. Canadénse, Torrey & Gray.

Indigenous. Swamps, &c. Lotbinière and Tadoussac (Brunet). New Brunswick (Dr. Fowler). Lake Temiscouata (Maclagan). Sea shore, River du Loup (Dr. Thomas). Mouth of the River St. Lawrence (Michaux). West coast of Newfoundland (Dr. Bell).

LIGUSTICUM, L. Lovage.

L. Scoticum, L. Scotch Lovage.

Indigenous. Salt marshes. River du Loup; Tadoussac (Brunet). Labrador, Caribou Bay (Butler). West coast of Newfoundland (Dr. Bell). New Brunswick (G. F. Mathews).

L. actaeifolium, Michx.

Indigenous.

THASPIUM, Nutt. Meadow-Parsnip.

T. barbinode, Nutt.

Indigenous. River banks. Rare, London (Saunders). Chippawa and Detroit River (Maclagan).

T. aureum, Nutt.

Indigenous. Dry hills and river banks. Common throughout Ontario and Quebec. Isle of Orleans (Brunet). New Brunswick (G. F. Mathews).

T. aureum, Nutt. Var. apterum, Gray.

Indigenous. Dry hills and river banks. Vicinity of Belleville (Macoun). Nuns' Island, Montreal (Dr. Holmes).

T. trifoliatum, Gray. Var. apterum, Gray.

Indigenous. Dry soil and banks of rivers. In Canada, according to Torrey & Gray. Fort Garry to Edmonton, and west by Little Slave Lake and Peace River to the Rocky Mountains (Macoun). Saskatchewan Plains (Bourgeau).

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SUPPOSED EVIDENCE OF THE EXISTENCE OF INTER-GLACIAL AMERICAN MAN.

BY DANIEL WILSON, LL.D., F.R.S.E.

The determination of a so-called palæolithic period for Europe, with its rude implements of stone and flint, chipped into shape without the aid of any grinding or polishing process, and belonging to an era when the European man was associated with animals either wholly extinct or unknown throughout the historic period, naturally stimulates the curiosity of American archæologists in their own native explorations. But thus far only very slight and uncertain indications have seemed to point to any corresponding evidences of a like antiquity for American man.

Various causes combine to give to the researches of the American archæologist a character essentially distinct from that which marked the earlier stages of antiquarian investigation in Europe, and which stimulated its votaries to ally themselves with the students of geology in a renewed and more strictly scientific inquiry into the earliest traces of primeval man. In Europe the antiquary had long been engaged in the elucidation of ancient historic monuments; and had passed beyond these to a study of the ruder traces of primitive art, and of the physical characteristics of races which appeared to have preceded the historic nations of the Old World. The researches directed to the solution of the problems thus originated were followed up through mediæval, classical, Assyrian, and Egyptian remains, to the very threshold of that prehistoric period which forms the debatable land between geological and historical epochs. Indeed, not the least significant fact in reference to the remarkable disclosures of recent years, is that some of the most characteristic drift implements—such as the spear-head found alongside of a fossil elephant's tooth in the vicinity of Gray's Inn Lane, London; or the large flint implements of the same type obtained from the drift of the Waveney Valley, at Hoxne in Surrey, underlying similar fossil remains,—had been brought under the notice of archæologists, and deposited in the British Museum, upwards of a century before the idea of the contemporaneous existence of man and the mammals of the drift found any favour.

The conception of the comprehensiveness even of historical antiquity was long trammelled in Europe by a too exclusive devotion to Greek and Roman remains; but the historical relations of the American continent with the Old World are so recent, that for it the fifteenth century is the historic dawn; and anything dating before the landing of Columbus has seemed to be inconceivably ancient. Hence antiquarian speculations and historical research have been almost exclusively occupied on very modern remains; and the supreme triumph long aimed at has been to associate the hieroglyphics and sculptures of Central America, and the architectural monuments of Mexico and Peru, with those of ancient Egypt. But in all that relates to the history of man in the New World, we have to reserve ourselves for further disclosures. There are languages of living tribes of which neither vocabulary nor grammar has yet been constructed. There are nations of whose physical aspect we scarcely know anything; and areas where it is a moot point even now, whether the ancient civilization of Central America may not be still a living thing. The palæolithic disclosures of the French drift belong to our own day; and though the researches of the Rev. Mr. MacEnery in the famous Kent's Hole cavern, had fully half a century ago brought to light true palæolithic flint implements in the same red loam which contained bones of the mammoth, tichorine rhinoceros, cave-bear, and other extinct mammalia, it is only now that the true significance of the disclosures of the ossiferous caves of England is being recognized. America was indeed little behind Europe in the earlier stages of cavern research. It is upwards of forty years since discoveries in the ossiferous caves of South America were communicated to the scientific world, which seemed to point to like conclusions in reference to the contemporaneous existence of man and the extinct mammalia of the cave deposits; and which even included what have been regarded by some as facts of special significance in reference to the hypothesis of evolution in its relation to the origin of man. A cabinet of the British Museum is filled with fossil bones of mammalia, obtained by Dr. Lund and M. Claussen from limestone caverns in the Brazils closely resembling the ossiferous caves of Europe. The relics were imbedded in a reddish-coloured loam, covered over with a thick stalagmitic flooring; and along with them lay not only numerous bones of genera still inhabiting the American continent, but also of extinct genera of fossil monkeys: the significance of which in relation to the hypothesis of transition through intermediate forms, from the lower primates to man, has since received ample recognition.

The comprehensive aspect which the prehistoric archæology of Europe is now assuming, with its palæolithic and neolithic subdivisions, its post-glacial and possible inter-glacial and pre-glacial periods, has not been overlooked in America. Its relations to the geological aspects of the great drift formation of the northern continent could not, indeed, escape observation, and has naturally stimulated both the geologists and the archæologists of the New World to aim at the recovery of corresponding evidence of its palæolithic era. Hitherto, however, the assumed proofs of any such palæotechnic American art, have been isolated and indecisive. A flint knife has been described, recovered from a depth of upwards of fourteen feet among the rolled gravel and gold-bearing quartz of the Grinell Leads, in Kansas Territory. Specimens of flint implements from the auriferous gravel of California were produced at the Paris Exposition of 1855. According to the geological survey of Illinois, for 1866, stone axes and flint spear-heads were obtained from a bed of local drift near Alton, underlying the loess, and at the same depth as bones of the mastodon and other fossil mammals. Other more or less trustworthy reports of discoveries of a like character have been published from time to time. Mr. Charles C. Jones, for example, in his *Antiquities of the Southern Indians*, notes the discovery of seeming palæolithic implements in the Nacoochee Valley, in the State of Georgia. There the river Chattahoochee flows through a rich auriferous region; and, in the search for gold, the explorers have made extensive cuttings through the soil and underlying drift-gravel, down to the slate-rock upon which it rests. During one of these excavations, at a depth of some nine feet, intermingled with the gravel and boulders of the drift, three flint implements were found, measuring between 3 and 4 inches in length, and, according to the description of Mr. Jones, "in material, manner of construction, and appearance so nearly resembling some of the rough so-called flint hatchets belonging to the drift type, that they might very readily be mistaken the one for the others."

In some of the illustrations of American palæolithic art thus adduced, there are undoubted indications of an undue bias in favour of the interpretation of the evidence in the direction of greatest antiquity, even where, as in the case of an implement from Californian gravel drift, the specimen adduced was a polished stone plummet, altogether at variance with any palæotechnic processes hitherto disclosed.

But the most startling discoveries of primitive flint or stone implements were of minor importance, in comparison with the recovery of human remains from the auriferous drift of California. In 1857 Dr. C. F. Winslow produced a fragment of a human skull found eighteen feet below the surface, in the "pay drift" at Table Mountain, in connection with the bones of the mastodon and fossil elephant. A later disclosure brought to light a complete human skull, reported to have been recovered from auriferous gravel, underlying five successive lava formations. Professor Whitney, after inquiries which satisfied himself of the genuineness of the discovery, produced the skull at the Chicago meeting of the American Association for the Advancement of Science, in 1869, to the manifest delight of some who were prepared upon such evidence to relegate American man to a remoter epoch than the flint-folk of the Abbeville and Amiens gravel drift. It was subsequent to this startling production of a complete human skull, assumed to be found *in situ*, in the drift, that the highly polished plummet of syenite, in the form of a double cone perforated at one end, was produced before the Chicago Academy of Sciences, as an implement found at a depth of thirty feet, in the drift gravel of San Joaquin, California, by workmen engaged in digging a well. In this case also Professor Whitney appears to have had no hesitation in assigning it to the age of the mastodon.

That flint and stone implements of every variety of form, and every degree of rudeness of primitive art, abound in the soil of the

New World, has been established by ample proof. But along with this, it has ever to be borne in remembrance that its indigenous population has not even now abandoned such arts. So striking, indeed, is the analogy between the arts of the primitive cave men of Belgium and France, and those of the Hyperborean race of this continent at the present day, that Professor Boyd-Dawkins, in his *Cave Hunting*, thus sums up a review of them: "All these facts can hardly be mere coincidences, caused by both peoples leading a savage life under similar circumstances : they afford reasons for the belief that the Exkimos of North America are connected by blood with the palæolithic Cave dwellers." Such a far-reaching deduction, which would recognize in living tribes within the Arctic Circle of the American continent lineal descendants of the Cave dwellers at the head waters of the Garonne in Europe's mammoth and reindeer eras, is not one to be accepted as yet as more than a hypothesis. But the analogies thus recognized between the manufactured implements and weapons of tribes at present in occupation of Arctic America and those of the post-glacial if not of the inter-glacial races of Europe's prehistoric dawn, warn the archæologists of America of the danger of error from a too hasty assumption of a like antiquity for chance-found objects analogous in form to the river-drift implements of Europe.

But the *Report of the Peabody Museum of American Archæology and Ethnology* for the present year, 1877, includes a special report by Dr. Charles C. Abbott, setting forth the discovery of data from which it is assumed that man may be shown to have existed on this continent during the process of formation of the great gravel deposit, now ascribed to glacial action, which extends from Labrador even as far south as Virginia; and has been found specially available for archæological research in the valley of the Delaware river, near Trenton, New Jersey.

The great importance which attaches to the discoveries now referred to is due to the fact that they are the result of a systematic research, based on the scientific analogies of European archæology. For it is important to bear in remembrance, in reference to such disclosures, that the evidences of the antiquity of European man do not rest on any number of scattered, chance discoveries of isolated illustrations of primitive art. On the contrary, the traces of primeval man are now successfully sought for on purely geological evidence. It is a very simple matter that the archæologist should dig into a Celtic or Saxon barrow, and find there the implements and pottery of its builder. But English geologists, having determined the character of the tool-bearing gravel of the French drift, have sought for flint implements in corresponding English strata, as they would seek for the fossil shells of the same period, and with like success. Palæolithic implements have now been recovered in this manner in Suffolk, Bedford, Hartford, Kent, Middlesex, Surrey, and other districts in the south of England. So entirely indeed has the man of the drift passed beyond the province of the archæologist, that in 1861 Professor Prestwich followed up his *Notes on Further Discoveries of Flint Implements in Beds of Post-Pleiocene Gravel and Clay*, with a list of forty-one localities where gravel and clay pits or gravel beds occur, as some of the places in the south of England where he thought flint implements might also by diligent search possibly be found; and subsequent discoveries have confirmed his anticipations.

Dr. Charles C. Abbott has applied the same principle on this continent, and selecting the glacial drift of the valley of the Delaware River, New Jersey, for his investigations, has as he believes, been rewarded with a like success. The character of these tool-bearing gravel-beds of New Jersey are thus described by Professor N. S. Shaler: "The general structure of the mass is neither that of ordinary boulder clay, nor of stratified gravels, such as are formed by the complete re-arrangement by water of the elements of simple drift deposits. It is made up of boulders, pebbles and sand, varying in size from masses containing one hundred cubic feet or more, to the finest sand of the ordinary sea beaches. There is little trace of true clay in the deposit. There is rarely enough to give the least trace of cementation to the masses. The various elements are rather confusedly arranged; the large boulders not being grouped on any particular level, and their major axes not always distinctly coinciding with the horizon. All the pebbles and boulders, so far as observed, are smooth and water-worn; a careful search having failed to show evidence of a distinct glacial scratching or polishing on their surfaces. The type of pebble is the sub-ovate or discoidal, and though many depart from this form, yet nearly all observed by me had been worn so as to show that their shape had been determined by running water. The materials comprising the deposit are very varied, but all I observed could apparently with reason be supposed to have come from the extensive valley of the river near which they lie, except, perhaps, the fragments of some rather rare hypogene rocks." As regards the distribution of those terrace deposits, Professor Shaler is still in doubt as to their origin, though he has made beds of this general character a subject of special study for eighteen years. They occur from Virginia northward to Labrador; and wherever found, correspond in structure. "The water-worn character of the pebbles," he remarks, "and the approximation to a level of the upper surface of the mass, make it plain that these beds were laid down beneath the water. The entire absence of organic remains in the mass proves that it was essentially a lifeless sea in which they were laid down. I am disposed to consider these deposits as formed in the sea, near the foot of the retreating ice-sheet, when the sub-glacial rivers were pouring out the vast quantity of water and waste that clearly were released during the breaking-up of the great ice-time." It is further to be noted, however, that on the one hand, in so far as this is to be regarded as a portion of the great glacial drift, it is not uniformly lifeless in the character of its contents; and, on the other hand, the deposits assumed to have been thus laid down in the depths of the ocean, appear to have been subsequently re-arranged or modified by other agencies, so as to suggest a reconsideration of the age assigned to the palæolithic remains which they have disclosed.

Such is the character of the geological formation in which Dr. Abbott claims to have successfully carried on researches leading to the discovery of examples of American palæolithic art analogous to those of the European drift. Professor Shaler says: "Along with the perfect looking implements figured by Dr. Abbott, which are apparently as clearly artificial as are the well-known remains of the Valley of the Somme, there are all grades of imperfect fragments, down to the pebbles that are without a trace of chipping;" and in the concluding sentence of a *Report on the Age of the Delaware Gravel Beds containing Chipped Pebbles,* he remarks: "If these remains are really those of man, they prove the existence of inter-glacial man on this part of our shore." Without any such cautious qualification, Professor F. W. Putnam, the experienced curator of the Peabody Museum, states in his report to the Board of Trustees: "From a visit to the locality with Dr. Abbott, I see no reason to doubt the general conclusion he has reached in regard to the existence of man in glacial times on the Atlantic coast of North America." Such then being the present state of this important inquiry, a review of the evidence thus far adduced cannot fail to be of interest.

The Report of Dr. Abbott is produced as an embodiment of the results of "investigations in the valley of the Delaware, made with reference to the occurrence of supposed palæolithic implements in the gravel beds facing that stream, based upon a series of careful examinations of the deposits in question, made at different points, together with a study of the surface soils, so far as these, of themselves and by their contained relics, bear upon the question of the origin and character of the specimens of stone implements taken from the underlying gravels." Keeping carefully in view the misleading traces of comparatively modern Indian remains in deposits geologically ancient, he remarks: "The chance occurrence of single specimens of the ordinary forms of Indian relics, at depths somewhat greater than they have usually reached, even, in constantly cultivated soils, induced me, several years since, to carefully examine the underlying gravels, to determine if the common surface-found stone implements of Indian origin were ever found therein, except in such manner as might easily be explained, as in the case of deep burials by the uprooting of large trees, whereby an implement lying on the surface, or immediately below it, might fall into the gravel beneath, and subsequently become buried several feet in depth; and lastly, by the action of water, as where a stream, swollen by spring freshets, cuts for itself a new channel, and carrying away a large body of earth, leaves its larger pebbles, and possibly stone implements of late origin, upon the gravel of the new bed of the stream."

But while thus recognizing the intrusion of relics of modern Indian workmanship at considerable depths in ancient gravels, Dr. Abbott claims to have discovered, independent of those, and readily distinguishable from them, though in the same underlying gravels, certain rudely shaped specimens of chipped stone, which have all the characteristics of the stone implements of palæolithic times. These are classified by him into a primitive form, to which he has given the name of "turtle-back" celt, with modifications of the same, and others approximating to the more familiar forms of the hatchet, the spear, and the scraper; while the deposit in which they occur is largely made up of ordinary smooth water-worn pebbles, varying in size from half an inch in diameter to boulders estimated to weigh from one to twenty tons. Intermingled with those there are indeed fractured angular pebbles, some of the partially ground and polished surfaces of which may, as Dr. Abbott conceives, be the defacing results of later trituration on what were originally rudely chipped implements of the same class; but as a rule, the angular pebbles appear to be of natural formation.

Having thus discriminated alike between ancient and modern remains, and between natural and artificially chipped stones, Dr. Abbott proceeds to remark that having satisfied himself that the so-called "turtle back" celts, which are the most primitive form of the chipped implements of the gravels, really are of artificial origin, it is further noticeable that some of them are identical in shape with the ordinary forms of European drift implements. Among the specimens thus found, is one unquestionable spearhead-like implement of flint, which is not only specially selected as one of the three supposed American drift implements for engraving to accompany and illustrate the Report, but is adduced at the conclusion of the Report as one of the strongest confirmations of the deductions from the whole evidence. "Having shown," says Dr. Abbott, "as I think, that the deposit examined is glacial drift; and that the stone implements found therein could not have reached their present position at any time subsequent to the formation of their deposit; and *having placed beyond doubt, I think, the question as to whether these rudely chipped stones be of artificial origin or not, by the discovery of an unquestionable spear-point* (fig. 3) *associated with them*, I am led to conclude that the rude implements found in the gravel were fashioned by man during the glacial period, and were deposited with the associated gravels as we now find them." To this flint spear-head I shall accordingly refer with such care as the significance thus attached to its discovery requires.

Professor Shaler states that specimens of the chipped implements of stone are found in great plenty along the escarpments facing the Delaware. On one of his visits a search of three hours was rewarded with two examples of the most artificial character, in a locality previously carefully explored by Dr. Abbott. But he adds: "All that I have seen, with a single exception, both of the perfectly and the imperfectly chipped fragments, are made of a curious granular argillite, the like of which I do not know in place."

Bearing the above facts in remembrance, the exceptional character of the spear-like implement of flint above noted is specially worthy of consideration; for it appears to be the only instance as yet observed of the occurrence of a drift implement of this mineral. Dr. Abbott remarks: "This specimen was taken from the gravel, at a depth of six feet from the surface, on the site of the Lutheran Church, Broad Street, Trenton, N. J. It was found lying *in situ*, in a shallow stratum of coarse pebbles, and clearly showed by its surroundings that it had not gotten in its position, where found, subsequently to the deposition of the containing layer of pebbles." When discussing the most likely objections to the conclusion affirmed by him, he asks: "Ought not these implements to be distributed equally throughout the area of the deposit?" and thus replies: "I have carefully considered this, and hoped to give a satisfactory reply by finding these same forms in widely separated localities; but in this I have failed, unless the exception of a *single rude spear-head* be accepted as indicative of a comparatively wide distribution of these palæolithic relics; this single specimen being taken from gravel, some distance from the river shore, and a mile from the bluff where the bulk of the collection was discovered. It must be remembered, however, that the gravel generally has not been systematically examined, and we do not know that these same implements are not abundant even elsewhere; although this I consider doubtful, inasmuch as they were probably not as numerous originally as the stone implements of the Indians subsequently were; and the majority would, I suppose, be broken and worn to ordinary oval pebbles, in the rubbing and grinding together of these and other fragments of rocks, while being transported either by ice or water."

While the Report was passing through the press, Dr. Abbott added the following note in reference to this single rude spear-head taken from the gravel: "Since the above was in type, I have been successful in discovering several well marked specimens, in many and widely separated localities, and am now led to believe that they will be met with in the gravel beds wherever occurring in Southern and Central New Jersey." It is not clearly apparent whether this note is designed to imply that these several well marked specimens of the spear-head type were also of flint. In a subsequent part of the Report, when referring to the character of the underlying soil, in relation to the lower accumulation of stone and gravel, where the large boulders occur *in situ*, he adds: "In such a stratum, immediately beneath a stone that would weigh at least half a ton, I found a well chipped spear-shaped implement." This, I infer, was not of flint, as the description occurs in the text of the same Report in which the flint spear-head shown in fig. 3 is more than once referred to as "the only instance of the occurrence of a drift implement of this mineral." But the very fact that in the note above quoted the material is not specified seems to indicate an inadequate appreciation of the significance of the occurrence of implements of flint in a drift deposit of unstratified gravel and boulders, in which flint is wanting as a natural constituent.

The flint spear-head, as figured in the Report, cannot fail to attract attention from its obvious correspondence to a familiar type of the drift implements of France and England. But this is deceptive. It may be described as a pointed lanceolate implement presenting a near resemblance to the worked flint, fig. 420, of Mr. Evans' *Ancient Stone Implements of the Drift*, found at Rampart Hill, Icklingham, Suffolk: or to another (fig. 472) from Milford Hill, Salisbury. Both of these are somewhat more symmetrical; but the important element of difference is that of size. The Icklingham implement measures nearly 6 inches in length; while that of Milford Hill, characterized by Mr. Evans as a "a magnificent specimen," is upwards of 8½ inches long. But the reduced scale upon which these and other undoubted examples of the drift implements of Europe are shown is apt to suggest a deceptive correspondence to the Delaware Valley implement, which is figured the full size, *i.e.*, barely 2¾ inches long.

But it is still more important to note the relation of the above analogous implements to the character of the English drift in which they were found. Icklingham is in Suffolk, in the centre of one of the most noted flint regions of the South of England, where even now the manufacture of gun-flints is still prosecuted to some extent. Milford Hill is in the vicinity of Salisbury, in Wiltshire, also in a flint-bearing region, where numerous implements of the same type have been recovered both from the gravel and the underlying chalk rubble, where they lay side by side with fragments of flint which retained their original colour. The localities are accordingly such as would encourage the search for flint implements, of which they have yielded numerous examples both of palæolithic and neolithic types. It is altogether different with the drift of the Delaware River. It appears to include deposits of gravel, sand, and boulders of glacial origin, varying considerably in mineralogical character, obviously originally derived from a wide area of diverse geological characteristics; and subsequently re-arranged and intermingled by the action of water. Prof. Cook mentions, in the *Geology of New Jersey*, that "in the azoic and paleozoic regions of the State, the denudation has been very extensive; but it is not so easy to measure its amount, as it is not at all probable that the surface was smooth when the denudation, whose marks we now see, was in progress. That it must have been very great we may safely infer from the immense quantity of material which we can identify from the gneiss, the Potsdam sandstone, the magnesian and fossiliferous limestones, the Oneida conglomerate, and the whole series of upper Silurian rocks, which are now scattered all over the State quite to Cape May." Elsewhere, speaking "of this wear and movement of earth, gravel and boulders," the same writer remarks, "in some localities, as along the highlands from Boonton to Pompton, every notch in the mountain has a hill of drift opposite to it, on the open plain to the south-east." Hence the miscellaneous character of the transported material, including enormous boulders, and smaller fragments of granitic, hypogene, sandstone and limestone rocks; along with water-worn pebbles of the same granular argillite as the "turtle-back" celts and other characteristic stone implements of this Delaware River drift gravel, but no flint.

Of the artificial origin of the flint spear-head there can be no doubt. But there is no satisfactory evidence to justify its being classed as a true drift implement; and if the several well marked specimens of the same type so slightly alluded to in the subsequently appended note, are also flint implements, it still remains to be seen how far there is reason for regarding them as other than intrusive examples of a class of Indian implements of very common occurrence in more superficial deposits. For indeed, when Dr. Abbott is discussing the origin of specimens identical with the seemingly genuine drift implements of the "turtle back" celt form, but obtained on the surface of the talus at the foot of the bluff, he remarks: "In the talus which now covers much of this bluff, there is nothing but the uniform mass of rounded and angular pebbles, and with them such chipped implements as the specimens here figured." He accordingly follows up this statement with the pertinent question: "As already pointed out, why should this recently displaced material only yield the rudest forms of chipped stone implements, when the surface is literally covered in some places with ordinary Indian relics; not a specimen of which has, as yet, occurred in this gravel?"

Excluding then, the spear-shaped flint implement or implements as of doubtful age, and inconsistent in mineralogical character with the deposit in which they were found: two other forms, both modifications of the same rude oval, with the two ends of equal breadth, include the characteristics of the entire series of these Delaware River gravel bed implements. The more perfect type is thus described by Dr. Abbott: "Figure 2 represents a more carefully wrought specimen of these rude implements, measuring nearly 5 inches in length, by $2\frac{1}{2}$ inches in average breadth; and less than 2 inches in greatest thickness. It is an excellent example of the form previously referred to as a 'turtle-back' celt. Of this specimen Prof. Wadsworth remarks: 'As far as can be told from examining its external surface without any fresh fracture, I should consider it to be made of very compact argillite. It shows weathering, and also a more recent fracture, which has weathered to some extent. I should consider it very doubtful if this could be formed naturally.' This specimen came from the bluff facing the river. It was taken out from a newly exposed surface, after making an excavation of fully three feet from the exposed face of the bluff; which was itself evidently the undisturbed gravel."

The other and more perfect form may also be described as only a more finished adaptation of the prevailing natural form of the discoidal and subovate rolled pebbles of the drift, in which naturally fractured specimens occur approximating in their shape to the so-called "turtle-back" celts; though Dr. Abbott says "it may at once be seen that it is, in every case, but an accidental resemblance. The outline is obtained, but not the subsequent chipping that gives the implement such finish as would make it desirable for use." Examples, however, do occur, of angular pebbles partially smoothed and polished, yet retaining in form and traces of fracture, in some cases at least, a marked resemblance to those clearly of artificial origin. "Such specimens," Dr. Abbott remarks, "may in fact have been fashioned by man, and only partially lost, by the polishing action of water and sand, those indications of artifically produced fractures. such as characterize the specimens here figured."

The following is the description which accompanies the figure of the ruder oval implement: "Figure 1 represents a specimen of these rude implements, which, unlike the so-called 'turtle-back' celts, is distinctly chipped upon both sides, and has but a slight amount of secondary chipping. The cutting edges, however, are comparatively straight. This and other examples of the supposed stone implements have been submitted to Professor M. E. Wadsworth of Cambridge to determine their mineralogical character, as this has an important bearing on the question of the fracturing being of natural or artificial origin. Prof. Wadsworth remarks of this specimen: 'It is an argillite. It is highly indurated, with a conchoidal fracture, without cleavage, and fuses to a yellowish green or white glass which is feebly magnetic. The weathering which it shows could hardly have taken place except before it was covered with soil; it might possibly, but I think not probably, in a loose open gravel. It is not at all likely to be of natural formation." It measures 3½ inches in length, and was found in the undisturbed gravel of the bluff facing the River Delaware, at a depth of six feet from the surface.

Analogous implements worked in flint occur in English river drift, as shown in fig. 452 of Mr. Evans' *Ancient Stone Implements*,—an oval implement found in gravel dug at Hackney Down, to the north-east of London; and in fig. 476, one of several specimens, some of them more coarsely chipped, recovered from the Bournmouth gravel, Hampshire.

So far then it is noticeable that while the flint spear-head—one or more,—found at a depth of six feet, lying apparentely *in situ*, in undisturbed gravel, is rather calculated to throw doubt on the palæolithic character of the implements of the Delaware river drift; the more abundant argillite celts accord with the drift gravel in which they occur, and cannot fail to awaken the keenest interest. In the Valley of the Somme, and in some of the English areas equally prolific in palæolithic flint implements, the archæologist is led back through successive stages of Frank, Saxon, Roman and Gaulish or British celt, to the neolithic arts of the lake dwellers of Switzerland, or of the Scottish and Irish crannoges; and so onward to the era of the cave men of an undefined post-pliocene age. The interval still unaccounted for between the oldest of those and the palæolithic era of post glacial man, according to any chronology hitherto applied, is indeed enormous. Yet such a series of stages of progression helps the imagination to realize in some degree the remoter past. But in the assumed revelations of palæolithic art in the North American drift, we pass abruptly from the savage Indian who still claims to represent the aborigines of the New World, to the ruder savage of that primeval dawn when the ice age of our northern hemisphere had only begun to contract its sway over the northern continent.

The theory at which Dr. Abbott has thus far arrived may be thus indicated. Towards the close of the great ice age, the locality which has thus rewarded his search for specimens of palæolithic art marked the termination of the glacier on the Atlantic coast. Here, at the foot of the glacier, a primitive people, in a condition closely analogous to that of the Esquimaux of the present day, made their home, and wandered over the open sea in its vicinity, during the accumulation of this deposit from their melting glacier in the bed of the neighbouring ocean. But the drift gravel thus deposited has been modified by subsequent action. According to Dr. Abbott's conclusions, this glacial debris was deposited in open water, on the bed of a shallow sea. But while it is indisputably originally of glacial origin, it appears to have been subjected to subsequent modifications which materially affect the question of the post-glacial or inter-glacial character of the supposed evidences of art included in it. The disposition of the large boulders, and the absence of true clay in the mass, both suggest that it has undergone great changes since its original deposition as glacial debris. Both Professors Shaler and Pumpelly remark on the absence of ice scratches on the pebbles and boulders; and if this is to be accounted for by subsequent action of water, the included chipped implements prove by their unpolished surfaces that they are of more recent origin. Huge boulders, of the same character as those which abound in the underlying gravel, also occur on the surface. Their presence there is referred to by Dr. Abbott as throwing light upon "the occurrence of rude implements identical with those found in the underlying gravels, inasmuch as the same ice-raft that bore the one, with its accompanying sand and gravel, might well gather up also stray relics of this primitive people, and re-deposit them where they are now found." Accordingly, seeking in fancy to recall this ancient past, he says: "In times preceding the formation of this gravel bed, now in part facing the Delaware River, there were doubtless localities, once the village sites of pre-glacial man, where these rude stone implements would necessarily be abundant. . . . But assuming that the various implements fashioned by a strictly pre-glacial people have been totally destroyed by the crushing forces of the glacier, and that the specimens now produced were not brought from a distance, may they not be referred to an early race that, driven southward by the encroaching ice, dwelt at the foot of the glacier, and during their sojourn here these implements were lost?" The assumption, it is manifest, is thus far based on imperfect, if not conflicting, evidence, which must be greatly augmented and carefully weighed in all its bearings. Nor need we wonder at the uncertainty manifested as to this discovery of a glacial, inter-glacial, or post-glacial man of America, when it is remembered that the result of the Conference on the Antiquity of Man, held recently by the Anthropological Institute of Great Britain, was on the whole either to throw discredit on the reputed cases of the occurrence of palæolithic remains in deposits older than the post-glacial; or to suggest that the river gravels containing palæolithic implements originated in their present condition at a later period than the glaciation of the districts in which they occur. Authorities of the highest character among the geologists and archæologists of Great Britain are at least equally divided on the subject; and the result of the Conference is,—if not absolutely to discredit the supposed evidence of palæolithic man, either in the caves or the river deposits of England older than post-glacial:—at least to demand much more conclusive evidence than any which has yet been adduced, before it can be accepted as a scientific fact that man existed in southern England and in France prior to the great ice age which wrought such enormous changes on the whole contour of Northern and Central Europe.

Professor Shaler purposely deals mainly with the geological aspect of the question, cautiously guarding his statements in reference to the age of "the specimens of supposed implements." He constructs a hypothesis at the close, "on the assumption that these pebbles owe their form to forces that antedate the deposition of the beds in which they are found." Thus—leaving to archæological experts to determine the artificial origin of the "supposed implements" found along the escarpments and imbedded in the drift of the Delaware Valley,—he arrives at the conclusion, that from its miscellaneous materials "pebbles of a peculiar composition were selected;" and after referring to evidences of a later change on the drift materials in which they lie, which lead him to the conclusion "that the pebbles were chipped before the waste which constitutes the mass was brought into its present position," he thus sums up: "If these remains are really those of man, they prove the existence of inter-glacial man on this part of our shore."

But the source of the later local changes, thus assumed to pertain to an inter-glacial epoch, has still to be determined; and with it the geological age of the drift gravel in its present condition. Professor Prestwich and others who discussed the age of the tool-bearing strata of Northern Europe, urged that their positions in the valleys show them to be more recent than the glaciations of the districts in which they occur; and the character of the drift gravel of the Delaware River Valley, seems still more open to a similar characterization. In the gravel of Long Branch, which according to Prof. Smock, the Assistant State Geologist, is of the same age as that at Trenton, rolled fragments of reindeer horns occasionally occur, and two skulls of the walrus have been found. Prof. Pumpelly has also visited the principal localities in which Dr. Abbott has carried on his researches; and both he and Prof. Shaler remark on the absence of ice scratches on the pebbles and boulders forming the deposit; and they apparently arrive at the same conclusion, that it is originally of glacial origin, but that its materials have been subsequently modified by the action of water, and so re-arranged with more or less of stratification. Dr. Abbott accordingly reverts to those deductions, communicated to him after the original draft of his Report had been written, and adds this comment: "Inasmuch as such subsequent action may have occurred long after the final deposition of the gravel as true glacial drift, the antiquity of the contained stone implements is proportionately lessened, and may be wholly unconnected with the glacial period, although the latest possible date that can be assigned to the deposition of the gravel in its present condition gives an antiquity to the implements found therein far greater than can be asserted of any previously found traces of man in North America, other than the discoveries of Prof. Whitney in California."

The subject is one which will not fail to receive ample consideration from those best qualified to test the full bearings alike of the archæological and the geological evidence. The researches have thus far been carried on with funds appropriated for the purpose by the Board of Trustees of the Peabody Museum of American Archæology and Ethnology; and the fruits of Dr. Abbott's labours are justly referred to in their annual report as probably the most important result attained in American archæology during the past year.

PROTOTYPOGRAPHY.

Read by Rev. Dr. Scadding, at the Caxton Celebration of the Canadian Institute, Toronto, June 13, 1877.

We contemplate with some astonishment the facility with which little children acquire a language, the quickness with which they catch the right use of words, of peculiar expressions and idioms. And when at a later stage, the processes of reading, writing and ciphering are proposed to them, we are equally struck with the readiness with which, in most instances, these processes are mastered; a readiness such that after the lapse of a few months or years, skill in these arts seems to the possessor and to others the result almost of intuition.

The reason of all this is: the certainty, now proved by long experience, that there is in the human mind, naturally, a predisposition and preparedness to form language, first simple, then complex; and to make it, when thus formed, visible and permanent in some way. And similarly in regard to numbers; there is, without doubt, a like predisposition and preparedness, first to use them, and then to reduce them, for convenience, to visible shape.

Printing, it is manifest, is an ultimate development of these innate human tendencies. The germ of the discovery was in the Race; but its evolution was deliberate, and regulated by conditions; and so, in natural order, first came the blade, then the ear, then the full corn in the ear. In short, the history of printing is a repetition of that of language itself, of writing, of numbers, of painting, of music; each of which took centuries to attain to the degree of excellence in which we now are so fortunate as to receive them. Signet rings and stamps of all kinds were a species of printing apparatus. The scarabæi, made of hard stone, found in the tombs of Egypt, bear on their under side elaborate inscriptions, evidently intended to be transferred—and that, too, probably through the medium of a pigment—to the surface of fitting substances. The dies of coins and medals in all countries involve the same idea—the transfer of inscriptions and devices by pressure. The Chinese, from an early period, have actually printed, laboriously carving in relief on separate tablets of wood the contents of each page about to be reproduced. And if such was a practice of the Chinese, we may be sure it was the practice also of other Asiatic peoples, equally, if not more civilized, but who have undergone greater vicissitudes.

In Europe, whether learned from Asia or devised independently, block-printing, just before the invention of the movable types, was well-known, though not practised as extensively as in China, nor with the same skill and elegance. The manufacture of playing cards was one common application of the process, but a more noble use of it was in the production of books, especially illustrated books, the picture and the description or moralization being all carved on the same wooden plate. The best known European example of an illustrated volume printed from carved blocks, prior to the invention of movable types, is the *Biblia Pauperum Prædicatorum*, a series of Scripture scenes rudely but boldly drawn, three on a page; the one in the middle from the New Testament, the other two from the Old; above and below are a pair of heads representing the prophets from whom respectively texts germane to the New Testament scene are quoted; all in Latin, with leonine descriptive verses subjoined; *e.g.*, under a picture of the Adoration of the Magi: *Christus adoratur; aurum, thus, myrrha donatur;* and under the Burning Bush, *Lucet et ignescit, sed non rubus igne calescit.* Other remarkable early block-books are the *Speculum Humanæ Salvationis*, the *Ars Moriendi*, the *Ars Memorandi*, the *Historiæ Sancti Johannis Evangelistæ*, and various editions of Donatus, an elementary Latin grammar.

But up to 1440, or a little earlier, no one, as it would seem, while contemplating a carved block prepared for an impression, had as yet chanced to carry forward his thoughts just the one step which would have led him to the happy reflection: Seeing that all the words in a page are made up of letters again and again repeated, would it not be practicable, instead of carving perhaps all the letters of the alphabet two or three times over in each page, to make separate letters, which might be fastened together so as to form the words contained in one page; and then, after having done duty in the production of that page, be released, and combined together afresh for the production of another page; and so on repeatedly? At length, in 1440, or a little earlier, the thought did start up in one mind at least, as will be narrated presently. The experiment was first made with wood. Separate letters were carefully carved, each at the end of a small block or stem, so shaped and trimmed as to fit in well with any of its fellows. The small blocks were strung together, we are told, by means of a strong thread passing through an eye or a hole deftly made in each of them. The result was encouraging; although the impressions produced were rude and uneven, and moreover, use speedily told upon the surface of the letter. Metal was thought of as a substitute for wood. Lead, as being most easy to manipulate, would of course be the first tried. Here again the effect of use was almost instantly to be seen. Then copper and tin were employed with respectable results. But the shaping and finishing of each letter by hand was tedious and costly. To save time and labour, small separate blocks were now cast with the view of having a letter cut in relief on the end of each; to cast the stem and the letter together in one piece was not yet proposed. Then came the idea of converting the perfectly carved letter, with its stem or shank, into a model, which, by being forced into sand or clay, or other fitting material, might form a mould, whence letters might be turned out at once in a finished state. Thus far the scale on which the experiment had been made, was a limited one. A few sets of the alphabet sufficed for the trifles as yet attempted. By the use of the knife and file enough of accuracy in the shape and height of the small number of types required, was secured. But when now larger designs began to be entertained, it was seen that the process of trimming each letter by hand was altogether too slow, as well as too costly. If the great folios which the writing-rooms of the monasteries had hitherto supplied, were in future to be furnished to the public by means of the new process, it was evident that the supply of type must be plentiful and readily sustained, and that the method of finishing must accordingly be improved and expedited. Here was the crux of the first stage of the art of printing. The difficulty was at length most ingeniously surmounted. When now, a metallic compound was devised, combining a sufficiency of hardness with easy fusibility, and a suitable and satisfactory ink, the great invention, which had been taxing the wit of experimenters so long, was in effect complete.

It is singular that in the course of their long practice of block-printing the use of movable types should never have been thought of by the Chinese, who, with their skill in minute carving, could so readily have fashioned them. Perhaps the immense number of characters used in the written language, and certain special methods observed in combinations, may have stood in the way; while in the West the invention was facilitated by the comparative fewness of the letters in the alphabets, and a consequent simplicity in the necessary combinations. A famous passage in a work of Cicero's on *The Nature of the Gods*, contained clearly the idea of words and sentences formed by selection from a mass of loose separate letters. In opposition to the philosophers who thought that the world and all that is therein had come from a fortuitous concourse of atoms, he says it would be just as easy to believe that "if a great quantity of the one-and-twenty letters, composed either of gold or any other material, were thrown upon the ground, they would fall into such order as legibly to form the 'Annals of Ennius.'" "I doubt," Cicero adds, "whether fortune could make a single verse of them." It is evident, had Cicero's mind happened for some reason to have been turned to the subject, one step further would have taken him to the thought of movable types to be employed in the reproduction of books. But with him the necessity of such an invention was not urgent. His numerous clever slaves, trained and highly accomplished as transcribers, were always at hand to supply him quickly with the volumes which he coveted so much and loved so well, whenever access for a short time could be obtained to a copy by loan from private or public collections.

Some years ago verbose disputes were rife as to the inventor of movable types. The distinctive pre-eminence of one out of two or more continental cities was involved in the issue of the strife. Haarlem, at the northern extremity of the Sea of Haarlem, a great sheet of shallow water so called, not far from the mouth of the Rhine, and Mayence, situated on the Rhine itself but far in the interior, each claimed the honour of having sheltered within its walls the man who struck out the happy thought. The question is now held to be settled by a kind of compromise. Great honour to him who conceived the idea of movable types and first employed them, however rudely; but as great, if not greater, to him who carried forward the idea, experimenting in metals and moulds, until the complex matrix and perfect type as we now see them were achieved. The invention, it is now generally believed, obscurely germinated at

Haarlem; but it developed itself very nearly to perfection at Mayence, the latter city really deriving the discovery in a crude state from the former. The story as told by the typographical authorities of Holland, but disputed, and supposed to be refuted by circumstantial evidence elsewhere, is as follows: Lourens or Lawrence Janssoen was a well-to-do citizen of Haarlem; according to some, a licensed victualler; according to others, a xylographer or block-book printer, who prepared with his own hands the wooden tablets from which, after duly tinting them with pigments, he took his one-side copies, pressing down the paper or vellum on the charactors, or the engraving, with the tips of his fingers. One day, idling away a leisure hour in one of the gardens or public walks of Haarlem, in company with his grandchildren, as he strolled along he fashioned with his pocket-knife, for their amusement, out of a piece of fresh bark casually picked up, a number of small letters, and then fastening them reversed on the surface of a piece of stiff paper, so as to form certain words, and turning the whole over on another piece of paper, he exhibited to his young friends a copy of these words produced by the stain of the fresh bark. At this moment of time, we are told, the notion of a wide application of the process just employed was begotten in Lawrence Janssoen's mind. The query then and there suggested itself to him: Instead of carving in solid mass the contents of each page of a book, as had hitherto been done, might not the letters be made separate and used in innumerable combinations? I pass over details; but some sets of movable letters were speedily constructed, first in wood and then in lead, and used with certain rude results, a few specimens of which are said to be in existence. The system adopted was kept secret in Lawrence Janssoen's household; but at length an unfaithful employé, we are assured, purloined the newly-contrived appliances, and made off with them, first to Amsterdam and then across the country to the Rhine, and so to his former home, Mayence—having taken advantage, some say, of a holiday at Christmas time in the office at Haarlem, or, as others think, of a temporary suspension of business when the death of Lawrence Janssoen occurred in 1440.

Now John Gensfleisch (better known as Gutenberg) appears on the scene, who afterwards substituted copper and tin for wood and lead in the cutting of type, who even succeeded in manufacturing punches, and constructing moulds and matrices from which type was cast never yet surpassed in beauty and accuracy of form, although, as we shall see, his, to some extent, was another case of the *sic vos non vobis* of old. It is recorded that the name of Lawrence Janssoen's unfaithful employé was John. No other designation is given him in the story, which is not so extraordinary, as surnames, in our sense of the term, were at the time not common. It was once conjectured that Gensfleisch was this man. But now the authorities show by a comparison of dates that this is improbable. They show at the same time that there were two persons of the same name, John Gensfleisch, senior, and John Gensfleisch, junior, uncle and nephew; and the runaway workman, they say, may have been John Gensfleisch, senior. The theft of material they think an angry Haarlem fabrication; it was simply the secret of the mode of manufacture and application that was carried off from Janssoen. On reaching Mayence, John Gensfleisch, senior, began in an obscure way the practice of the new art. Later he was joined in the same occupation by his nephew, John Gensfleisch, junior, who had now dropped the surname Gensfleisch (Gooseflesh), and assumed that of Gutenberg, from a property in or near Mayence once possessed by his family, which was noble by descent. We first hear of Gutenberg, or John Gensfleisch, junior, at Strasburg, further up the Rhine. Of an ingenious turn of mind, we find him employed there in working a new apparatus, an invention of his own, for polishing gems. With him in this undertaking are associated as partners, Hans Riffe, Andrew Drytzehen, and Andrew Heilmann, who have each supplied him with money. When the particulars of the recent discovery at Haarlem reached him, probably through his uncle at Mayence, he at once set about making the experiment himself. He resolved to attempt the cutting and casting of a set of types for the reproduction of the *Speculum Humanæ Salvationis*, a book in considerable demand. His partners in the gem-polishing scheme again opened their purses to him, but strict secrecy in regard to the new undertaking was enjoined. Certain prying questions put by wives and others as to what was now engaging the attention of the partners so closely, were met by the reply that they were busy making looking-glasses for the approaching fair at Aix-la-Chapelle—an allusion to the meaning of *Speculum*, *i.e*, mirror or looking-glass. The letters were still fitted for use by individual manipulation. The slowness and general unsatisfactoriness of this process led Gutenberg to turn his attention to the construction of better moulds; a study which resulted in the invention of the matrix by means of which type, cast perfect in face at once, and mathematically accurate in dimensions, has continued to be manufactured to the present time. On the death of one of the partners, Andrew Drytzehen, and a consequent lawsuit, the company which Gutenberg had formed was broken up. He now removed to Mayence, and took up his abode with his uncle there. Inspirited by his typographical experiments at Strasburg, he conceived the bold idea of casting type, by his new process, for an edition of the whole Bible in folio, to be in every respect a fac-simile of the handsome manuscripts of the sacred volume to be seen, and, on occasion, purchased, at the monasteries. Much money was required for such an undertaking. The number of letters wanted for the 1282 folio pages of the proposed Bible was about 12,000 exclusive of ornamental capitals, double letters and abbreviations. John Fust, a rich banker of Mayence, was struck with Gutenberg's project, and advanced considerable sums in order that the work might be duly prosecuted. Not, however, without the proper legal security against loss on his part; as appeared after a time; for, just as everything was almost ready for the final issue of the great volume, we find Fust suddenly foreclosing on the typefounder and printer for non-fulfilment of the conditions of his bond. The courts of Mayence sustained the claim; the whole of the plant and contents of Gutenberg's office was taken legal possession of by Fust in 1455.

We now form the acquaintance of Peter Schoeffer, of Gernsheim. This is a young man who had been in the employment of Gutenberg, and was found to possess pre-eminent skill in cutting the punches for the types, plain and ornamental, required for the forthcoming Bible. Peter Schoeffer, in fact, had an educated taste as well as high skill. Like so many others who became fascinated with the new art at the outset, he was a scholar; only a few years previously he had been a student in the University of Paris. Fust perceived that he was a most eligible person to be put in charge of the printing establishment which had come into his possession. Such confidence had the shrewd banker now acquired in the prospective profits of printing and publishing, and in the superior competency of Schoeffer, that he proposed to him at once a copartnership on a suitable basis, and more; Schoeffer was to receive in marriage his daughter and sole heiress, Christina. Subsequent incidents need not be narrated. It will be sufficient to say, that the great Bible soon saw the light. A sense of what was due to Gutenberg seems to have led the publishers to abstain from claiming the merit of the performance. It made its appearance without date or name of printer in the colophon; but it has since been universally known as Gutenberg's Bible. In modern times it is sometimes spoken of as the Mazarin Bible, from the particular copy of it discovered in the library of Cardinal Mazarin, which attracted the especial attention of bibliographers. Subsequent editions of the same work, not quite equal in grandeur and finish to the first, have appended to them the names of Fust and Schoeffer, as the printers conjointly. John Schoeffer, the son of Peter, and his successor as the head of the printing establishment, which long continued to flourish, frankly declared in a Dedicatory Epistle to the Emperor Maximilian of Germany, which he prefixed to an edition of Livy, that the whole merit of the fused metal types then come into use among printers everywhere was due to Gutenberg, and not to his father.

It is consolatory to find that Gutenberg was not crushed. In conjunction with one Nummeister, he established a press at Mayence, and issued works of importance. In 1465 the Archbishop of Mayence, Prince Adolphus of Nassau, made him one of the pensioned attachés of his household; and within the friendly walls of the archiepiscopal palace he breathed his last in 1468. This prince-archbishop was not desired by the people of Mayence, and he was obliged to oust, by force of arms, another archbishop already in possession, placed there by an anti-pope. In the process, the city was sacked, and all the industries of the place broken up, especially those connected with the printing-press. Adolphus may have wished to make some reparation for the ruin which he was the means of bringing on the city, by shewing kindness to the illustrious inventor. Gutenberg's remains were deposited in the Church of the Franciscans at Mayence. As to Fust, he died of the plague at Paris in 1466, at the age of 72, whilst on one of his business expeditions to that city in connection with the sale of his books. The stories of his unfavourable reception in Paris, and of attempts to palm off his Bibles as manuscripts, are now known to be groundless. The place of his sepulture in Paris was the Church of St. Victor.

On parting company with the four personages whose names are associated with the very first beginnings of the art of printing, it will be of interest to note the portraits or other representations of them, that exist.

A fine engraving by Houbraken of Lawrence Janssoen, the Sacristan, may be seen in the *Origines Typographicæ* of Gerard Meerman, of Rotterdam. We behold a face slightly aged; long, emaciate, and smoothly shaven, with speaking thoughtful eyes, looking out at the spectator; a benevolent, intelligent, somewhat clerical countenance, surmounted by the soft four-cornered scholar's cap, usually seen on Erasmus. The authenticity of this portrait is not certain; and the heads of the statues erected to Janssoen at Haarlem have been moulded from some other likeness. In Meerman's work is given a fac-simile of a supposed early effort of Janssoen's with his movable wooden or lead types; a so-called *Horarium*, a little vade mecum for children, containing first the Alphabet, and then the Creed and Lord's Prayer, in Latin. The inscription placed by public authority in Janssoen's house at Haarlem is also given; *Memoriæ sacrum. Typographia, Ars Artium Omnium Conservatrix, hic primum inventa circa annum mccccxxiix* (1428). Attempts have been made to show that Lawrence Janssoen of Haarlem lived after the Gutenberg era, and was not in any way connected with the art of printing. Advantage is here probably taken, as in so many instances, of identity of name in two different persons. The special pleading, having for its aim the complete annihilation of the Haarlem tradition, which is old, persistent and reasonable, rather overshoots the mark.

Of Gutenberg's form and presence, posterity derives an ideal image from the statue at Strasburg, where in one of the squares he is seen raised aloft; a thin spare figure in furred cap and ample furred gown; stepping forward with energy, the two hands holding out an open scroll, on which is the inscription *Et la lumière fut*—"And there was light." The face is long, care-worn and aged; a patriarchal beard descends upon the breast. In a public place in Mayence, there is another statue of Gutenberg, not so striking perhaps as that at Strasburg, notwithstanding the celebrity of the artist of the former, namely, Thorwaldsen. In Lacroix's *Historie de l'Imprimerie*, is the head by Julius in 1698, which is the prototype of the likeness presented by the statues.

The faces of Schoeffer and Fust are familiar to us from a medal struck in their honour, showing their profiles, conjointly with that of Gutenberg. A small copy of this group is to be seen in Johnson's *Typographia*, and in numerous other works.

The new Art of Printing spread rapidly throughout Europe. The learned class everywhere at once discerned its incalculable value. In numerous instances, scholars of the first order associated themselves with the Press, not simply as active patrons, but as editors and correctors, and even as manual participants in its work. And this continued to be the case for several generations after Gutenberg's day. In the monasteries many who had been trained as transcribers and illuminators learned how to set up type, and brought their skill and taste to bear on the printed, instead of the written, sheet. Copies of works on every subject, produced by the new method, began to be in general demand. The same hunger of the mind for more abundant and more satisfying food than it had been long wont to receive, seemed to be everywhere felt. Even in the aged, the mental appetite and curiosity of youth were re-awakened by a sight of the feast of fat things, to which the new art gave unlooked for access.

In the regions which we now style the Netherlands and Belgium, there were presses at work, before the close of the century which witnessed the birth of printing with metal types, at Utrecht, at Gouda, at Delft, at Louvain, at Deventer, at Alost, at Antwerp; and in Germany and German Switzerland, at Cologne, at Bamberg, at Nuremberg, at Augsburg, at Spires, at Ulm, at Esslingen, at Frankfort, at Basle, and other important towns.

In France, at Paris, a press was set up in a room of the Sorbonne, in 1478, the services of three Germans, Ulrich Gering, Michael Friburger, and Martin Crantz, having been secured by Dr. Guillaume Fichet of the Sorbonne. Peter Keyser and John Stol, workmen under Gering, soon began printing on their own account, at the sign of the Green Rod, Rue St. Jacques. Some twenty years earlier (1458) the King, Charles VII., had endeavoured to introduce printing at Paris, but Nicholas Jenson, after acquiring the secret at Mayence, at the King's expense, went off with it to Venice, where he established a press for himself. In 1478, a printer with a French name, Jacques Lachet, brought out Sebastian Brant's *Ship of Fools* at Paris. In 1473, Guillaume Le Roy and Antoine Vincent were engaged in printing at Lyons; also Klein and Treschel in 1488 at the same place; and at Caen, Robert Macé in 1491.

From Germany especially, the adepts in the new art scattered themselves like so many apostles, far and wide, carrying with them their practical skill, and sometimes even the implements of their business. In Rome, in Venice, in Milan, in Florence, in Naples, in Sicily, the earliest printers bear German names. At Rome, Conrad Sweynheim and Arnold Pannartz, in 1465 (settled first for a short time Subiaco, near by); and Ulric Hahn, who Latinized his name into its equivalent *Gallus*, a cock; Silber in 1490, who did the same with *his* name, making it Argenteus; and Andreas Fritag in 1492. At Venice, John of Spires, 1469, and his brother Vendelin; John Emeric of Udenheim and Erhard Radolt. At Milan, Waltdorfer of Ratisbon, better known as Valdarfer, printer of the *Decameron* of Boccaccio, a copy of which, with his imprint, sold at the Roxburghe sale in London in 1812 for £2,260. At Florence, John Petersen of Mayence and Nicholas of Breslau in 1477. At Naples, Sixtus Riesinger of Strasburg in 1471, Berthold Rying and others. In Sicily (at Messina), Heinrich Alding in 1478. In 1479, a Bible in Spanish was issued at Valencia in Spain by a German named Lambert Palmaert. (The first press in America was set up through the instrumentality of a German printer at Seville, John Cromberger. It is thought, however, that he never himself crossed the ocean, but committed the management of an establishment known by his name in the city of Mexico, in 1540, to an agent, a foreman of his, named Pablos.)

As in other departments of human activity, the practice of the new art soon began to descend from father to son through successive generations. One or two remarkable instances of such descent in the families of eminent printers will now be given; but I shall have to pass down occasionally into the sixteenth century.

And first, the Italian Aldi. These were Aldo Manuccio of Venice and his descendants. Aldo Latinized his name into Aldus Manutius, to which he sometimes added Romanus, as being a native of the Roman States. He was an accomplished scholar. He invented and largely used the Italic letter, which is said to be a careful reproduction of the handwriting of Petrarch, whose Canzoni and sonnets he printed in this type. He was the first to bring out books in octavo and duodecimo, a form quickly recognized to be an improvement on the cumbersome folio. He and successors of the same name issued editions of all the great works of classic antiquity, and of all the best Italian authors of their own time. Aldo Manuccio married the daughter of Andrea Torresani, a distinguished typographer, the successor of Nicolas Jenson at Venice. The well-known badge of the Aldine press, the Dolphin and Anchor, was adopted from a medal of Titus Vespasianus, and is intrepreted by Erasmus in his *Adagia* to denote the Latin *Festina lente*—"Be steady; take your time;" advice of use in literary work.

At Florence the Juntas or Giuntas were a typographical family flourishing for several generations. Bernard and Philip were eminent printers of this name. The device on the title pages of their books was the Lily or Fleur-de-lis.

At Basle, the Frobens, father and son, have a special interest as the friends of Erasmus, and the printers of his works. The house of John Froben was the home of Erasmus, when he took up his abode in Basle. John Froben's wife was the daughter of the learned Wolfgang Lachner, who like Marcus Heiland, Wolfgang Museulus, Œcolampadius, and Erasmus himself, was a corrector and reviser in Froben's office. Froben's son-in-law, Nicholas Bischoff (Episcopius), was also a notable printer. The *Utopia* of our own Sir Thomas More was printed at Basle by John Froben in 1519, and the *Encomium Moriæ* in 1522, the work in the title of which Erasmus amusingly plays on More's name. Holbein drew the illustrations which form so essential a part of this book. Many other works printed by Froben were also enriched by the genius of Holbein, who designed and executed elaborate and most beautiful borders and other ornamental woodcuts for them. The ready graver of Holbein has not only made his own countenance familiar to us, and those of Erasmus and More and other historic personages, but also that of John Froben, the great printer. Copies of Holbein's portrait of the latter may be seen well engraved in Knight's *Life of Erasmus*, and also in Woltmann's *Holbein and his Time.*

At Lyons, the printers Gryphii were famous for several generations: Sebastian, Antony, John, the last at Venice. The device on their title pages is a griffin and winged ball or globe.

At Paris, the illustrious typographic dynasty of the Stephani took its rise. In England the Stephani would be spoken of as the Stephenses. In their own vernacular they were Les Estiennes. The first of the name, eminent as a printer and scholar, was Henry, born at Paris, 1470. This Henry is styled Henry I. to distinguish him from Henry II., a successor a few years later. Francis, Charles, and Robert Stephens, also printers, were his sons. Robert was a profoundly learned man. He publicly offered a reward to every one who would report to him an *erratum* in his publications. In 1531, he was appointed by Francis I. King's printer in the Greek and Hebrew languages. Henry II. was his eldest son and worthy successor. To an edition of Andrew Gellius issued by him he prefixes a Latin letter addressed to his own son Paul, in which he speaks of the household of his father, Robert: "All in it were learned," he says; "even the domestics understood Latin, and in some sort could speak it." His mother, Paul's grandmother, could understand persons speaking Latin, as readily as if they spoke French; his sister could speak the language, having learnt it not from grammars, but from use, just as French is learnt in France, Italian in Italy, and any other language in the country where it is spoken. Notable works published by Robert Stephens were Bibles in Latin, Greek, Hebrew, and French, and a Latin Thesaurus in three volumes folio. He dismissed from his edition of the classics all the contractions inherited from the MSS. A marvellous perfection marks all the productions of his press which were supervised wholly by himself. De Thou said the labours of Robert Stephens had done more for the honour and glory of France than all the high deeds of her warriors. Robert married the daughter of Josse Bade of Asch, near Brussels, another eminent printer usually spoken of by his Latin designation, Jodocus Badius Ascensius. Michel Vascosan and Jehan de Roigny, two other great French printers, also married daughters of Josse Bade. Henry II.'s *Greek Thesaurus* in four volumes folio (1572), is like his father's *Latin Thesaurus*, a wonderful monument of human labour and perseverance. The story of the shameful way in which John Scapula, an employé of his, filched the substance of this *Thesaurus* and constructed out of it the one-volume Lexicon (1579), formerly so familiar to English scholars, and so often reprinted, can only here be glanced at. The learned Isaac Casaubon married a daughter of Henry Stephens.

In the line of the Koburgers (properly Wolgemuths), at Nuremberg, there was an Anthony I. and an Anthony II., with a John, a Melchior, and others.

At Antwerp, Christopher Plantin founded a long-lived printing-house. His *officina* was one of the wonders of Europe and the chief lion of the city. More fortunate than some of the great printers, Plantin accumulated wealth, and lived in princely style, indulging his fine tastes, and bequeathing at his death, in 1598, a magnificent private library to his grandson Balthasar Moret, his heir and successor. Among the products of Christopher Plantin's press was a polyglot bible in eight volumes folio, published under the auspices of Philip II. of Spain.

Finally, I name the Dutch Elzevir family, members of which, between 1583 and 1683, obtained great celebrity as printers. The first Elzevir (or Elsevier), Louis, began to print at Leyden in 1583. His brothers, connexions and descendants, were established as printers in various places in Holland, but chiefly at Amsterdam and Utrecht. In this dynasty Louis I., Louis II., Louis III., are to be distinguished; other Elzevir names are Matthew, Œgidius, Jodocus, Bonaventure, Daniel, Abraham, and Peter. The list of the Elzevir publications, embracing the whole range of literature ancient and contemporaneous, including works in Hebrew, Syriac and Arabic, fills seven octavo volumes. The Elzevir print is quickly to be recognized on account of a certain pleasant openness and clearness in the fashion of the type. The foolish story about the use of silver type seems to have arisen out of the sound of the name Elzevir or Elsevier. It is said that some of the Elzevirs employed female compositors. (The device of a printer in the *officina Elzeviriana* at Leyden in 1617 was an open music-book, with notes: his name was Godefridus Basson.)

Although in the course of the preceding narrative I was brought more than once into the neighbourhood of Bruges, I reserved my mention of that city until now, in order that in association with its name I might introduce our own William Caxton.

The city of Bruges, situated not many miles inland from the port of Ostend, and connected with that port by a canal, was, during the era in which we are interesting ourselves, the capital of the Dukes of Burgundy, who held there a splendid court. These dukes, in addition to their own proper domain, Upper Burgundy (Franche Comtè), had by degrees become lords also of other vast territories. They were nominal vassals of the German Emperors and of the French Kings, but far surpassed both these potentates in resources and real power. Under the German Empire they held Burgundy proper, East Flanders, Luxembourg, Alsace, the duchies of Brabant and Limberg, the marquisate of Antwerp, the counties of Hainault, Holland, and Zealand; to the French King they did homage for the counties of Ponthier, Amiens, Vermandois, Nevers, and Namur.

From 1419 to 1467 Philip the Good was the reigning duke, a munificent patron of art and promoter of commerce and industry.

To commemorate the perfection to which woollen manufactures had attained among his people, he instituted an order of knighthood—that of the Golden Fleece. A great lover of learning and literature, he maintained within the walls of his palace a staff of skilled copyists and illuminators.

William Caxton was brought into intimate relations with this Philip the Good, being at Bruges after 1463 what we should now call British Consul—a public agent stationed there, charged with the care of English interests, chiefly commercial, in the dominions of the Duke of Burgundy; technically, "Governor of the English Nation." As a man of literary tastes, Caxton was held in especial esteem by the duke.

In 1467, Philip the Good died. His successor, Charles the Bold, whose reign proved disastrous to himself and his dominions, was no professed patron of letters. It happened, nevertheless, that Caxton's relations with the Burgundian court became now even more intimate than they had been under Duke Philip. The new duke, soon after his accession, brought home as his bride the Princess Margaret, Edward the Fourth's sister, who forthwith evinced a great regard for her countryman Caxton, now a polished courtier as well as an experienced man of business. She attached him to the court as one of the gentlemen of her household. It would seem that about this time Caxton resigned the post of "Governor of the English" at Bruges, wearied perhaps with the anxieties of the post, growing more and more serious during a troubled period, and glad to withdraw into a position likely to afford him more leisure for the literary pursuits which had become so fascinating to him.

In 1470, reverses sustained by the Yorkist party in England obliged the King, Edward IV., to fly the country, accompanied by several of his adherents among the nobles; and the court at Bruges was the temporary resort of the fugitives. After the lapse of five or six months, Edward regained his throne. During this short sojourn of Edward abroad, Caxton became personally known to him and his friends through the Princess Margaret; and it is believed that this circumstance, together with public changes in progress at Bruges and elsewhere, ultimately led to the removal from Flanders to England, which took place a few years later. Caxton may have deemed the time opportune for the introduction of Printing into England. As a commercial venture he must have seen the probability of its success. The capabilities of the novel invention for the rapid multiplication of books in request among the learned were self-evident, and he would feel sure of the royal countenance and the patronage of influential friends in the enterprise. But first it was expedient that he should make himself in some degree practically acquainted with the art, and with the economy of a printing establishment. Many intelligent men had, to his knowledge, passed over with comparative ease from other avocations to that of the printer. Why should not he? While yet acting as British agent, he had been in the habit of utilizing his intervals of leisure by translating into English a French work, entitled *Le Recueil des Histoires de Troyes*, a paraphrase of the leading passages of the *Iliad*, written by Raoul le Fevre, formerly chaplain and secretary to Philip the Good, and probably a personal friend of the translator. After various interruptions he at length completed his English version of the work, encouraged in his undertaking by the Princess Margaret, "his redoubted ladye," who deigned to suggest some improvements in the phraseology. It was begun at Bruges, he tells the reader, continued in Ghent, and finished in Cologne. And farther he more specifically states: "It was finished in the time of the troublous world, and of the great divisions being and reigning as well in the realms of England and France, as in other places universally throughout the world, that is to wit: in the year of our Lord one thousand four hundred and seventy-one." Of the translation thus continued and ended in the midst of inauspicious surroundings, Caxton proceeded to supply copies in manuscript to his mistress the princess, and his other English-speaking friends. And it was while personally engaged in this rather wearisome employment that his plans for the future took definite shape, and the resolution was formed to master for himself the new art of printing, and to issue by means of it an edition of the English version of the *Recueil* for the English market.

At this juncture we become acquainted with Colard Mansion, a Frenchman settled at Bruges. Colard Mansion was a clever engraver, caligrapher and illuminator, who had been in the pay of Duke Philip the Good, but who had betaken himself to the practice of the new art, and had set up a press in a small room over the porch of the church of St. Donatus at Bruges. Here also he manufactured with skill the punches and matrices required in type founding, and put them successfully to their proper uses. It is conjectured that the fine founts of his office were in the first instance cut and cast at the command and cost of the late munificent literary duke. Caxton put himself under the tuition of Colard Mansion, handsomely recompensing him for his pains, learning the new art and mystery by setting up with his own hands the type of the English *Recueil*, and partaking in the manual labour of its actual imprinting at Colard Mansion's press. "I have practised and learned," he says, "at my great charge and dispense, to ordain the said book in print, after the manner and form as you may here see." A further memorandum informs us that the printing was completed "on the last day of March, 1474." A monogram or cipher is seen in several of the books afterwards printed by Caxton in England, consisting of the Arabic numerals 7 and 4 reversed and interlaced, placed between the initials of his name. On either side, in some instances, certain marks are to be seen which have been thought to be respectively an *s* and a *c*; but they are more probably only flourishes in the ornamentation of the border. If, however, the *s* and the *c* be insisted on, their interpretation may more plausibly be *sine calamo* than *Sancta Colonia*. The whole device will then be a cryptic commemoration of the time when Caxton first embarked in the novel avocation of issuing books to his friends and the public, *sine calamo*, "without the aid of the pen." Thus the first old printers were wont to boast in their colophons; and Caxton also himself thought good to remark at the close of the *Recueil*, that the work in the reader's hands was "not written with pen and ink as other books be:" an observation not altogether needless for the superficial observer, as the types used in the impression are the closest possible imitation of a local style of hand-writing.

The bulk of the printed edition of the English *Recueil* would no doubt be shipped off to an agent in London. Persuaded that he had struck a profitable vein, Caxton now completes another translation from the French, *The Game and Playe of the Chesse*, a work chiefly compiled by one Jehan de Vigny from the Latin work of J. de Cessolis, *Liber de ludo Scachorum*. This translation was committed to type as speedily as possible in the office of Colard Mansion, Caxton himself taking some part as before in the manual work. The book was dedicated to the King of England's brother, the Duke of

Clarence, and sent off at once to London. (About the same time Colard Mansion put forth an edition of the French work, on his own account, using—whether his own or ducal property—the identical founts employed in the English version.)

The work next taken up for translation, with a view to publication, seems to have been, *The History of Jason*, another of Raoul le Fevre's productions. But this was not printed until after the removal to Westminster, as is said to be proved by the type. An edition of the original French was, in this case also, subsequently printed by Colard Mansion. (The idea that Caxton learned and practised printing at Cologne, arose from a casual expression in the *Recueil*, taken wrongly by Wynkyn de Worde to mean that the book was printed there, whereas Caxton simply says that the translation into English was finished there.) It is entitled *The Book of the Whole Life of Jason.* It was from the pen of the same Raoul le Fevre, who wrote the *Recueil*, and in some sort it celebrates the institution of the Order of the Golden Fleece by his first patron, Duke Philip. The translation had probably been some years in hand. With his usual policy, Caxton dedicates the book to the eldest son of the King of England, the Prince of Wales, "our to-coming sovereign lord," as he speaks, then only four years old. He does not presume, he says, to dedicate the volume to the king, inasmuch as he doubts not that he who had permitted himself to be enrolled in the said Order of the Golden Fleece, was already in possession of the work in French; but he presents it to the prince that he may "begin therein to learn to read English." In Halliwell's *Letters of the Kings of England* are preserved the instructions given by Edward IV. to Earl Rivers, as tutor of his son, the Prince of Wales, in 1475; and amongst them it is directed that there should be "read unto him such noble stories as behoveth to a prince to understand and know." The *Book of Jason* may have been one of the noble stories used in this way in the education of the prince. In the prefaces to several of his publications, Caxton indulges in some personal gossip. In the prologue to the *Jason* he falls, consciously or unconsciously, into the vein of Froissart, and describes some arras hangings which he remembers seeing in the hall of Hesdin Castle in Artois, executed and placed there by order of Philip the Good, on which were depicted the exploits of Jason when in quest of the Golden Fleece.

No room is left for doubt as to the place of issue of the next volume of Caxton's which I have to notice, *The Dictes and Sayings of Philosophers*. He had now for certain severed the ties which bound him to Flanders and the Rhineland, after a residence there of over thirty years; and had transferred himself to the neighbourhood of the great city where his youth had been spent. Undeterred by the approaches of age, he resolved on a new career, and brought with him from abroad a full equipment as printer, his founts of type being cut and cast for him, as their appearance sufficiently proves, by Colard Mansion at Bruges. With him also came a staff of experienced assistants. On the title page of the *Dictes and Sayings* we read: "Imprinted by me, William Caxton, at Westminster, in the year of our Lord mcccclxxvii." Here at last we have the three desiderated elements of certainty, and the tangible date is supplied, by means of which the present year, 1877, has been distinguished as the four hundredth anniversary of the introduction of printing into England. The author or translator of the volume now issued was no less a personage than the Queen's brother, Lord Antony Woodville, Earl Rivers, governor, as we have already seen, of the Prince of Wales. The astute printer contrives to keep in the sphere to which he had become habituated at Bruges. By cultivating the good graces of the higher powers he secures their patronage, and anticipates, doubtless, the solid advantages likely to accrue therefrom to his several ventures. In 1484 we have him dedicating a work to Richard III., who had then obtained possession of the throne—*The Book of the Order of Chivalry*. In the preceding year he had put forth the *Legenda Aurea, or Golden Legend*, a work probably known to be acceptable to Richard. In the life of St. George of England in this book, he says that in the Chapel of St. George, at Windsor, the heart of St. George is preserved, a precious relic presented to Henry V. by the Emperor Sigismund.

In 1485, Henry VII. assumed the crown, and Caxton takes an early opportunity of presenting to him in person a copy of the latest product of his press, the *History of Charlemagne*. In this year he prints Sir Thomas Malory's *Morte d'Arthur*, a compliment, we may be sure, to the Tudors, who prided themselves on their descent from Arthur through the Welsh princes. In 1489, he translates and prints at Henry's express desire, the *Feats of Arms and Chivalry*, a work by Vegetius, and in 1490, he dedicates a translation of the *Æneid* of Virgil to Henry's eldest son, Arthur, Prince of Wales. Henry VII. had derived from his mother, "the saintly Margaret of Lancaster," a love of books and learning. This royal lady, of whom I shall speak again, patronized Caxton, and at her command, as he himself informs us, conjointly with that of the Queen, he printed, also in 1490, the *Fifteen Oes*, a volume of prayers. He had previously printed two more translations by the hand of Lord Rivers, for whom he printed the *Dictes and Sayings*. More than sixty books, besides those named, from the press of Caxton, including the *editio princeps* of Chaucer, are to be seen in the libraries of England or the Continent. For an account of these, recourse must be had to the usual writers on bibliographical subjects. The particular spot in Westminster where Caxton first set up his press is known from an extant advertisement of his. It reads as follows:—"If it please any man, spiritual or temporal, to buy any Pies [pica prayer-books] of two and three Commemorations of Salisbury Use, imprinted after the form of this present letter, which be well and truly corrected, let him come to Westminster, into the Almonry, at the Red Pale, and he shall have them good-cheap." He appends a brief request to the reader or binder in Latin, *Supplico stet cedula* (*schedula*), "Don't destroy this slip;" and then we have his cabalistic W. C., etc. The Pies were Calendar-tables (also called Picas), with rubrical directions, relating to church-services on saints' days; and the "Two or Three Commemorations" spoken of were an accumulation, so to speak, of two or three observances in one day, in which case certain combinations and omissions of proper collects were, for brevity's sake, permissible. The Red Pale was an escutcheon or shield bearing a conspicuous red stripe drawn vertically down its middle, set up over the door as a sign. The Almonry or Aumbry was a portion of the Abbey buildings now destroyed, forming part of the precinct towards the western entrance. It was the place where the doles of the monastery were wont to be distributed to the poor. Some disused apartments here, together with the dismantled chapel of St. Anne near by, were, it is supposed, leased by the Abbey authorities to Caxton. The Abbot of Westminster at the time was John Esteney. Caxton inscribes none of the productions of his press to him; but in his prologue to the *Æneid* he mentions a reference made by the Abbot to himself on one occasion for assistance in deciphering an antiquated English document.*

In 1485, the presses were removed from the Monastery buildings to premises of Caxton's own in King Street, Westminster. In 1491, Caxton died. He was buried in the churchyard of St. Margaret's Church, close to the Abbey.

Caxton's career was a prosperous one, and probably accompanied with much personal happiness, actively and usefully employed as he

* At the present day, Caxton's English requires, for its ready comprehension, some of the same kind of assistance from a friendly hand which Abbot Esteney sought to obtain from Caxton himself, in regard to English held to be "old" in the reign of Henry VII I give, as a specimen, the preface to a translation of a French work, entitled "Cato," a paraphrase of the so-called Distichs of Cato, much used in the mediæval schools. We gather from this "prologue or proheyme" what were Caxton's impressions of the rising generation of the city where his own youth had been passed some forty years previously. The translation was published in 1483. Thus the work is introduced :

"Unto the noble, auncyent, and renommed cyte, the cyte of London in England, I, William Caxton, cytezeyn and conjurye of the same, and of the fraternyte and felauship of the mercerye, owe of ryght my servyse and good wyll, and of every dute am bounden naturelly to assiste, ayde, and counceille, as ferforth as I can to my power, as to my moder, of whom I have receyved my nourcture and lyuynge, and shall praye for the good prosperite and polecye of the same duryng my lyf, for as me semeth it is of grete nede, bycause I have knowen it in my yong age moche more welthy, prosperous, and rycher than it is at this day, and the cause is, that there is almost none that entendeth to the comyn wele, but only every man for his singuler prouffyte. O whan I remember the noble Romayns, that for the comyn wele of the cyte of Rome, they spente not only theyr moevable goods, but they put theyr bodyes and lyves in jeopardy, and to the deth, as by many a noble ensample we may see in the actes of Romans, as of the two noble Scipions, Affrican and Asyan, Actilius, and many other ; and amonge al other the noble Catho, auctor and maker of this book, whiche he hath lefte for to remayne ever to all the peple for to lerne hit, and to knowe how every man ought to rewle and governe hym in this lyf, as well for the lyf temporall, as for the lyf spyrytuel. And, as in my judgment, it is the beste book for to be taught to yonge children in scole, and also to peple of every age, it is full convenient yf it be wel vnderstanden. And bycause I see that the children that ben borne within the sayd cyte encrease, and prouffyte not like theyr faders and olders, but for the mooste parte, after that they ben comeyn to theyr parfight yeres of discrecion, and rypenes of age, how well that theyre faders have lefte to them grete quantite of goodes, yet scarcely amonge ten two thryue I have seen and knowen in other londes, dyuers cytees, that of one name and lynage successyvely have endured prosperously many heyres, yea v. or vi hundred yere, and some a thousand ; and in this noble cyte of London, it can vnnethe contynue unto the thyrde heyr, or scarcely to the second O blessyd Lord, whan I remembre thys I am al abasshed ; I can not juge the cause, but fayrer, ne wyser, ne bet bespoken children in theyre youghte ben nowher than ther ben in London ; but at their ful rypng there is no carnel ne good corn founden, but chaff for the moost parte. I wote wel there be many noble and wyse, and prove wel, and ben better and richer than ever were theyr faders ; and to thende, that many myght come to honoure and worshyppe, I entende to translate this sayd book of Cathon, in whiche I doubte not, and yf they wylle rede it, and understande, they moche be the better conne rewl themself therby ; for among all other bookes this is a singular book, and may well be callyd the regyment, or governaunce of the body and sowle There was a noble clerk named Pogius, of Florence, and was secretary to pope Eugenye, and also to pope Nychcolas, which had, in the cyte of Florence, a noble and well stuffed librarye, which all noble straungyers comynge desyred to see, and therin they fonde many noble and rare bookes, and whan they had axyd of hym which was the best booke of them alle, and that he reputed for the best, he sayd, that he held Cathon glosed for the best book of his lyberary," &c.

constantly was in mind and body. But his times, as we have seen, were full of perturbations. What with popular risings, war with France, contests for the throne between the houses of York and Lancaster; and, on the Continent, the French determination to expel the English, the struggles of the Kings of France against their nobles, the rivalries and feuds between Louis XI. and Charles the Bold, and the German Emperor, no one of any class was sure of dying peacefully in his bed. Caxton, in the case of many of those with whom he was brought into close relations, must have been impressed with the miseries and perils attendant on high position, and the mutability of human affairs generally. It is sad to recall the fates of several of the personages whose names are associated with the books which he printed. The Duke of Clarence, to whom the first edition of *The Game and Playe of the Chesse* was dedicated, was secretly put to death in the Tower, plunged, it was currently reported, into a butt of Malmesey wine. The Prince of Wales, addressed in the *Book of Jason*, was suffocated along with his young brother, also in the Tower; and the Earl of Rivers was ruthlessly beheaded at Pomfret. For Richard III., slain on the field of Bosworth, we feel less compassion. The other young Prince of Wales, Arthur, son of Henry VII., to whom the *Æneid* was presented, never ascended the throne.

Caxton is one of the few characters in the history of England who have moulded themselves into shape with some distinctness in the imagination of most Englishmen. He lives and moves, a real person in their minds, individually recognisable, like Alfred, like Chaucer, like Shakespeare himself. And this in spite of meagre data. A few autobiographical facts casually supplied to us in addresses to the reader, scattered about in certain of his publications, a few allusions in contemporary annals, an occasional mention in legal and other documents of the time accidentally preserved, these are the only materials out of which to construct a biography of Caxton. And then we have the portrait which has come down to us as his, which, when once we have seen, we do not forget: a peaceful unmilitary face; large inquiring eyes looking out from under a slightly perplexed brow, a well-formed nose, plentiful hair and beard, grey and curling; lips making inquiry along with the eyes; the whole surmounted by quaint, almost oriental head-gear, the incipient modern hat nevertheless, with narrow brim turned up all round, retaining, however, still a portion of the hood *à la* Henry IV., with liripipe dangling on one side. (For the instructive story of Caxton's childhood in the Weald of Kent, and his youth and early manhood in the city of London, I must refer you to the books which are in every one's hands.)

It is hardly necessary to add that the *Caxtoniana* of Lord Lytton are only remotely connected with our Caxton. They are a series of pleasant essays, whose subjects were suggested to the writer from time to time during the composition of *The Caxtons* and *My Novel.* The supposed author of these fine fictions, Pisistratus Caxton, narrates, we shall remember, the very serious differences between his father Austin and his uncle Roland, on the unsettled point as to whether they came from the branch of the ancient Caxtons whence the great printer sprung, or from that to which Sir William de Caxton belonged, slain in the battle of Bosworth field, fighting for Richard III. Considering the wide range of the *Imaginary Conversations* of Walter Savage Landor, it is singular that among the interlocutors none of the prototypographers are to be met with. With his great dramatic insight, and perfect mastery of precise, accurate English, Landor, had he chosen, might have constructed much admirable discourse between Gutenberg and Adolphus of Nassau, for example, or between Colard Mansion and the Seigneur de la Gruthuyse, or between Caxton and Earl Rivers, or Caxton and Abbot Esteney. Charles Knight, at the close of his Memoir of Caxton, presents us with a scene, not badly conceived, in which Wynkyn de Worde, Richard Pynson, William Machlinia and Lettou are the dramatis personæ.

Caxton's foreman, Wynkyn de Worde, succeeded to the establishment in King Street, Westminster, and carried on printing operations there until 1497, when he removed to Fleet Street, at the sign of the Golden Sun. He was a native of Holland, and had accompanied Caxton from Bruges. He improved on his master's style and adopted the Roman type. The issues of his press were numerous and multifarious, including even the Koran "of the false necromancer Mahomet," as the phrase is on the title page. The first edition of Sir John Maundeville's *Travels* was also issued by him. Four hundred and ten works or editions are enumerated as coming from Wynkyn de Worde's press. He put forth repeated editions of the *Scala Perfectionis, or Ladder of Perfection,* a religious book printed at "the command of Margaret Beaufort of Lancaster, the King's mother," who also, as we have seen, was a patroness of Caxton; and on the occasion of the death of this princess the funeral sermon pronounced over her remains by Fisher, Bishop of Rochester, was printed at the press of Wynkyn de Worde. This interesting printer died in 1534, and was buried in St. Bride's, Fleet Street.

Another assistant of Caxton's, Richard Pynson, a Norman by birth, but naturalized in England by letters patent, had established himself independently as a printer, first, just outside Temple Bar, and secondly, in Fleet Street, at the sign of the George. Lady Margaret, the king's mother, patronized him likewise, as also did her son Henry VII. In his colophons Pynson styles himself "Printer unto the King's noble grace." After the death of Henry, his son and successor Henry VIII. continued to him the same title, and Pynson had the honour of printing the king's treatises against Luther which acquired for him the title of Defender of the Faith. Among the 215 works or editions issued by Pynson were the *Chronicles* of Froissart, and the *editio princeps* of the *Promptuarium Parvulorum*, a famous Latin-English dictionary. Pynson died in 1529. Two other printers said to have been brought over from the Continent by Caxton afterwards became distinguished on their own account, Lettou and John Machlinia.

It is not my intention to note with minuteness the English typographers who came after Caxton and his co-labourers. Between 1477 and 1500 there were one hundred and ninety master printers in London. Notary and Facques are early names on the list. There, as elsewhere, presses pass from father to son. Thus in the period mentioned, there are two Walleys, three Wolfes, three Wyers, three Powells, three Jugges, including the widow of one, three Halls, three Herfords, two Hills, two Coplands, two Days, two Alders, two Barkers, two Jacksons, two Whites. Day and Grafton, Wolfe and Wight, are especially eminent. The works printed are for the most part of the same nature as those issued by Caxton and his compeers—church books, school books, law books, medical books, classics, books of sports, fiction (poetry and prose); and it is a significant fact that Bibles are now added. The printers' places of business continue to be known by signs, the Mermaid, the St. John the Evangelist, the Holy Trinity, Our Lady of Pity, Maiden's Head, Brazen Serpent, the Well and Two Buckets, Lucretia Romana, White Horse, White Bear. At Oxford Theodore Rood of Cologne was printing in 1480, with a partner named Hunt, who probably was the person who put forth a volume without a printer's name two years previously. The date of this book reads "mccclxvi;" out of which an "x" has dropped, a mishap which has befallen printed dates in other instances. In 1671 books printed under the auspices of the University began to be dated "E Theatro Sheldoniano," a practice which continued more or less until the establishment of the Clarendon. In 1480, also, books were being printed at St. Albans by the "Schoolmaster" of the Monastery there. At Cambridge, John Siberch, a German, was printing in 1521, Erasmus himself being a resident in the University at the same time. It was John Legate, a distinguished printer here in 1589, who first made use of the device still to be seen in the Cambridge books—a figure of *Alma Mater Cantabrigia* standing behind an altar with streaming breasts, and holding in one hand a sun, in the other a chalice, with an encircling legend of *Hic lucem et pocula sacra.* At York, a Hollander, Hugo Goes, was printing in 1506; at Canterbury, John Mytchell was similarly engaged in 1550. A press was established in Edinburgh in 1507, under the auspices of James IV. In Dublin, printing was introduced in 1551.

After the manner then just narrated sprang up the pre-eminently human art of type-printing; after the manner just narrated did it begin to spread. The rude wooden letters of the Haarlem block-printer, slowly carved with the hand, were quickly transformed into the magnificent metal characters of Gutenburg and Schoeffer, cut and cast with a finish, and impressed on paper and vellum with an effect which have never been surpassed. The adaptation of the invention to the intellectual wants of men was instantly, universally recognized. The appliances indeed by means of which these nimble ministers of man's wit are made to do their office, have undergone mighty changes. The primitive wooden wine-press of the Rhineland, with its screw and movable bar, gave the first idea of the apparatus required; nay, perhaps, in some cases was extemporized into the apparatus required. And grievous for a time was the wear even on the hardest type by the brute power of such a machine. Bleaw, of Amsterdam, an ingenious and scientific man, in 1601, civilized some of the first contrivances; but it was not until the beginning of the 19th century that the Stanhope press was constructed, made wholly of iron, and doing its work to perfection by means of delicate adjustments of pressure through spiral springs and the nicely calculated action of a bent lever handle. Then followed the Ruthven, an Edinburgh machine, and the Columbian, a Philadelphia production, both based on the Stanhope principle, but accomplishing their tasks with greater economy of labour and greater speed.

But the demands of the age were insatiable. The successful application of steam power to machinery in other directions, quickly of course suggested itself as an auxiliary in printing, especially in the printing of newspapers, the circulation of which had now become exceedingly great. In 1814, the cylinder press of the London *Times* was the marvel of the day. Then, each in succession claiming and proved in practice to be really an advance in excellence, came the American Rotary, the Walter Web-feeder, the Prestonian Automaton—the last throwing off by a series of actions, looking like the result of self-consciousness and reason, huge sheets printed on both sides, disengaged from each other, and folded in incalculable numbers and with lightning rapidity. Caxton boasted in the Colophon of his *Recueil*, that the whole book was begun in one day and finished in one day: that is, that the first folio of the whole edition was worked off in one day, and the last folio in the same space of time. This for an edition of five hundred, and probably Caxton's would not be larger, would, when the sheet was printed on both sides, involve one thousand inkings, one thousand pulls of the press handle, one thousand placings and replacings, with a variety of other careful manipulations. Under the circumstances the old printer might legitimately claim some credit for the capabilities of his art. Perhaps not much more could have been accomplished with the machines at which Franklin worked in London and Philadelphia. The Stanhope furnished forth completed sheets of letter-press at the rate of 250 per hour. The first *Times* cylinder printed perfect copies of that great daily publication at the rate of 1,100 per hour, and now we hear of 10,000 perfected sheets per hour as the rate of production attained by the Automaton Web-feeder.

What the intellectual exigencies of future generations may be, who can say? Education is spreading every day, and in every country. The love of knowledge, of science, of literature, is penetrating all communities deeper and deeper, and will, in the onward march of civilization, be universal. And accompanying this great movement, another phenomenon is apparent—a tendency to a unity of alphabet, a unity of typography, a unity of language. The demand for reading-matter—perhaps English reading-matter—great as it is, must in the future be vastly greater. But we must believe that man in the future, as in the past, will continue to develop contrivances answerable to his needs. Photography and electricity may be enlisted yet further than they already have been in the service of letters ; and appliances for satisfying the mental hunger of the human race, having photography and electricity as co-efficients, may possibly be thought of, which to us now would seem to involve the incredible, but which, to our descendants, will be things of course, and classed by them among the ordinary conveniences of every-day life.

CATALOGUE OF BOOKS, AND OTHER OBJECTS,

Illustrative of the Art of Typography, Exhibited at the Rooms of the Canadian Institute, Toronto, June 13–16, 1877, on the occasion of the Four Hundredth Anniversary of the Introduction of Printing into England by William Caxton.*

1. Works on the General Subject: Typography.

Joseph Ames. Typographical Antiquities. London. W. Faden, for J Robinson, 1749 4to. It has a good portrait of Caxton.

Gerard Meerman Origines Typographicæ The Hague. 1765 4to. It has a fine portrait of Lawrence Coster.

Henri Gockinga. De l'Invention de l'Imprimerie. Paris. F. Schoell 1809 12mo.

Paul La Croix. Histoire de l'Imprimerie. Paris Plon frères. 1852. Royal 8vo Plates.

Noel Humphreys. History of Printing. London. Bernard Quaritch 1868. Folio. Numerous reproductions and *fac similes.*

Gulielmus Nicol. De Literis Inventis: Libri Sex. London: for H Clement. 1714. 12mo The frontispiece shews the Earl of Pembroke in his Library.

John Johnson. Typographia London. John Johnson. 2 vols. Large paper copy. It shews in a medallion the heads of Gutenberg, Schœffer and Fust.

J Ph. Berjeau. Le Bibliophile Illustré. Londres. W. Jeffs. 1862. Octavo. Cuts.

Le Bibliophile Français. Paris. Jules Bonaventure. 1868. 8vo.

Richard Heber. Catalogue of the Bibliotheca Heberiana. London. W. Nicol. 12 vols 8vo.

A. A. Renouard. Bibliothèque d'un Amateur. Paris. Crapelet. 1819. 2 vols. 8vo.

Catalogue of the Kloss Library. London Sotheby. 1835. 8vo.

2. Illustrations of the Pre-Typographic Period: Alphabets, Inscriptions, Manuscripts, etc.

The Four Gospels. A Greek MS. on vellum. Twelfth Century. Small 4to. From the Levant. With miniatures and illuminations at the beginning of each Gospel; and in the original cedar or cypress-wood covers

The Four Gospels. A Latin Manuscript on vellum Fourteenth Century. 8vo. Western monastic work. The capitals rubricated. The original cover replaced by olive-morocco antique binding

The Book of Esther. A Hebrew manuscript on five sheets of prepared skin. Length of roll or megillah, ten feet; height, twelve inches. Lined at one end with green silk.

Jac de Effordia Tractatus. Cologne. John Veldener. 1470. Xylographic or block-book. Illuminated letters.

The Biblia Pauperum Predicatorum. Xylographic or block-book J Russell Smith's *fac simile* reproduction. Forty plates. 4to.

A Chinese xylographic block or wooden tablet, with a page of matter carved thereon, ready for printing from.

A Chinese volume, "The Book of Heroes" The paper printed on one side only, and folded with the unprinted sides back to back Many illustrations; and examples of the transition from formal to cursive writing on every page. Chinese binding

Chinese Bible. Gutzlaff. Printed and bound in the Chinese style.

Japanese Alphabets and Object Lessons. Boldly drawn on sheets for school purposes

Arabic Manuscript. Preces et Capitula Alcorani. On Bombycine paper. Miniature 4to.

* The works exhibited were kindly lent by the authorities in charge of the Public Libraries of Toronto, and by several private amateurs of books in the city and neighbourhood. The Institute is indebted to the following for loans on the occasion:—*The Parliamentary Library of the Province of Ontario, the Library of the University of Toronto, the Library of Osgoode Hall, the Library of the Department of Public Education, the Library of the Upper Canada Bible Society, N G Bigelow, Esq., Dr. Canniff, A. Elvins, Esq., Alderman Hallam Dr C B Hall, Arthur Harvey, Esq., S. Hart, Esq, F Krauss, Esq., F. A Knapp, Esq, C Lindsey, Esq. Prof. Loudon, W J Macdonell, Esq. (French Consul), J Notman, Esq., J. Paterson, Esq, Dr. Reeves, H Rowsell, Esq, Rev. Dr Scadding, W. H. Van der Smissen, Esq., S. J. Watson, Esq, Prof. Daniel Wilson, R. B. Willing, Esq, J. Young, Esq.*

Early French Black Letter Manuscript Jardin Delectabile (Devotional).

A Persian volume. "The Poems of Hafiz." Printed from blocks Ornamental capitals, finials, etc. Persian binding.

Specimen of Persian caligraphy.

MS. Riccius. De Regibus Hispaniarum et Siciliæ. 8vo.

MS. Legal Documents relating to Lands temp. Edward III., Henry VII., Henry VIII., Edward VI., Mary, Elizabeth, Charles I. With the Seals appended.

J. B. DuHalde: Description of China. The Hague. H. Scheurler. 1736. 4to. 4 vols Chinese characters.

Dr. John Lamb. Hebrew Hieroglyphics. Cambridge Pitt Press. 1835. 8vo.

C. Forster. Harmony of Primæval Alphabets. London. 8vo.

James Harris. Hermes. Universal Grammar. London. J. Nourse. 1765. 8vo. Fine frontispiece.

Comte de Gebelin. Histoire Naturelle de la Parole. Paris. Boudit. 1776. 8vo. Plates

F. J. Bastius. Palæographia. London R. Watts. 1835. 8vo.

London Palæographical Society's publications The Seven parts. One hundred folio plates of exact *fac-similes* by the autotype process of authentic and very rare MSS on papyrus and vellum, from B C 152 down to the era of Wycliffe and Chaucer; consisting of portions of the Greek and Latin classics, gospels, psalters, office-books, charters, works in early English, etc., preserved in the libraries of Great Britain, Ireland, France, Italy and Spain.

Sir W. Betham. Etruscan Inscriptions. Dublin: for F D Hardy. 1842. 8vo. 2 vols

Gio Battista Vermiglioni. Etruscan Inscriptions at Perugia. Perugia V. Bartelli. 1833 4to. Chev. Bunsen's Copy.

Mazochius. Inscriptions of Herculaneum. Naples. B. Gessar 1754. folio.

Odericus. Ancient Latin Inscriptions, Medals, &c. Rome. F. B. Komarek. 1765. 4to. From Library of Trinity College, Cambridge.

Ciampini. Vetera Monimenta. Ancient Inscriptions Rome. Bernabo. 1699. 4to.

Odescalum Museum. Rome J. G Salomoni. 1751. folio. 2 vols

Marmora Oxoniensia. The Arundel and other Inscriptions London R Boyer. 1732. folio

S. Nerses. Preces (in Thirty-three Languages). Venice 1862 12mo.

Armenian. Meditations. Imitation Armenian MS. Rome. 12mo

Humboldt. Ancient Inhabitants of America Mexican Inscriptions. London. J. G. Barnard 1814. 2 vols. 8vo.

3. Books Printed before A.D. 1500.

Johannes de Gersonâ. Tractatus. Nuremberg. John Gensenschmidt. 1472-3. folio. Illuminated capitals and initials.

Bonaventura. Speculum B. Virginis. Augsburg. Antonius Sorg. 1477. folio.

Antonius Rampegolis Aureum Repertorium (without place, date or printer's name): before 1475. 4to.

Durandus. Rationale Divini officiorum. Venice. Erhardt Radolt. 1485 folio.

Gregory IX. Decretalia. With Bernhard's Gloss. Spires. Peter Drach. 1486. Large folio.

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4. Books Printed A.D. 1500—A.D. 1600.

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Mandchou Testament.

Creole New Testament. Copenhagen. 1818.

Pali New Testament. Colombo. 1835.

Cree Bible. In the Cree character. London. 1861

Book of Proverbs, in embossed type for the Blind.

Bagster's Bible in Every Land.

John Jackson. Index Biblicus. Cambridge. John Field. 1668. 4to.

The Zend-Avesta of Zoroaster. Anquetil du Perron's translation. Paris. 1771. 4to. 3 vols.

Confucius. His Scientia. Paris. Daniel Horthemels. 1687. folio. Portrait of Confucius standing in his Library. *Fac-similes.*

Testament of the Twelve Patriarchs. London. M. Clark. 1684. 12mo.

10. Books from the Presses of the Elzevirs.

Cluverius. Geographia. Amsterdam. Ex off. Elzevir. 1679. 32mo. Horace Walpole's copy.

Virgil. Opera. Amsterdam. Ex off. Elzevir. 1664. 32mo.

Sleidan. De Quatuor Summis Imperiis. Amsterdam. Ex off. Elzevir. 1678. 32mo.

Cunæus. De Rep. Hebræorum. Leyden. Ex off. Elzevir. 1632. 32mo.

Pliny. Historia Naturalis. Leyden. Ex officina Elzeviriana. 1635. 32mo. 3 vols.

Terence. Comœdiæ. Leyden. Ex officina Elzeviriana. 1635. 32mo.

Ovid Metamorphoses. Amsterdam. Daniel Elzevir. 1664. 32mo.

Melancthon. Epistolæ. Leyden. Bonaventure and Abraham Elzevir. 1647. 12mo.

Jonston. Enchiridion Ethicum. Leyden. Ex officina Elzeviriana. 1634. 12mo.

Meursius. Glossary. Leyden. Louis Elzevir. 1614. 4to.

Eusebius. Polychronius. Psellus In Cant. Canticorum. Leyden. 4to. Ex off. Elzevir. 1617. 4to. (Joh. Meursius' editio princeps.)

Busbequius. Legationis Turcicæ Epistolæ quatuor. Amsterdam. Ex officina Elzeviriana 1660. 32mo.

Belgii Confederati Respublica. De Laet. Leyden. Elzevir. 1630. 32mo.

Des Marets. Ariana. Amsterdam. Louis and Daniel Elzevir. 1659. 24mo.

Tacitus. Annales, etc. Leyden. Ex off. Elzevir. 1640. 32mo. 2 vols.

11. Books from the Presses of the Aldi.

Abduensis de Jure Civili. Venice. Aldi Filii. 1546 Anchor and Dolphin.

Libri de Re Rusticâ. Venice. In ædibus Aldi et Andreæ Soceri; *i.e.*, A. Torresani, the successor of Nic. Jenson. 1514 8vo.

Faletus. De Bello Sicambrico. Venice. Aldus. 1557. 4to.

Chrysostom. De Virginitate. Rome. Paulus Manutius. Aldi filius. 1582. 4to.

Robert Langlande. Vision and Creed of Piers Plowman. London. W. Pickering. 1842 Rebus and device, *Aldi Discip. Anglus.*

12. Works of Erasmus (Early Editions).

The Adagia. Hanan Wechel 1617. folio. pp 774, exclusive of copious indices, and H. Stephens' Animadversiones. Wechel's device on title page.

The Paraphrases of Erasmus. In Latin. Basle. John Froben. 1541. folio. Fine example of Froben's device on title page.

The Paraphrases. In English. Udal's transl. Lond. E. Whytchurch. 1548. Black-letter folio.

Epistles of Erasmus. Antwerp. Loei. 1551.

Colloquia. Amsterdam Gul. J. Cæsius. 1629.

Varia. (Treatises.) Leyden. J. Mayre. 1641. 2 vols.

Moriæ Encomium. Oxford. W. Hall. 1633.

Moriæ Encomium. Amsterdam. Hen. Wetstein. 1585. 24mo. Engraved title.

Eloge de la Folie. Guendeville's Translation. Leyden. Vander Aa. 1713. 12mo. With Holbein's illustrations.

Colloquies translated by Sir R. L'Estrange. London: for Daniel Brown. 1725. 8vo.

Pilgrimages to Canterbury and Walsingham (reprint). Westminster. J. B. Nichols. 1849. 12mo. Wood-cuts.

Jortin's Life of Erasmus. London Ric. Taylor. 1818. 8vo 3 vols. Fine portrait.

Knight's Life of Erasmus. Cambridge. C. Crownfield. 1726. 8vo. Engravings.

13. Curiosities, Special Editions, Etc.

Bunyan. Pilgrim's Progress. 27th Edition. London. A. W., for W. Johnson 1748. Wood-cuts.

Bunyan. Pilgrim's Progress. 31st Edition. London. 1760, 1764, 1765. The three parts, with the cuts

Milton Paradise Lost. 3rd Edition. 1678. Portrait

Pope. The Dunciad. Notes and Prolegomena of Scriblerus. London: for Lawton Gilliver. 1729. 8vo.

The Eulenspiegel. Without printer's name or place. 1799 Plates.

Horace Walpole. Poems, and Castle of Otranto. Strawberry Hill Press. 1758.

Ferrarius The Hesperides. Rome. H. Scheus 1646 Folio. Horace Walpole's copy.

Ferrarius. De Florum Culturâ Rome. S Paulinus 1633 4to. Plates.

Dibdin. Reminiscences. London. J. Major. 1836 8vo. 2 vols. Plates.

Dibdin. Decameron London. W Bulmer. 1817. 8vo. 3 vols. Plates.

Dibdin. Library Companion. London. W Nicol 1825. 8vo.

Dibdin. Bibliomania. London. J. McCreery 1811. 8vo. Wood-cuts.

Dibdin Bib. Tour in France and Germany. London. W. Nicol. 1829. 3 vols 8vo. Plates

Dibdin. Bib. Tour in N England and Scotland London. J. Bohn. 1838. 2 vols. 8vo. Plates

Dibdin. Greek and Latin Classics London. J. Gosnell. 1804. 8vo.

Ovid. John Gower's translation of "The Festivals." Cambridge. Roger Daniel. 1640. 12mo.

Herman Hugo. Pia Desideria. London. 1690. Copperplate engravings.

Lud. Vives. Vera Sapientia. Dublin. Geo. Grierson. 1730

Epictetus. Enchiridion. Glasgow. R. and A. Foulis. 1750.

Ozell Trans. Boileau's Lutrin. Glasgow. R. and A. Foulis. 1752.

Young. Night Thoughts. Glasgow. Andrew Foulis. 1776. 2 vols.

Homer. The Iliad. Glasgow. Andrew Foulis 1778. 2 vols.

Horace. Milman. London. John Murray. 1849. 8vo. Illustrations.

F. Meres. Wit's Commonwealth. London. W. Stansby 1598 3 vols. Speaks of "mellifluous and honey-tongued Shakspeare," and of his "sugared sonnets among his friends."—P. 282, vol. iii.

Robert Langland Vision of Piers Plowman. London. Robert Crowley. 1550. Black-letter. 4to.

Newton. Philosophiæ Naturalis Principia Mathematica. Comment. of T. le Seur and F Jacquier. Glasgow. G. Brookman. 1833. 8vo 2 vols.

Guillim. Display of Heraldrie. London. Richard Blome. 1660. folio. Shields coloured.

Feltham. Resolves London. Henry Serle 1634. 4to.

Charron. On Wisdom Sennard's translation. London 1670.

Cartwright. Harmonia Evangelica. Leyden F. Hacke. 1647. 4to

Cocker. Arithmetic. 44th Edition. London: for Ed. Midwinter. 1677.

Travels before the Flood. London: for G. G and T. Robinson. 12mo. 2 vols.

John Collier. Tim Bobbin York. T. Wilson & Sons. 1818. 12mo Curious cuts.

Puckle. The Club. 5th Ed. London. 1710 7th Ed. Dublin. 1743. 12mo. Portrait

Anacreon. Forster's Edition London. J. Bulmer. 1802. Fine Greek type and illustrations

Emp Julian. Select Works. J. Duncombe's translation. London. J. Nichols. 1784. 8vo 2 vols. in one.

Emp. Julian Les Césars. Paris: Chez D. Thierry. 1683. 4to. Portrait of F. W., Grand Elector of Brandenburgh.

Fortescue. On the Laws of England. London T. Wight and B. Norton. 1599.

Duport Psalms of David, in Greek hexameters. Cambridge. J. Field. 1666. 4to.

Clement Marot. Pseaumes de David. Charenton. P. des Hayes. 1613 32mo; with music.

Sternhold and Hopkins. Psalms with music. London. 1560. 48mo.

Owen. Epigrammata. Amsterdam. J. Jansson 1697. 32mo. Portrait.

Leigh Hunt. Foliage London. C. H. Reynell. 1818. 12mo.

Tristram Risdon Survey of Devon. London. W. Mears. 1723. 8vo.

Verstegan. Restitution, etc. London. J. Bill. 1628. 4to.

Camden. Remaines, etc. London. J. Leggatt. 1628. 4to.

W. Musgrave. Belgium Britannicum. Exeter. 1719. 8vo.

Milton De Doctrina Christiana: translated by Sumner. London Charles Knight. 1825. 4to

Milton. His Latin and Italian Poems: translated by Cowper. London: for J. Johnson printer, J Seagrave, Chichester. 1808 4to. Flaxman's illustrations

Milton. Minor Pieces. English, Italian and Latin; with T. Warton's Notes. London. J. Dodsley. 1785. 8vo.

Cotton Mather. Magnalia Christi Americana. London: for Thomas Parkhurst. 1702. folio.

Nibelungenlied. Otto and George Wigand's edition. Leipsic 1840. 4to. Fine wood-cuts

Nibelungenlied. Lettsom's translation. London: for Williams and Norgate. 1850. 8vo.

Dante Vita Nuova. Theodore Martin's Translation. London. Chiswick Press. 1862. 8vo

Lays of the Minnesingers. London. Ric Taylor. 1825. "Alere Flammam" device.

Ballads, Seventy-nine black-letter. 1559-1597. London. Lilly's reprint. 8vo.

H B. Wheatley. Of Anagrams. Hertford. S. Austen. 1869. 12mo.

R Southey. Omniana. London. Longman. 1812. 12mo 2 vols.

Shaftesbury, Antony, Earl of. Characteristics of Men, Manners, etc. London No printer's name. 1757. 3 vols.

Roger Wilbraham. Cheshire Glossary. London: for T Rodd by R. Taylor. 1826. Bp Thirlwall's copy.

Sydney Smith. Sketches of Moral Philosophy. London. Longman. 1850. 8vo.

Valerian Krasinski. Religious History of the Sclavonic Nations. Edinburgh. Johnstone and Hunter. 1850. 8vo. Portraits.

Mrs. Henry Stisted Bye-ways of Italy. London. John Murray, Albemarle Street. 1845 8vo Plates by Col. Stisted

Louis XIV. Medailles Paris Fleurimont. Contemporary. 4to

Geo. Woodley. Cornubia: a poem. London: for Longman, by Mitchell, Truro. 1819.

Virtuoso's Companion. London. 1794 4 vols.

Breviarium Metense. L. J. de Montmorency Laval anctoritate. Metz. J. B. Collignon 1778 4 vols 12mo.

Trial of the Regicides. London. 1679.

Bourchier. Sermon, etc. MS. with ornamental borders: presented to Chief Justice Littleton and Mrs. Ann Littleton. 1639.

Antony à Wood. Historia et Antiquitates Universitatis Oxoniensis. Oxford. è Theat Sheld 1674. folio. Portraits.

Theophilus Gale Court of the Gentiles. Oxford H Hall for T. Gilbert. 1672. 4to.

Epistolæ Obscurorum Virorum. Leipsic Truebner. 1869.

Alciati Emblemata. Antwerp Ch. Plantin. 1581. Cuts.

Rara Mathematica J O. Halliwell Cambridge Metcalfe and Palmer. 1839.

Vegetius Renatus. Mulomedicina. Mannheim. Soc. Lit. 1781. 16mo. Bracy Clark's MS. notes

Bruno Seidelius. De Morbis Incurabilibus. Leyden. P. Hacke. 1662. 12mo.

H D. Gaubius Pathologia Medicinalis Leyden: apud S and J. Luchtmans. 1781. 8vo. Dr Widmer's copy.

Hippocrates. Coacæ Prænotiones L. Duret Interp. Paris: apud Gaspar Maturas 1658. folio

John Hunter On the Blood, etc. London. J. Richardson. 1794 4to Reynolds' Portrait

N. Bailey Etymological English Dictionary. London: for J Darby, etc 1726. 8vo. 2 vols

G. S Faber The Mysteries of the Cabiri Oxford. Univ. Press 1803 8vo 2 vols

Young. Night Thoughts. London. C. Whittingham, for T Heptinstall. 1798. Portrait Royal 8vo.

Ballantyne Press, History of: in connection with Sir W. Scott. Edinburgh. Ballantyne & Co 1871. 4to.

Herman Moll. Geographica Classica. London. Bowler and Carver. No date. 32 maps. 4to

Abraham Ortellius. Atlas London J. Norton and J. Bell 1606 folio. Dedicated to James I Portrait of Ortellius. Previously published at Antwerp, and dedicated to Philip II

Vincenzo Maria Coronelli. Atlas. Venice. Domenico Paduani. 1690. folio.

Matthæus Seutter. Atlas Amsterdam. 1750 folio.

J Janssonius. Ancient Atlas. Descriptions in black-letter. folio.

Roma Vetus: hoc est: Ædificia ejus præcipua, suis quæque locis.

Heriot. Travels in Canada London. T Gillet 1807. 4to. Plates

Chappell. Newfoundland and Labrador. London. R Watts. 1818. 8vo.

European Settlements in America. London. Dodsley. 1777. 8vo. 2 vols.

Rochefoucauld-Liancourt. Travels London. J. Phillips. 1799. 4to.

Kalm Travels Warrington. W. Eyres. 1770. 8vo. 3 vols.

Carver. Travels. Dublin. S. Price. 1779. 8vo

Nicholson. British Empire in America. London J. Nicholson. 1708. 8vo 2 vols.

Hugh Gray. Letters from Canada. London Longman 1809 8vo.

Boulton. Description of Upper Canada London 1809 4to.

Gabriel Sagard Deodat. Histoire du Canada. Paris Chez Claude Sonnius. 1636

Marc Lescarbot. Histoire de la Nouvelle France. Paris. Chez Adrian Perier. 1618. Maps

Lahontan. Nouveaux Voyages en Amerique. La Haye. Chez les Freres Honoré 1703 12mo. 2 vols.

Louis Hennepin. Nouveaux Voyages. Amsterdam. Chez Adrian Braakman. 1704. 12mo

Charlevoix. Voyage to North America. Dublin: for John Exshaw and James Potts. 1766 8vo. 2 vols.

14. Medals, Portraits, Photographs, Views, Etc.

Medal struck at Mayence in 1837, in honour of Gutenberg. On the obverse, Thorwaldsen's Statue. On the reverse, Gutenberg holding up a separate metal type to one bearing an engraved wooden block. Artist: H. Lorenz. Rome

Medal in honour of Pierre Didot l'ainé, Typographe Français On the obverse, the head of Didot On the reverse, a Press—"Presse Jules Didot," surrounded by the legend "Horace, Virgile, Racine, La Fontaine, ed. in folio." Veyrat fecit. 1823.

The Shakspeare Tercentenary Medal.

Medals of Milton, La Fontaine, Boerhaave, Cervantes, Fenelon, Addison, Congreve, Charles V, Goujon, Dante, Oxenstierna, De Cormerin, Ducange, George Canning, Peter Paul Rubens, Agassiz.

Wittemberg medal. Luther on metal in a frame. Plaque of Calvin.

Portraits, etc.

W. Caxton, in Ames. Laurence Coster, in Meerman.

Gutenberg, from the Statue at Strasburg.

Froben, in Knight's Life of Erasmus.

Paul Manutius. Aldus Manutius. Robert Stephens.

Brunet, in Bibliophile Français.

Thuanus (De Thou), in Collinson's Life of T.

Lady Margaret, patroness of Caxton, W. de Worde and Pynson, in Dr. Hymers' edition of the Funeral Sermon printed by Wynkyn de Worde.

Andrew Marvell. Henry Spelman. Leland. Geo Hearn. Jno. Strype W. Somner. Justel Chapman (Homer). Gerard (Herbal). Lydgate. Gower Lilly. Fosbroke. Bewick. Duke of Roxburghe, 1804. J. Evelyn. Charles Knight. Coleridge. J. O. Halliwell.

Volume of Danish Portraits. Copenhagen. 1806.

Two Photographs of Gutenberg's Statue at Strasburg. A Photograph of Gutenberg's Statue at Mayence. A Photo. view of Mayence. Jugel's Views on the Rhine, 1829: before Steam

Death of Bede. The First Proof. Press of Badius Ascensius

Interior of the Library of St. John's College, Cambridge; of Trinity College, Cambridge the Bodleian.

Interior and Exterior Views of Westminster Abbey and St. Paul's, London.

15. Specimens of the Early Toronto (York) Press.

Upper Canada Gazette, or American Oracle. 1798. William Waters and Titus G. Simons, printers.

Peter Russell's Proclamation. Dec. 15, 1798. Same printers.

Upper Canada Gazette, or American Oracle. 1803–1807. J. Bennett, printer.

Almanac. 1804. J. Bennett, printer. Almanac. 1815 John Cameron, printer.

English Acts of Parliament relating to Upper Canada and Provincial Statutes of Upper Canada from 1792. 2 vols. 4to. R. C Horne, printer. 1818.

Upper Canada Gazette and Weekly Register. 1824. Charles Fothergill, printer.

Upper Canada Gazette and U. E. Loyalist. Jan. 5, 1826. June 30, 1827 R. Stanton, printer.

Gospel of St. Matthew in Otchipway. York. Printed at the Colonial Advocate Office, by James Baxter, printer. 1831.

Sibbald's Canadian Magazine. January, 1833.

Todd's Manual of Orthoepy. 4th Edition. Printed at the Office of the Guardian. York. 1833

Walton's York Commercial Directory and Street Guide. Thomas Dalton, printer. 1834.

Patrick Swift's Almanac. 1834

Warren's Selection of Church Music. Robert Stanton, printer. 1835.

Toronto Almanac and Royal Calendar. 1839. Printed at the Palladium Office, York Street

Toronto Recorder. July 30, 1834. Geo. Perkins Bull, printer.

Commercial Herald. Feb. 21, 1838. Hackstaff and Rogers, printers.

The Advocate. No. 539. Oct. 16, 1834. Bancroft and Baxter, printers.

Correspondent and Advocate. June 8, 1836. W. L. Mackenzie, printer.

The Observer. Jan, 1828. John Carey, printer.

The Courier. Feb. 29, 1832 Geo. Gurnett, printer.

The Sapper and Miner. Oct. 25, 1832 G. W. Thompson, printer.

Palladium. May 9, 1838 Charles Fothergill, printer

The Patriot. Jan. 14, 1834. T. Dalton, printer.

Canadian Freeman. April 17, 1828 Francis Collins, printer.

Mackenzie's Gazette. June 8, 1839. Rochester, N.Y.

The Maple Leaf. 4to. Henry Rowsell. 1848.

16. Specimens of the Early Quebec Press.

Quebec Gazette. June 21, 1764. Printers, Brown and Gilmore (*fac-simile*).

Quebec Gazette. May 22, 1770. John Neilson, printer. Aug 14, 1794, to April 21, 1803. The same.

From the same press. The Laws of Lower Canada. On the title-page is a copy of the seal of the first Province of Quebec. The central device is the King pointing to a map of Canada; below in the exergue, "Extentæ gaudent agnoscere metæ" The whole surrounded by the legend, "Sigillum Provinciæ Nostræ Quebecensis in America"

The Times: Cours du Tems. 11 Mai, 1795. Quebec, à la Nouvelle Imprimerie.

Nouvel Alphabet. Quebec, à la Nouvelle Imprimerie, Rue du Palais. 1797.

Le Canadien. Nov, 1806. March, 1810. Printer, Charles Roi

Copy of Dilworth's English Spelling Book, with the inscription, "Ce livre appartien à Louis Chiniquy. Quebec, 1803."

Smith's History of Canada. 2 vols. 8vo. John Neilson. 1815.

Quebec Almanac for 1819: pp. 237. J. Neilson, 3 Mountain Street.

Hawkins' Picture of Quebec, with Historical Recollections. Neilson and Cowan. 1834.

17. Specimens of the Early Montreal Press.

Proclamation of Lieut. Gov. Simcoe, dated at Kingston, July 9, 1792; but printed at Montreal by Fleury Mesplet.

From the Press of Nahum Mower: A Concise Introduction to Practical Arithmetic, by the Rev. John Strachan, Rector of Cornwall, Upper Canada.

Smart's Sermon on the Death of General Brock, preached at Brockville, Nov. 15th, 1812.

Montreal Herald: 1811–1814. William Gray, printer.

Report Loyal and Patriotic Society of Upper Canada. Wm. Gray, 1817.

Letters of Veritas. Montreal. W. Gray. 1815. 8vo.

Letters of Nerva. Montreal. W. Gray. 1815. 8vo.

Dr. Strachan's Sermon on the Death of the Hon. R. Cartwright. W. Gray. 1816.

Canadian Courant. Montreal, Wednesday, Dec. 29, 1819. Vol. xiii. No. 35. Nahum Mower, printer.

Canadian Review, 1824–1826. E. V. Sparhawk, printer. Montreal.

Canadian Magazine and Literary Repository. Montreal, 1824.

Hawley's Quebec, The Harp, etc. Montreal. A. Ferguson. 1829. 12mo.

Hawley's The Unknown. etc. Montreal J. H. Hoisington & Co. 1831. 12mo.

Kidd's Huron Chief, etc. Montreal. Office of Herald and New Gazette. 1830. 12mo.

18. Specimens of the Early Niagara Press.

The Imposing Stone of the First Printing Press of Upper Canada. Presented by Mr. R. C. Gwatkin. The following inscription has been cut upon it: "Imposing Stone of the first Printing Press in Upper Canada, at Newark (Niagara), 1793 Teste W. Kerby, Niagara, 1873."

No 1, Vol i., of the Upper Canada Gazette, or American Oracle. April 13, 1793. Louis Roy, printer: at Newark or Niagara.

Vol ii. of the same periodical is printed by G. Tiffany.

In Vol. iii. the name of Titus G. Simons appears as that of the printer. In the autumn of 1798 the paper is issued at York: "W. Waters and T. G. Simons, printers."

"A Proclamation to such as are desirous to Settle on the Lands of the Crown in the Province of Upper Canada," is printed by G. Tiffany at Newark, in 1795. This document is a reprint of one dated at Quebec, Feb. 7, 1792.

Tiffany's Almanac for 1802.

Niagara Spectator, No. 12. 1818. Amos McKenney, printer.

Niagara Gleaner. Feb. 11, 1819. Andrew Heron, printer.

David Thompson. History of the Late War. Niagara. T. Sewell. 1832.

St David's Spectator. No. 20, 1816. Printed for the Proprietors.

19. Specimens of the Early Kingston Press.

Dr. Strachan's Sermon on the Death of Dr. John Stuart. Printed by Charles Kendall, Kingston, 1811.

Kingston Chronicle. 1819. Vols. i. and ii. Printed for the Editors.

Kingston Gazette. Nov. 17, 1812. Printer, Stephen Miles. (Obituary of Gen. Brock.) Other numbers.

The Upper Canada Herald. Kingston, April 4, 1832. No. 683. Vol. xiv. T. H. Bentley, printer.

Port Hope Gazette. Nov. 29, 1845. W. Furby, printer.

20. Specimens of the Early Halifax Press.

Halifax Gazette, July 28, 1763. Printer, Antony Henry.

Perpetual Acts of Nova Scotia. Printer, Robert Fletcher. 1767. folio.

21. Specimens of the Early Boston Press.

The New England Courant: No. 80. Feb. 11, 1723. Printed and sold by Benjamin Franklin in Queen Street, Boston.

Boston Gazette. May 12, 1770. (Account of the Boston "Massacre.")

Jonathan Edwards' Dissertations. Printer, S. Kneeland. 1765.

Hubbard's Indian Wars. Printer, John Boyle. 1775.

New England Weekly Journal. April 8, 1728. Boston. S. Kneeland and T Green. Charter of William and Mary to Province of Massachusetts Bay, and Laws of said Province. Boston S. Kneeland. 1759. folio. pp. 624.

Increase Mather. Sermon on an Execution for Murder. Boston. Richard Pierie. 1687. 12mo.

Cotton Mather. Sermon on a Man about to be Executed for Murder. Boston. Richard Pierie. 1687. 12mo.

Samuel Willard. Mourner's Cordial. Boston. B. Harris and J. Allen. 1691. 12mo.

Samuel Mather. Life of Cotton Mather, with sermons on his death. Boston: for S. Gerrick 1729. 8vo.

22. Specimens of the Early Philadelphia Press.

A German work in 4to. Fragen, etc., von einen Knecht Jesu Christi. 1742. Philadelphia. Gedruckt und zu haben bey B. Franklin.

Mackenzie's Travels. Arctic Regions. 8vo. Philadelphia: for John Morgan. Printer, R. Carr. 1802.

Philadelphia: Claypoole's Daily Advertiser. Feb. 25, 1793.

Philadelphia Gazette and Daily Advertiser. July 12, 1800.

Geographical View of Upper Canada. M. Smith. Philadelphia. J. Bioren for T. and R. Desilver. 1813. 12mo.

New York Morning Post. Nov. 7, 1783. Morton and Horner, printers.

New York Time Piece. Nov. 24, 1797.

New York Herald. April 25, 1807.

M. de Staël. Germany. New York. Eastburn Clark & Co. 1814. 12mo. 2 vols. Printed at Albany by E. and E. Hosford.

Other Papers.

The North Georgia Gazette and Winter Chronicle, complete; put forth in MS. in the Arctic Regions during Capt. Parry's First Voyage towards the North Pole.

Wilkes' North Briton, complete.

The Kentish Post and Canterbury News Letter. Aug. 26-29, 1761.

Evening Mail. London. Monday, Jan. 28, 1793. Printed logographically by J. Walker, Printing House Square.

London Times. Jan. 1, 1788. (*fac-simile.*)

London Times. Jan. 5, 1795.

London Times. Oct. 3, 1798.

Mercurius Domesticus. London. Dec. 19, 1679. (*fac-simile.*)

Edinburgh Advertiser: No. 1174. Year 1774. (Contains Letter of Am. Congress to the People of England.)

Glasgow Advertiser. Vol. for 1789. J. Mennon, printer.

English Mercurie: No. 50. July 23, 1588. London. *fac-simile.*

Weekly Newes: No. 19. Jan. 31, 1606. London. *fac-simile.*

The Gazette: No. 432. Sep. 5, 1658. London. *fac-simile.*

London Courier. Mar.-Dec., 1815.

The Age of Science. Jan. 1, 1977. A Newspaper of the xxth Century, by Merlin Nostradamus.

Wreck of Westminster Abbey. London. C. Stalker. 2001.

English Revolution of 1867. By Lord Macaulay's New Zealander. London. Warne. 3867.

THE CANADIAN JOURNAL.

NEW SERIES.

No. XCVII.—JANUARY, 1878.

YONGE STREET AND DUNDAS STREET.

THE MEN AFTER WHOM THEY WERE NAMED.*

BY HENRY SCADDING, D.D.

When it has happened that a town, city or region has received a name intended to be an enduring memorial of a particular personage, it is natural to suppose that some interest in his history and character will there be felt. In the many places, for example, which have been, or are sure to be, called *Livingstone*, we may expect that hereafter a special acquaintance with the story of the great explorer and missionary will be kept up. But names quickly become familiar and trite on the lips of men; and unless now and then attention be directed to their significance, they soon cease to be much more than mere sounds. The inhabitants of Lorraine probably seldom give much thought to the Lothaire, of whose realm, *Lotharii regnum*, their province is the representative. Few citizens of Bolivia waste time in recalling Bolivar. To the Astorians, Astoria speaks faintly now of John Jacob Astor; and Aspinwall, to its occupants, has by this time lost the personal allusion implied in the word. Ismailïa, on the Upper Nile, may be a momentary exception. That is altogether too fresh a creation. Who Ismail, the living Khedive, is, must be sufficiently well known at present to the people there.

Nevertheless, I suppose, even where the notability commemorated has almost wholly departed out of the public mind, a recurrence to

* Read before the Canadian Institute.

the story really wrapped up in the name of a given place cannot be unwelcome.

Sir Thomas Browne, in his "Urn-burial," says: "To be content that times to come should only know there was such a man, without caring whether they knew more of him, was a frigid ambition in Cardan. For who careth," he asks, "to subsist like Hippocrates' patients, or Achilles' horses in Homer, under naked nominations, without deserts and noble acts, which are the balsam of our memories, the entelechia and soul of our subsistences?"

And even so in respect of local names amongst us, borrowed from worthies of a former day—it may be taken for granted that thoughtful persons will not wish to rest content with "naked nominations;" but, on the contrary, will desire to become familiar with the "entelechia," as Sir Thomas Browne chooses learnedly to express himself—the true motive and "soul of their subsistences."

I accordingly proceed to summon up, so far as I may, the shades of two partially forgotten personages, commemorated and honoured in the style and title of two great thoroughfares familiar to Toronto people and Western Canadians generally—Yonge Street and Dundas Street. I refer to Sir George Yonge and the Right Hon. Henry Dundas, from whom those two well-known main-roads of the Province of Ontario respectively have their appellations.

I am assisted in my attempt to revive the forms of these two men of mark in a former generation, by the possession of an engraved portrait of each of them. That of Sir George Yonge is from a painting by Mather Brown, engraved by E. Scott, "engraver to the Duke of York and Prince Edward." It shows a full, frank, open, English countenance, smoothly shaven, with pleasant intelligent eyes; the mouth rather large, but expressive; the chin double; the hair natural and abundant, but white with powder. The inscription below is: "The Right Honourable Sir George Yonge, Bart., Secretary at War, Knight of the Bath, One of Her Majesty's Most Honourable Privy Council, F.R.S., F.A.S., &c., M.P."

I.—SIR GEORGE YONGE.

Sir George Yonge was the chief representative of an ancient Devonshire family. He was born in 1732, and sat in Parliament for the borough of Honiton from 1754 to 1796. His father, the fourth baronet, Sir William Yonge, sat for the same place before

SIR GEORGE YONGE, Bart. (1732—1812).

After whom Yonge Street, Province of Ontario, was named.

him. Sir George was Secretary at War from 1782 to 1794, when he was succeeded by William Windham. He also held the offices of Vice-Treasurer for Ireland, and Master of the Mint. In 1797 he became Governor and Commander-in-Chief at the Cape of Good Hope, succeeding Lord Macartney there. He died at Hampton Court, September 26, 1812, æt. 80.

In the debates taking place in the House of Commons during the movement in the American Colonies which resulted in their independence, Sir George Yonge took a favourable view of the intentions and wishes of the colonists. Thus, in reply to Lord North, when some resolutions were being adopted on a petition from Nova Scotia setting forth the grievances of that loyal colony, and calling respectfully for a redress of them at the hands of the Imperial Parliament, Sir George Yonge said: "The sentiments of the petitioners were the sentiments of the General Congress: they alike acknowledge the Parliament of Great Britain as the supreme legislature; they alike own it their duty to contribute to the exigencies of the State; and they alike claim the right of giving and granting their own money." He added, "that it was in the power of the Ministry so to frame the bill as to give peace to all America, and he wished that were their inclination." Thus his remarks are summarized in the *Gentleman's Magazine* of December, 1776. As a specimen of Sir George's speeches at a later period, as Secretary at War, I give the summary of one preserved in the same periodical, which will show that he possessed tact and address. It relates to a proposed reduction in the Household Troops in 1787, to effect which, however, a larger sum than usual was to be asked for from the Parliament. The point was to make it clear that the extra charge on the revenue would result in a "saving to the public."

The reporter of the *Gentleman's Magazine* informs us that "The Secretary of War rose and said, that when he presented the army estimates, he had not included in them those of the King's household troops, because, as he had long since informed the House, His Majesty had at that time under consideration a plan of reform in those corps by which a considerable saving might be made to the public. It being impracticable, however, to digest this plan so soon as was expected, the intended reform could not take place till the 24th of June next. It was therefore necessary to vote the pay of all the household troops from Christmas Day last up to Midsummer.

After the latter period, two troops of Life-Guards would be reduced, and replaced by the Grenadier Guards. The pay would be continued to the officers until vacancies happened in other regiments; and to the private gentlemen, all of whom had purchased their situations, it would be but just to make compensation. It was the King's intention," Sir George proceeded to say, "that the two colonels of the troops to be reduced should receive £1,200 each a year for life; but a vacancy having lately happened in a regiment of dragoons by the death of General Carpenter, one of them would be appointed to fill it, and thus £1,200 a year would be saved to the nation; the other Colonel (the Duke of Northumberland), who was far above all pecuniary consideration, and had nothing so much at heart as the good of the service, had nobly requested that the annuity designed for him might make part of the saving that was to arise from the reform. He (Sir George) said that the public would save by the reform, at first, between £11,000 and £12,000 a year; but that when the officers shall be otherwise provided for, or drop off by death, the savings would then amount to £24,000 per annum. Such advantage, however, could not be expected this year; on the contrary, this year's expense would be much greater than that of any which preceded it; but then the cause of its increase would never occur again, particularly as he proposed to move that the sum of £28,000 should be allowed as a compensation to the private gentlemen for their purchase money." Sir George then concluded by moving for the full establishment of 715 men, officers included, of the four troops of Horse and Grenadier Guards up to Midsummer Day, after which one half of their establishment should be reduced; and for the several sums for compensation, which, on the whole, amounted to £79,543 5s. He remarked, before he sat down, that much had recently been said on the subject of patronage; but this reduction was a proof that the extension of patronage was not a favourite object with His Majesty, who proposed it, as it was clear he might have greatly lessened the expenses of the nation, and yet preserved the usual patronage, by reducing the privates and keeping up the establishment of the officers. It is then added: "The sums moved for were voted without debate, and the House was immediately resumed."

The nominally independent action of the King in relation to the Household Troops, and its open allegation by the Secretary, tell of an age when the Stuart ideas of kingly prerogative still, in theory, survived. The Duke of Northumberland spoken of, as intending to forego the compensation about to be provided for the disbanded portion of the Body Guard, was the friend of our Mohawk Chief, Joseph Brant, whose acquaintance the Duke formed while serving as Lord Percy* in the Revolutionary War. An interesting letter from the Duke to Brant, in which the latter is addressed as "My dear Joseph," may be read in Stone's Life of the Chief, ii., 237. The letter is signed, "Your affectionate friend and brother, NORTHUMBERLAND, *Tho-righ-we-gé-ri*" (Mohawk for "The Evergreen Thicket").

I likewise give a specimen of a kind of communication with which, no doubt, Sir George Yonge was familiar in his capacity as Secretary at War. It will be of some special interest to us, as it comes from the hand of Lord Dorchester, at the time Governor-General of Canada, and it is dated at Quebec in 1790. It relates to an application which, it appears, Lord Dorchester had made for a commission for his son in the Guards, which application, it was thought, had been too long overlooked, while in the meantime the young man was rapidly growing, and exceeding the prescribed age for entering the army. Consequently Lord Dorchester asks for a cornetcy, temporarily, in some other regiment. Thus the letter reads (I transcribe from the autograph original): "SIR,—As I apprehend that many importunities have retarded the success of my application, about four years since, for an Ensigncy in the Guards for my eldest son, Guy; and fearing lest the same reasons may still continue, while he is advancing considerably beyond the age judged necessary for entering into the military profession, I am to request you will take a proper opportunity of laying my petition before the King, that He would be graciously pleased (till such time as it may suit His Majesty's convenience and good pleasure to honour him with a commission in His Guards) to give him a Cornetcy in any of His Regiments in Great Britain. I am, Sir, with regard, your most obedient and most humble servant, DORCHESTER. Sir George Yonge, &c., &c., &c."

It may be that the intended reduction in the Household Troops, to which Sir George's speech referred in 1787, had something to do with the apparent neglect of Lord Dorchester's petition. The letter just given is, as I have said, dated in 1790, and the delay had been continuing for nearly four years. Guy, in fact, never obtained even the

* Portraits of Earl Percy may be seen in Andrews' History of the War, i., 289; and Lossing's Fieldbook, ii. 613.

cornetcy. He died in 1793, aged 20. Neither did his next brother, Thomas, who died in the following year at exactly the same age. But Christopher, the third son, born in 1775, was a lieutenant-colonel in the army, and was father of Arthur Henry, the second Baron. A memorial, I believe, of Guy Carleton, first Lord Dorchester, exists in Toronto in the name of one of its streets—Carleton Street.

Besides being a statesman and skilled in the theory of war, Sir George Yonge was what our grandfathers would style an "ingenious" person, a man of letters, and fond of science and archæology. The initials appended to his name under his portrait indicate that he was a Fellow of the Royal Society and of the Society of Antiquaries of London. In volume nine of the *Archæologia*, or Transactions of the Society of Antiquaries of London, I find a letter addressed by him to the secretary of the Society, on the subject of Roman Roads and Camps. Major Hayman Rooke, a Fellow of the Society, had discovered some Roman remains near Mansfield, in the county of Nottingham, and Sir George had suggested the probability of a Roman road or camp somewhere near by. The conjecture turned out to be correct, although before the search which was instituted the existence of such works there had not been suspected. In a letter to Sir George, Hayman Rooke justly observes that "the discovery proves your superior judgment in these matters." Sir George introduces Major Rooke's discoveries to the Society of Antiquaries thus (the document is addressed to the secretary of the Society): "SIR,—I transmit to you, at the request of my respectable and ingenious friend, Major Rooke, of Woodhouse, a small treatise which he has drawn up on some Roman Roads, Tumuli, Stations and Camps, which he has lately traced in the neighbourhood of Mansfield, and which have not hitherto been noticed." I cannot comply with his request that it might be transmitted to the Society, without explaining some particulars which gave rise to this treatise. When I first saw the account which he sent to the Society, of a Roman villa which he had discovered near Mansfield, I communicated to him some few sentiments of mine, on which I grounded an opinion, though I was quite unacquainted with the country, that this villa was probably the residence of some military Roman commander, and that there was probably some Roman camp or station, or some military Roman road, running near it. This did not by any means appear by his answer to be the case. And yet it still seemed to me to be improbable that it should be otherwise.

Having had an opportunity last year of waiting on Major Rooke and viewing this Roman villa, I was first struck with the appearance that Mansfield was probably a Roman station, from whence the villa was not above a mile distant, and indeed was in sight of it; and I thought I saw traces of some Roman roads running near it. On viewing the villa itself (which I found well worth the view), I saw a post still nearer it which had all the appearance of a Roman camp, from its form and other circumstances; but on inquiry from Major Rooke, he assured me there was no such thing there, nor Roman road in the neighbourhood. However, having communicated to him my sentiments grounded on observations which I had occasionally made on Roman roads, stations and camps, from whence I had formed a decided opinion that there was a uniform system of such roads, camps and stations throughout the kingdom, and all connected with each other as *diverticula*, I entreated Major Rooke to look a little more narrowly into this point; and ventured to prophesy that, on searching further into this particular spot, which wore the name of Pleasley Wood, he would not only find *that* to be a Roman station, but would probably from thence be able to trace a connected chain of them through the country. The time and the season not allowing of it *then*, he promised to do so as he had leisure and opportunity; and the result of his labours is contained in the treatise herewith enclosed. I hope I shall be forgiven if I take this opportunity, fortified by this experiment of the truth of my ideas on the subject, humbly to submit it to the Society whether they would not think it advisable to direct some encouragement should be given to an investigation of all the Roman roads, camps and stations throughout the kingdom, county by county, for the purpose of ascertaining the connected military system and principles on which they were formed; which may lead to a curious discovery of the extent and situation of the many Roman towns, camps and villas which must have existed in this country during the period of four hundred years for which Britain was a very distinguished member of the great Roman Empire. Such investigation, gradually but regularly pursued, would neither be expensive nor laborious, there being very little doubt but that there are ingenious persons in every county, who, on such a wish being properly communicated to them by the Society, would readily second those wishes, and, with very little assistance in having plans or drawings made by order of the Society, where the accounts transmitted might appear to justify it, produce in time a very complete account and system of these military Roman remains, as well as of other *municipia*, and perhaps *baths* and other vestiges of Roman magnificence. I beg pardon for the liberty I have taken of suggesting thus much, and for detaining you so long upon this subject; but I thought the explanation necessary to elucidate the occasion of the treatise transmitted from Major Rooke, and I also thought the subject not unworthy of the attention of the Society. It will give both Major Rooke and me great pleasure if they should be of the same opinion, or if they should think what has been offered in any degree deserving their notice. I am, with regard, Sir, your most obedient and humble servant, GEO. YONGE."

This communication to the Society of Antiquaries is dated "Stratford Place, May 7, 1788." After reading it, we can readily understand why the first organizer and Governor of Upper Canada, General Simcoe, should have attached the name of Sir George Yonge to the great military road cast up and hewn out by him, in 1793, through the primitive woods from Lake Ontario to Lake Huron. It was not simply as a compliment to the Secretary at War of the day, but it was also something to give special gratification to a Fellow of the Society of Antiquaries who had made himself, by his observation and research, an authority on Roman roads. The application, too, of the term "Street" to the two great original highways opened up within the new province, and intersecting each other at right angles in the heart of its capital town, is thus explained. It was to follow the example of the old Roman colonizers, who wisely made it an essential part of their system to establish at once, throughout the length and breadth of each region occupied, a public way, well constructed, and usually paved with blocks of stone—hence called a *via strata*—vernacularized into *Street* by our Saxon forefathers. Thus we have Watling Street, a Roman road leading from Richborough to Canterbury and London; Ickneild Street, a Roman road leading from Tynemouth through York, Derby, and Birmingham to St. David's; Ermin Street, leading from Southampton, also to St. David's. Whilst Ardwick-le-Street in Yorkshire, Chester-le-Street in Durham, Stretton, Stratton, Streatham, and several places called Stretford and Stratford, all imply that they were each of them situated on the line of some old Roman street or road.

I observe among the "Traditions and Recollections" of Polwhele, the historian of Cornwall, a reference to the literary tastes of Sir George Yonge. Polwhele had communicated to him, for his judgment, a certain composition, intended apparently to compete for some distinction at the University of Oxford. Sir George replies as follows: "I very much like your poetical ideas, and think they will do for Oxford very well. The ode might be spoken (Sir George suggests) by a bard from the top of the Promontory of Hercules," [*i.e.*, Hartland Point, North Devon, jutting out into the Bristol Channel.] And in another place in the same work of Polwhele's we meet with an allusion to Sir George Yonge as an encourager of the author in his labours in relation to the History of Cornwall, notwithstanding the adverse criticism of a few. Thus:

"Though Acland, scowling midst his scatter'd plans,
May spots innumerous in my book espy;
Though Incledon each fact severely scans,
In pedigrees, perhaps, more sage than I;
Yet whilst a Downman wishes to peruse
(His mind the seat of candour!) all I write;
Whilst YONGE still prompts me to enlarge my views,
And bids me soar with no ignoble flight;
Whilst Whitaker approves my various scheme,
And wakes my ardour in each bold essay;
With friendly light illumining the theme
Of Roman relics sunk in dim decay;
Shall not the Spirit of Research proceed,
And, spurning Envy, grasp the historic meed?"

(Downman was a literary contemporary of note, a clerical M.D. Whitaker was the Rev. John Whitaker, author of the History of Manchester, of the Life of St. Neot, the eldest brother of King Alfred, and other works.)

Sir George Yonge died, as I have already mentioned, in 1812. Sir W. Courthope observes, in his "Synopsis of the Extinct Baronetage of England," that he died *sine prole*, so that the baronetcy became extinct, after existing since 1661, the time of the Restoration. It is to be regretted that we have to state that towards the close of his life Sir George became involved in difficulties from having invested largely in wool-mills, in the neighbourhood of Honiton, the borough which he, as his father before him, had represented in Parliament for many years. And Mr. George Roberts, of Lyme Regis, in his

"Introduction to the Diary of Walter Yonge, Esq.," published in 1848 by the Camden Society, says of Sir George that he was once heard to say that he began life with £80,000 of family property, that he received £80,000 with his wife, and that he had been paid £80,000 by the Government for his public services, but that Honiton had swallowed it all. All had been sunk in the "wool-mills" at or near Honiton. (The Walter Yonge just mentioned was an ancestor of Sir George's, who likewise represented the Borough of Honiton in Parliament.) Sir George Yonge was buried at Colyton in Devon, where his coffin-plate is preserved. But it appears that no tablet to his memory has been erected. Doubtless a great error of judgment was committed when Sir George ventured to meddle with "wool-mills;" ventured to engage in speculations connected with the manufacture by machinery of serges and broad-cloths. Actuated, it may be, by public spirit in entering on such undertakings, and also by a desire, perhaps, to become rapidly rich, yet wholly without practical experience in the conduct of such enterprises, he became, it is likely, the dupe of sharpers. The broad pleasant acres of Devon, to which he and his fathers had been wont to trust for comfortable revenue, slipped away out of his hands, and like Antæus when lifted off from the earth, the country gentleman, uprooted from the land, soon found his power and influence gone. Although many bearing his family name, more or less nearly connected with him by blood, have since become distinguished in the world of letters and scholarship, we do not, after him, observe any one of his name going up to the House of Commons from Devon, and serving the State as Minister of the Crown.

Besides Yonge Street, we have in Ontario another memorial of Sir George Yonge, in the name of the township of Puslinch, in the county of Wellington, that being the name of a well-known family seat of the Yonges near Yealmton, in Devonshire; for although the subdivision of the wide-spread sept of the Yonges to which Sir George Yonge belonged, was known strictly as the Yonges of Colyton, yet it is to be observed that Burke, in his *Landed Gentry*, gives his notice of the Yonges of Colyton under the more comprehensive head of the Yonges of PUSLINCH.

I now proceed with my memoir of the other personage whose life and career I desire to recall, viz., Henry Dundas.

HENRY DUNDAS, FIRST VISCOUNT MELVILLE. (1740—1811).

AFTER WHOM DUNDAS STREET, PROVINCE OF ONTARIO, WAS NAMED.

II.—HENRY DUNDAS, FIRST VISCOUNT MELVILLE.

The engraved portrait which I have of the Right Hon. Henry Dundas, is from a painting by the distinguished Scottish artist, Sir Henry Raeburn, R.A. It represents him in his ermined robes as a member of the House of Peers; for our Henry Dundas became finally a Viscount—Viscount Melville. He is standing at a table and speaking. His left hand rests lightly on papers before him. His right arm is sharply bent. The hand, planted on the hip, rather awkwardly draws back a portion of the robe, displaying its interior silken lining. He wears a curled and powdered wig of the time of George III. The oval, smooth-shaven countenance is not very remarkable; but some dignity is thrown into it by Raeburn's art, which, nevertheless, has failed to divest it of an expression of self-consciousness. The brows are slightly knitted; the eyes look out over the head of the spectator, and the lips are compressed. The nose is good. Below is a *fac simile* autograph signature, "MELVILLE."

Henry Dundas was, as it were, an hereditary Scottish juris-consult. His father and grandfather had been judges of the Scottish bench. His father was Lord President of the Court of Session, sitting by the title of Lord Arniston. His brother Robert also held the same high legal office, and assumed the same title, which was derived from an estate named Arniston. The Dundasses of Arniston were descended from George Dundas of Dundas, sixteenth in descent from the Dunbars, Earls of March. Henry Dundas was bred to the bar, and became a member of the faculty of advocates in 1763. Though of high Scottish rank, the family fortune by no means rendered him affluent. It is said "that when the young Henry established himself in his chambers in the Fleshmarket Close, in Edinburgh, he had, after paying his fees and other expenses connected with admission to the bar, exactly £60 remaining in his purse as capital, so far as cash was concerned, wherewith to make a start in the world. But his solid and well-trained abilities stood him in excellent stead. They soon began to tell. He was appointed successively assessor of the magistrates of Edinburgh, depute-advocate, *i.e.* deputy to the Lord Advocate of Scotland, for public prosecutions, and Solicitor-General for Scotland. Boswell, in his Life of Johnson, thus speaks of the pleading of Dundas in the case of Joseph Knight, a negro slave from the West Indies, who claimed his freedom in Scotland: "I cannot too highly praise the speech which Mr. Henry Dundas contributed to the cause of the sooty stranger. On this occasion he impressed me, and I believe all his audience, with such feelings as were produced by some of the most eminent orators of antiquity." Boswell, quite gratuitously, indulges in a reference to the accent of his fellow-countryman. "Mr. Dundas's Scottish accent, which," he observes, "has been so often in vain obtruded as an objection to his powerful abilities in Parliament, was no disadvantage to him in his own country." And again, in another place, Boswell goes out of his way to allude in coarser terms to the same quite natural accident of Dundas's oratory. The truth was, Boswell had been trying to school his own tongue in southern ways, and piqued himself on his supposed superior success in that regard. "A small intermixture," he says, "of provincial peculiarities may, perhaps, have an agreeable effect, as the notes of different birds concur in the harmony of the grove, and please more than if they were all exactly alike. I could name some gentlemen of Ireland," he continues, "to whom a slight proportion of the accent and recitative of that country is an advantage. The same observation will apply to the gentlemen of Scotland. I do not mean," he then adds, "that we should speak as broad as a certain prosperous member of Parliament from that country; though it has been well observed that it has been of no small use to him, as it rouses the attention of the House by its uncommonness, and is equal to tropes and figures in a good English speaker."

The "prosperous member of Parliament" was Dundas, who was returned member for Edinburgh in 1774. He at once took a leading part in the proceedings of the House. "As a public speaker," we are told, "he was clear, acute and argumentative, with the manner of one thoroughly master of his subject, and desirous to convince the understanding without the aid of the ornamental parts of oratory, which he seemed in some sort to despise." He supported the administration of Lord North, and voted for the prosecution of the war against the American colonies. In 1775 he was appointed Lord Advocate for Scotland and Keeper of the King's Signet for Scotland. The Lord Advocate of Scotland, we should observe by the way, holds the highest political office in Scotland, and he is always expected to have a seat in Parliament, where he discharges something resembling the duties of Secretary of State for that quarter of the kingdom. In those days, all the patronage of the crown in Scotland was in his hands.

Lord Cockburn, in the "Memorials of His Times," writing from the Whig point of view, speaks of Dundas as absolute Dictator of Scotland, as Proconsul, as Harry the Ninth. "The suppression of independent talent and of ambition," he says, "was the tendency of the times. Every Tory principle being absorbed in the horror of innovation, and that party casting all its cares upon Henry Dundas, no one could, without renouncing all his hopes, commit the treason of dreaming an independent thought. There was little genuine attraction for real talent, knowledge or eloquence on that side, because these qualities can seldom exist in combination with abject submission. And indeed," he then candidly adds, "there was not much attraction for them among the senior and dominant Whigs, among whom there was a corresponding loyalty to the Earl of Lauderdale." And again, Lord Cockburn writes: "In addition to all the ordinary sources of government influence, Henry Dundas, an Edinburgh man, and well calculated by talent and manners to make despotism popular, was the absolute dictator of Scotland, and had the means of rewarding submission, and of suppressing opposition, beyond what was ever exercised in modern times by one person in any portion of the empire." "A country gentleman," he says, "with any public principle except devotion to Henry Dundas, was viewed as a wonder, or rather as a monster. This was the creed also of all our merchants, all our removable office holders, and all our public corporations."

When Lord North's administration at length fell, and that of Lord Rockingham came into power, Henry Dundas still retained the office of Lord Advocate of Scotland; and when Lord Rockingham died, and Lord Shelburne succeeded, he was appointed Secretary of the Navy; but on the formation of the Coalition Ministry very soon after, he resigned, and became Pitt's right-hand man in the Opposition. Lord North, the head of the Coalition, resigned on the rejection of his India Bill by the Lords; when Pitt became premier, with Dundas as Treasurer of the Navy. Dundas materially assisted Pitt in the elaboration of the new India Bill, which passed, and under the arrangements of which he became President of the Board of Control; and he fully believed, as he expressed himself to the House, that the new measure would be a means of prodigiously lightening, if it did not finally extinguish, the national debt, so large would be the surplus revenue accruing in future from India.

As Treasurer of the Navy, Dundas was the originator of many beneficial reforms in the navy. For several special benefits accruing from his enactments to the common sailors, he was long spoken of amongst them as "the sailors' friend."

By a kind of irony of events, a regulation introduced by him in the Navy Department was made use of, at a subsequent date, to set up a series of charges against himself. The salary of the Treasurer of the Navy had hitherto been £2,000; but perquisites and the command of the public money set apart for navy purposes, added greatly to the emoluments. To prevent the risk, profusion and irregularity inseparable from such a system, Dundas' bill fixed the salary at £4,000, and prohibited the treasurer from making any private or individual use of the public money. How this salutary provision was brought to bear against himself by his political opponents at a subsequent period, will be presently seen. Dundas became also, under Pitt, Secretary of the Home Department and Secretary at War. He was likewise sworn of the Privy Council. As Secretary of the Home Department, in view of the expected invasion from France, he promoted the formation of the fencible regiments, the supplementary militia, the volunteer corps, and the provisional cavalry. Due to him was the whole of that domestic force which, during the war consequent on the French Revolution, was raised and kept in readiness, as a defence at once against foreign invasion and internal disturbance.

I am enabled to give a specimen-dispatch of Mr. Dundas's, as Secretary at War, transcribing from the original, wholly in his own handwriting. It is addressed to the Governor of the Island of Jersey, General Hall, during the troublous times of the Revolution in France. The island, it seems, had been made a convenience of by the French Royalists and by some scoundrels engaged in the manufacture and circulation of forged assignats—French paper currency of the day. The Secretary at War thus addresses General Hall on the subject, leaving us under the impression that due vigilance had not been used by the Governor, who, it appears, is about to be relieved. It is dated "Horse Guards, 26th October, 1794," and marked "secret:"

"SIR,—Some unpleasant occurrences which have lately happened on that part of the coast of Brittany on which persons sent from Jersey have been landed, with a view of establishing a communication with the Royalists in the interior of France, render it absolutely necessary that you should not permit or authorize any person whatever to embark from Jersey with a design of proceeding to France, and particularly to that part of the coast which I have described, unless you shall hereafter receive from me directions contrary to those of this dispatch, to which, in the present state of affairs, I must request you will pay immediate and particular attention. One reason in particular which induces me to urge this precaution is that I have reason to believe an intercourse has lately been established between Jersey and the coast for the sale and distribution of forged assignats. The parties concerned in this speculation will of course make every exertion to prevent its failure, and it will therefore be necessary that any person supposed to have taken a share in it should be carefully watched, and it is of the greatest importance, particularly at the present moment, that no communication should be permitted with the coast, except by the boats which Capt. D'Auvergne may think proper to detach with such persons as he may select for the service, which requires the greatest secrecy and caution. It is principally with a view of securing these points—absolutely necessary in a communication of this nature—that I have entrusted the management of it to Capt. D'Auvergne exclusively, who, by his situation on board a ship, can execute my directions without incurring any risk of their being divulged, which, whatever precaution may be taken, they would frequently be if the same measures were carried on from the Island. I understand that you have received permission to return to England as soon as you can be relieved in the command of His Majesty's Forces in Jersey. In the meantime, I rely with the fullest confidence in your zeal and attention in the discharge of this important trust, and I can assure you that you will find Capt. D'Auvergne ready to concert with you, whatever measures may be thought most expedient for the safety and defence of the Island, inasmuch as it depends on the naval force under his command. I am, Sir, your obedient humble servant, HENRY DUNDAS. Major-General Hall, &c."

In the debates on the Bill for the division of the Province of Quebec into Upper and Lower Canada, Mr. Dundas's name appears several times; and in the Simcoe correspondence preserved at Ottawa are several official communications addressed to and received from him. I transcribe a sentence or two from those in which the project of a street or military road is spoken of, viz., that to which by way of compliment the Governor attached the name of Dundas. In 1793, he writes: "I have directed the surveyor early in the next spring to ascertain the precise distance of the several routes which I have done myself the honour of detailing to you, and hope to complete the military street or road the ensuing autumn." And in 1794, he reports: "Dundas Street, the road proposed from Burlington Bay to the River Thames, half of which is completed, will connect by an internal communication the Detroit and the settlements at Niagara. It is intended to be extended northerly to York by the troops, and in process of time by the respective settlers to Kingston and Montreal."

At the present time, I believe, the practice has become somewhat obsolete of applying the name *Dundas Street* to the whole of the long highway originally so called, extending from Detroit to the Point au Baudet. A portion of it immediately west of Toronto, may be spoken of as the Dundas road; and the prevalent impression may be that the name denotes simply the route which leads to the town of Dundas. But this, of course, would be quite a mistaken idea to adopt. On the old manuscript maps, contemporary with the first organization of the country, long before the town of Dundas existed, the route from the Western to the Eastern limit of Upper Canada was marked *Dundas Street* throughout its whole length. And thus we have it still laid down in the excellent and interesting map of Canada given in the handsome, large General Atlas published in Edinburgh, by John Thomson, in 1817, constructed from authentic sources, and dedicated to Alexander Keith, of Dunottar and Ravelston. And at the end of the first Gazetteer of Upper Canada, published in London in 1799, we have the following postscript which, while serving to shew that the whole of the highway from the west to the east was denominated *Dundas Street,* will also help us to realize the stern conditions in respect of means of inter-communication and locomotion under which our patient fathers first began to shape out and mould for us the pleasant rural scenes, the amenities and comforts of civilized life, everywhere now to be beheld and enjoyed amongst us. This postscript, dated 1799, reads thus: "Since the foregoing notes have come from the press, the editor is informed that the Dundas Street has been considerably improved between the head of Lake Ontario and York; and that the Government has contracted for the opening of it from that city to the head of the Bay of Quinté, a distance of 120 miles, as well as for causewaying of the swamps and erecting the necessary bridges, so that it is hoped, in a short time, there will be a tolerable road from Quebec to the capital of the Upper Province." It may excite a smile to find York styled a "city" in 1799: but the terms of the passage shew, as I have said, that the whole of the highway from the west to the east, passing through York, was regarded as Dundas Street. *That*, in fact, was the name long borne by our present Queen Street here in Toronto; and Queen Street, as everyone knows, is in a right line with the "Kingston road," which was, as we see, simply the prolongation of Dundas Street, the great provincial highway, or Grand Trunk, as it were, of the day, leading to Montreal and Quebec. It is scarcely necessary to observe that the distinction and celebrity of both Dundas Street and Yonge Street, taken in the original extended meaning of their names, have been eclipsed in these days by the greater glory and the greater convenience of the Grand Trunk, Great Western, and Northern Railways of Canada. Highways, like men, have their vicissitudes.

Hinc, apicem, rapax
Fortuna, cum stridore acuto,
Sustulit; hic possuisse gaudet.

Travel and traffic having been in this way largely turned aside from our two primitive historic "streets," they have both of them dropped, in some measure, out of the knowledge of tourists, and even out of the knowledge of many among the younger portion of our settled inhabitants.

Besides Dundas Street, another permanent memorial of Henry Dundas was established in Canada, in the name of a county toward the eastern limit of the present Province of Ontario. The County of Dundas is united with the Counties of Stormont and Glengarry, with the well-known borough of Cornwall for county-town conjointly.*

But to return:—In 1801 Pitt resigned the premiership, not being able to induce the King to assent to the enfranchisement of the Roman Catholics, a measure which had been virtually promised when the legislative union of Ireland and Great Britain was effected. Dundas retired with him, but was raised to the peerage in the following year, by the Addington Ministry, as Viscount Melville, of Melville Castle, in the County of Edinburgh, and Baron Dunira, of

* For this portion of Canada a local historian has happily appeared. Mr. James Croil, of Archerfield, in 1861, published at Montreal an elaborate and interesting volume of 350 pages, bearing the following title: "Dundas, or a Sketch of Canadian History, and more particularly of the County of Dundas, one of the earliest settled counties in Upper Canada." It is dedicated to "the descendants of the United Empire Loyalists residing in the United Counties of Stormont, Dundas and Glengarry, formerly the Old Eastern District."

Dunira, in the County of Perth. In these titles the name of "Dundas," in which we are chiefly concerned, henceforward merges and is lost. On his elevation to the peerage, the Lord Provost and Town Council of Edinburgh presented him with an address, in which they expressed their attachment to him and his family, their admiration of his talents, and their gratitude for the many services he had rendered to the country, and in particular to the City of Edinburgh. The new lord appeared in person before the Council and delivered a speech in reply, in which, among other topics, he dwelt on the practical blessings of the British Constitution, of which his own career, he said, afforded a striking example. "While we therefore continue to resist the fanatic principles of ideal equality, incompatible with the government of the world and the just order of human society, let us, he exhorted his hearers, rejoice in those substantial blessings, the results of real freedom and equal laws, which open to the fair ambition of every British subject the means of pursuing with success those objects of honour, and those situations of power—the attainment of which, in other countries, rests solely upon a partial participation of personal favour, and the enjoyment of which rests upon the precarious tenure of arbitrary power." While the civic authorities of Edinburgh, in the presence of Viscount Melville, are yet before our mind's eye, it will perhaps be of some interest to hear what Lord Cockburn, a contemporary, says of them, and their place of meeting, in the "Memorials of His Times." We must of course make allowance for the Whiggish bias of his pen. "In this Pandemonium," he says [namely, in what he had just before described as "a low, dark, blackguard-looking room, entering from a covered passage which connected the north-west corner of the Parliament Square with the Lawnmarket"], "sat the Town Council of Edinburgh, omnipotent, corrupt, impenetrable. Nothing was beyond its grasp; no variety of opinion disturbed its unanimity, for the pleasure of Dundas was the sole rule for every one of them. Reporters, the fruit of free discussion, did not exist; and though they had existed, would not have dared to disclose the proceedings. Silent, powerful, submissive, mysterious and irresponsible, they might have been sitting in Venice. Certain of the support of the Proconsul, whom they no more thought of thwarting than of thwarting Providence, timidity was not one of their vices." A curious picture, surely; of which, let us be thankful, no exact counterpart can be found in any city or town in the Empire at the present day.

In 1804, when, on the resignation of the Addington Ministry, Pitt returned to power, Viscount Melville became First Lord of the Admiralty; and now it was that the tide of his good fortune began to ebb. He was, all of a sudden, called to account by the House of Commons for certain malpractices indulged in some twenty years previously by one Alexander Trotter, the Paymaster of the Navy when Melville was Treasurer of the Navy in 1786. The charge came up indirectly in connection with another inquiry, and the occasion was greedily seized by the Whig Opposition as one that might perhaps bring on the downfall of Pitt's administration. On the motion of Mr. Whitbread, a resolution was carried, only, however, by the casting vote of the Speaker, in a house of 433, asserting that "large sums of money had been, under pretence of naval services, drawn from the bank by Alexander Trotter, Paymaster of the Navy, and by him invested in exchequer and navy bills, lent upon the security of stock, employed in discounting private bills, and used in various ways for the purposes of private emolument; and that in so doing he acted with the knowledge and consent of Lord Melville, to whom he was at the same time private agent; and therefore that Lord Melville has been guilty of gross violation of the law, and a high breach of duty." Before the resolution was put, Pitt and Canning had both spoken eloquently and powerfully in defence of their colleague. On the day after the condemnatory vote, Pitt announced to the House that Lord Melville had resigned his office of First Lord of the Admiralty; and three weeks later Pitt intimated that, in deference to the prevailing sense of the House, the King had been advised by his ministers to erase Lord Melville's name from the list of Privy Councillors, and that accordingly it would be done. Four weeks later, Melville asked to be heard before the House of Commons, where he appeared in person, and offered reasonable explanation of his conduct as Treasurer of the Navy twenty years before. The Opposition was implacable, however, and, at the instigation of Whitbread, a vote was carried to institute formal impeachment; and in due time, Westminster Hall witnessed a scene somewhat similar to that which had been enacted within about twenty years before, at the trial of the other great Proconsul, Warren Hastings.

The process lasted from April 29 to June 12 (1806), when the accused peer was acquitted of malversation personally, but judged guilty of negligence of duty in respect of his agent. There can be no question but that Melville's alleged offence was greatly magnified by political rancour and sectional prejudice, and that every nerve was strained by the party out of power at the time to make it appear that he had clearly transgressed the law of purity imposed by himself on the Navy Department in 1785. "The charges against Lord Melville were groundless," Lord Cockburn says in his "Memorials," "and were at last reduced to insignificancy. To those who knew the pecuniary indifference of the man, and who think of the comparative facility of peculation in those irregular days, the mere smallness of the sums which he was said to have improperly touched, is of itself almost sufficient evidence of his innocence. If he had been disposed to peculate, it would not have been for farthings."

Lord Cockburn then goes on to remark on the benefits which accrued, especially in Scotland, to the Whigs, by the impeachment, notwithstanding its failure. "It did more," he says, "to emancipate Scotland than even the exclusion of Melville's party from power. His political omnipotence, which without any illiberality on his part, implied, at that time, the suppression of all opposition, had lasted so long and so steadily, that in despair the discontented concurred in the general impression that, happen what might, Harry the Ninth would always be uppermost. When he was not only deprived of power, but subjected to trial, people could scarcely believe their senses. The triumphant anticipations of his enemies, many of whom exulted with premature and disgusting joy over the ruin of the man, were as absurd as the rage of his friends, who railed, with vain malignity, at his accusers and the Constitution. Between the two, the progress of independence was materially advanced. A blow had been struck which, notwithstanding his acquittal, relaxed our local fetters. Our little great men felt the precariousness of their power; and even the mildest friends of improvement—those who, though opposed to him, deplored the fall of a distinguished countryman more than they valued any political benefit involved in his misfortune, were relieved by seeing that the mainspring of the Scotch pro-consular system was weakened."

A satirical poem of the day which I possess, entitled, "All the Talents," by Polypus, expresses the Tory feeling in regard to Melville and his chief accuser, Whitbread. It thus speaks:

"Could Whitbread catch a spark of Windham s fire,
To deeds more dang'rous Whitbread might aspire;
But as it stands, our brewer has not νοῦς
To lead the mob or to mislead the House.

See how the happy soul himself admires!
A hazy vapour thro' his head expires;
His curls ambrosial, hop and poppy shade,
Fit emblems of his talent and his trade.
Slow yet not cautious; cunning yet not wise;
We hate him first, then pity, then despise.
* * * * * *
Puft with the Pride that loves her name in print,
And knock-kneed Vanity with inward squint.
Laborious, heavy, slow to catch a cause,
Bills at long sight upon his wits he draws,
And with a solemn smartness in his mien,
Lights up his eyes and offers to look keen.
But oh! how dullness fell on all his face,
When he saw Melville rescued from disgrace!
Not more agape the stupid audience stared,
When Kemble spoke of *Aitches* and a *Baird*.
Cold from his cheek the crimson courage fled;
With jaw ajar, he looked as he were dead,
As from the anatomist he just had run,
Or was bound 'prentice to a skeleton.
Then, seeing thro' the matter in a minute,
Wished to high Heav'n he ne'er had meddled in it.
Rough as his porter, bitter as his barm,
He sacrificed his fame to Melville's harm,
And gave more deep disgust, than if his vat
Had curst our vision with a swimming rat.

The same satirist thus comments on the fact, that before proceeding to the impeachment in Westminster Hall, Melville's accusers had succeeded in having him pronounced guilty of the charges, and unworthy of being on the roll of the Privy Council:

"Justice, turned scholar, changed her vulgar plan,
And, just like Hebrew, from the end began;
First found the culprit guilty, tried him *next*,
And from *Amen* preached backwards to the text.
So crabs advance by retrograde degrees,
And salmon drift, tail foremost, to the seas!
To vex the Scotchman answered every end:
Unhappy in his servant and his friend."

"To vex the Scotchman answered every end:" this line glances at a narrow and unworthy anti-Scottish prejudice which had been prevalent, more or less in England, ever since the days of the Scottish favourite, Lord Bute. A caricature of the day, by Sayer, represents a figure, made up of barrels and tubs, aiming a flail at a large thistle.

The thistle, of course, is Melville, and the figure, Whitbread, who, as we have had already intimated to us, was a brewer, a wealthy London brewer. Underneath are the following lines, to understand which we must be informed that Sansterre, the commandant of the National Guard who had presided at the recent execution of Louis XVI. in Paris, happened also to be a brewer. "Sansterre," we are told—

> "Sansterre forsook his malt and grains,
> To mash and batter nobles' brains,
> By levelling rancour led:
> Our Brewer quits brown stout and washy,
> His malt, his mash-tub, and his quashea,
> To mash a Thistle's head."

In Lockhart's Life of Scott is given a song, written by Sir Walter on the occasion of Lord Melville's acquittal. It was sung with great applause at a public dinner in Edinburgh, by Mr. James Ballantyne. Scott regarded the impeachment of his friend as a mere act of vindictiveness on the part of the Whigs. Of the eight stanzas of which this production consists, I quote one, wherein Pitt and Melville are named together, and an allusion occurs to the recent death of Pitt, who, it must be added, did not long survive the trouble which had befallen his faithful supporter, Melville. In fact, he died before the trial in Westminster Hall came on. The name Despard, which occurs near the close of the stanza, is that of an ex-Lieutenant-Colonel Despard, who endeavoured to create sedition among the soldiers and others in England in 1803. And the Arthur O'Connor mentioned just before, was a coadjutor of Lord Edward Fitz-Gerald, Napper Tandy, Addis Emmet, and other conspirators in Ireland, known as the United Irishmen, whose aim was to make Ireland a Republic like France in 1793. The word "reform," it should be observed, is used in an invidious sense. Thus the stanza reads:

> "What were the Whigs doing, when, boldly pursuing,
> PITT banished Rebellion, gave Treason a string?
> Why they swore on their honour, for ARTHUR O'CONNOR,
> And fought hard for DESPARD against country and king.
> Well then we knew, boys,
> PITT and MELVILLE were true boys,
> And the tempest was raised by the sons of Reform.
> Ah, woe!
> Weep to his memory;
> Low lies the pilot that weathered the storm."

"The Pilot that weathered the storm" is the echo of a phrase of Canning's, used by him as the title of some verses on Pitt, written in 1802.

Lockhart does not applaud the animus of Scott's song; and Sir Walter himself subsequently allowed the unwisdom of much of it.

In this song, too, occurred the expression—"Tally-ho! to the Fox!" which was interpreted by some to be an allusion to Fox, the great Whig rival of Pitt, who was known at the time to be prostrated by sickness—sickness likely to prove mortal, and which did prove mortal on the 6th of the following September. "If," says Lord Cockburn, "Scott really intended this as a shout of triumph over the expiring orator, it was an indecency which no fair license of party-zeal can palliate. But I am inclined to believe," Lord Cockburn continues, "that nothing was meant beyond one of the jocular and not unnatural exultations over the defeated leaders of the impeachment, of which the song is composed. There were some important persons, however," it is added, "whose good opinion, by this indiscretion, was lost to Scott forever."

On the death of Pitt, the coalition-ministry, known as "All the Talents," was formed, consisting of Grenville, Fox, Lord Howick, Erskine; which was speedily followed by the Duke of Portland's ministry, comprising Canning, Castlereagh, Percival, Lord Eldon. Melville's name was replaced on the list of the Privy Council; and it was suspected by some that this was preparatory to acceptance of office. We have the Whig feeling on this point expressed in some stanzas which I quote from a satire, styled Melville's Mantle, put forth in reply to Canning's Elijah's Mantle, a piece in which Elijah rather strangely adumbrates the lately deceased Pitt:

"When by th' Almighty's dread command
Old Bute had left this injured land,
He long had set in flame,
His mantle crafty Jenky caught—
Dundas, with equal spirit fraught,
The Tories' hope became.

In these were qualities combined
Just suited to the royal mind—
The supple spirits here:
What sad reverse! that spirit reft,
No confidence, no hope was left—
The Whigs impeached the Peer!

Is there (since gone is that great band
Who ruled with Freedom's liberal hand)
'Mong those who power resume,
One on whom public faith can rest—
One fit to wear a Chatham's vest
And cheer a nation's gloom?

Melville! to aid thy batter'd fame,
Thy monarch's secret favour claim,
His pulse at Windsor feel!
A Privy Councillor you soar;
God grant you may be nothing more,
Or, farewell public weal!

* * * * *

Young Jenky, you've no cause to mourn
Tho' Whigs your servile conduct scorn,
Your Cinque Ports cannot fail:
You thank your stars that Pitt's a corse,
Nor care, tho' patriots till they're hoarse
At you and Melville rail."

Some appended notes explain that the "Crafty Jenky," of the first stanza, meant Sir Charles Jenkinson, the first Lord Liverpool, "Lord Bute's scrub," as the annotator speaks; whilst the "Young Jenky" of the last stanza is his son, who, on the death of Pitt, became his successor as Warden of the Cinque Ports, thus following his father in the road of place and preferment—"plus passibus æquis," the annotator observes. Another title of the Earls of Liverpool was Baron Hawkesbury; whence our Hawkesbury on the Ottawa.

But after the death of Pitt, Melville was little inclined to enter again on public life. He henceforward remained chiefly in retirement, taking part only occasionally in the debates of the House of Lords.

Lockhart informs us that Lord Melville, after his fall, used to be a constant visitor at Sir Walter's house, in Castle Street, in Edinburgh, and that "the old statesman entered with such simple-heartedness into all the ways of the happy circle, that it came to be an established rule for the children *to sit up to supper* whenever Lord Melville dined there." "In private life," we are told by Robert Chambers, "his manner was winning, agreeable and friendly, with great frankness and ease. He was convivial in his habits, and, in the intercourse of private life, he never permitted party distinctions to interfere with the cordiality and kindness of his disposition; hence it has been truly said," Robert Chambers remarks, "that Whig and Tory agreed in loving him; and that he was always happy to oblige those in common with whom he had any recollections of good-humoured festivity."

I have said that the tide of Lord Melville's good fortune began to ebb when he received the appointment of First Lord of the Admiralty, in 1804. But previous to that date, his bed had not always been one of roses. "Uneasy lies the head that wears a crown;" and the sovereign's lot in this respect is often shared by his servant, the statesman. To this effect we have in Sir John Sinclair's Memoirs a remark of Lord Melville's noted. Sir John had waited on him on the new year's morn of 1796, to wish him a happy new year. Melville's reply was: "I hope this year will be happier than the last; for I can scarcely recollect spending one happy day in the whole of it." This confession, coming from one whose whole life had hitherto been a series of triumphs, and who appeared to stand secure on the pinnacle of political ambition, Sir John Sinclair used often to dwell upon as exemplifying the vanity of human wishes.

Lord Melville's death was a sudden one. He had come into Edinburgh from his country residence, to attend the funeral of President Blair, an old friend, when a fit of apoplexy seized him. He had retired to rest in his usual health, but was found dead in his bed next morning. These two early-attached, illustrious friends were thus lying, both suddenly dead, with but a wall between them. Their houses on the north-east side of George Square, Edinburgh, were next each other.

That Lord Melville's end was quite unexpected by himself at the moment, is shewn by a curious circumstance. A letter was discovered lying on the writing table in the room where he was found dead, containing, by anticipation, an account of his emotions at the funeral of President Blair. It was addressed, ready to be sent off, to a member of the Government, with a view to obtain some public provision for Blair's family; and the writer had not reckoned on the possibility of his own demise before his friend's funeral took place. "Such things are always awkward when detected," Lord Cockburn observes, "especially when done by a skilful politician. Nevertheless, an honest and true man might do this," Lord Cockburn observes; "it is easy to anticipate one's feelings at a friend's burial, and putting the description into the form of having returned from it, is mere rhetoric."

Sir Walter Scott speaks with great feeling of the decease of Lord Melville. Thus he writes in a letter to Mr. Morritt: "Poor dear

Lord Melville! ''Tis vain to name him whom we mourn in vain!' Almost the last time I saw him he was talking of you in the highest terms of regard, and expressing great hopes of again seeing you at Dunira this summer, where I proposed to attend you. 'Hei mihi! Quid *hei mihi?* Humana perpessi sumus!' His loss will be long and severely felt here; and envy is already paying her cold tribute of applause to the worth which it maligned while it walked upon earth."

Lord Melville was buried without pomp at Lasswade, near Edinburgh, in which parish Melville Castle is situated.

Deriving from his parents a solid understanding and a sound constitution, he, as we have seen, learned early, as is the custom of Scotland, to put them both to their proper use. Starting, as narrated, with little other capital but these endowments and this training, he laid the foundation of his house with wisdom, and the superstructure upreared thereupon by him has accordingly endured. The title of Lord Melville, of which he was the originator, has come down with distinction to the present time; and his family, immediate and collateral, continues to send forth from time to time men able and willing to do good service, civil and military, to the commonwealth. A column and a statue preserve the memory of the first Lord Melville in Edinburgh. The former, begun during his lifetime, stands in St. Andrew's Square. Its proportions are those of the column of Trajan, in Rome; but instead of being covered with a spiral series of sculptures, like Trajan's pillar, it is fluted. It cost £8,000. The height is 136 feet; the figure at the top, added at a later period, is 14 feet: the altitude of the whole is thus 150 feet.

His statue in white marble stands at the north end of the Great Hall of the Parliament House in Edinburgh. It is by Chantry; and Lord Cockburn's caustic remark is: "It is, perhaps, Chantry's worst. The column," he adds, "has received and deserves praise."

It is a curious circumstance to take note of, that on the column in St. Andrew's Square, to this day, there is no inscription. Pope's couplet on the so-called Monument in London, everyone remembers:

> "Where London's column, pointing at the skies,
> Like a tall bully, lifts the head and lies."

Some such biting satire as this, it is certain, would quickly have shaped itself in men's mouths, had the exaggerated language appeared on the Edinburgh pillar, which the worshippers of Melville would inevitably have desired to see placed there at the moment of their party's triumph, when such a conspicuous trophy was suggested. Wiser men may have counselled phrases more modest, which the stubborn extremists would not away with; and thus, between the two, it may have happened that no inscription at all was carved. Better, perhaps, this—than that at an after-period an erasure should be demanded, and procured, on the plea of untruth, as has actually come to pass in the case of the Monument in London, since the days when Pope wrote.

Here I close my memoirs of the two eminent men, whose respective careers I have desired to recall to your recollection.

Whenever next we cross and re-cross the route of our now classic and even ancient Yonge Street, as we travel to Orillia or Gravenhurst, by the Northern Railway of Canada; or whenever, borne swiftly along on the track of the Great Western, we look down from the cars upon the thriving town and picturesque valley of Dundas, it will, in both cases, invest the scene with fitting associations, and add interest to the journey, if we recall to our minds, as we proceed on our way, the fates and fortunes of the two personages from whom the localities on which we gaze derive their names—the frank, genial-looking, many-sided Devonshire man, Sir George Yonge, Secretary at War in 1782; and the cool, shrewd-featured, able and dextrous Scot, Henry Dundas, Viscount Melville, First Lord of the Admiralty in 1805.

NOTE ON THE DISTRIBUTION OF XANTHIUM SPINOSUM: LINNÆUS.

BY GEORGE JENNINGS HINDE, F.G.S.

(Read before the Canadian Institute, November 3rd, 1877.)

This plant, though generally affecting a more southerly climate, appears to have established itself in the sheltered valley of Dundas, at the western extremity of Lake Ontario; the only spot in Western Canada in which it is known to occur. Though it has been noticed here for at least seven or eight years past, it does not appear to have extended its area of growth to any adjoining locality; and if the facility with which the seeds attach themselves to passing objects and are thus transported, be taken into account, the restriction of its growth to this one place seems owing to the unsuitability of the climate in places less sheltered than the Dundas valley.

In common with a host of other plants now thoroughly naturalized on this continent, this species has been introduced from Europe, but whether it has been brought to this northern continent directly, or by the circuitous way of South America, is open to question. Linnæus gives its habitat as France and Portugal; it has come under my own notice in Italy; and in Loudon's Encyclopædia of Botany, it is noted as growing in the South of Europe generally. In Buenos Ayres, and some other Provinces of the Argentine Republic in South America, the soil and climate are very favourable to its growth, and by means of the numerous cattle and sheep which pasture on the fenceless pampas, the seeds are readily distributed. The great extension of sheep-farming in these countries within the last few years has been the means of very widely spreading this troublesome weed, for not only do the sheep transport the burrs in the wool, but they feed down closely the native flora, and thus afford a better opportunity for this intruder to gain a root-hold. Thus districts in the pampas previously free from this weed, become, very soon after the introduction of sheep, infested with it. There is every probability that the seeds were first carried to these countries from Europe, attached to the coats of the sheep and cattle which the Spanish colonists brought with them from their native land, where the plant is indigenous.

On this northern continent, according to Dr. Gray, the *Xanthium spinosum* grows in waste places on the sea board and along rivers southward, and he quotes it doubtfully as naturalized from Tropical America. Whilst it is possible that the plant may have thus reached the United States, there is yet another way by which the seeds are constantly being introduced into that country, viz., in the wool which is very extensively imported thither from South America, and more particularly from Buenos Ayres. Rarely could a fleece of wool from this latter place be met with, without some of the Xanthium burrs sticking to it, and in the preparation of this wool for use, every woollen mill becomes a centre for the dispersion of the seeds. Probably, by this means, the sporadic appearance of this plant in Canada may be explained, as a woollen mill formerly stood at Dundas, near the place in which the plants are now found.

Although the climate of Western Canada may prove sufficiently rigorous to prevent the growth of this noxious weed, save in sheltered localities, yet it would be a wise step to endeavour to eradicate it whilst it is yet confined to a limited district, and before it becomes thoroughly acclimatized.

NOTE ON THE OCCURRENCE, NEAR TORONTO, OF BOULDERS BELONGING TO THE CALCIFEROUS FORMATION.

BY GEORGE JENNINGS HINDE, F.G.S.

(Read before the Canadian Institute, December 15th, 1877.)

Amongst the numerous erratic boulders scattered on the surface of the country to the north and west of Toronto, there are, not unfrequently, some of a very hard bluish-gray rock, composed of rounded grains of quartz-sand imbedded in a calcareous cement. Through weathering, the calcareous portion of the exterior of these boulders is dissolved away, leaving a crust, of an inch or so in thickness, of a reddish-brown friable sandstone. As a rule, the boulders are rounded in figure and from eight inches to two feet in diameter. No traces of glacial striæ are present, and even had such been formed, they would most probably have been obliterated through the decay of the outer surface. The majority of these boulders are destitute of organic remains, but I have lately found some filled with the casts of *Ophileta compacta*: Salter. This shell is characteristic of the Calciferous formation, and as the material of the boulders is also identical in character with the rocks of that formation, and very distinct from any other known rock in this portion of Canada, it may be concluded that the non-fossiliferous, as well as the fossiliferous, boulders have been derived from the same source. The calciferous formation prevails in a very extensive area between the St. Lawrence and Ottawa Rivers in the eastern portion of this Province of Ontario, but it is not known with certainty to occur on the western side of the Laurentian spur crossing the St. Lawrence at the Thousand Isles. Thus the nearest localities from which the boulders in question could have been derived are about 200 miles distant, in a direction between the angles of N. 55 E. and N. 71 E. from Toronto. The boulders are found at levels of 350 to 450 feet above the sea, which is, if anything, slightly higher than the present general level of the rock-beds from which they have been brought.

NOTES ON VENTILATION.

1. In designing a combined system of heating and ventilation for public buildings, one of the main difficulties is to get a uniform draught in all the ventilation flues leading from the different rooms. Where, as frequently happens, some of the ventilation flues act and others do not, the equable distribution of heat is interfered with, and therefore it is all the more necessary when a building is to be well heated and ventilated to see that both sets of flues, hot-air and foul-air, shall act properly. The following plan, it appears to me, will be attended with success when the building is heated by steam on the indirect system, and there is an attic available. When the hot-air flues are in the inner walls, the ventilation flues should be in the opposite or outside walls, and *vice versa.* In the former case, all should be extended directly up until they connect with a large tin-lined box running around the exterior of the attic and leading into a ventilation shaft or chimney. On the bottom of this box and along its whole length a large steam pipe should be laid so as to cross the openings provided for the ventilation pipes. All joints and connections should be made tight, and the dimensions of the flues adjusted in due proportions. When the ventilation flues are in the inner walls a corresponding treatment can be adopted.

2. It has also appeared to me that, to a limited extent at any rate, the ventilation of railway cars would be improved by taking the supply of fresh air, so as to avoid dust and smoke, from a point in front of the locomotive. A pipe could be extended from this point to any part of the train by means of rubber connections between the cars, and any excess of draft at the point of delivery of the fresh air could be reduced by means of check plates. Were it not for the admirable system of heating cars by means of hot water pipes, it might be worth while considering if the fresh air so supplied could not be first warmed by passing it over heated pipes in a special car near the locomotive.

J. L.

THE "HADES" OF HOMER AND THE "HADES" OF VIRGIL.

BY NEIL MACNISH, B.D., LL.D., CORNWALL, ONTARIO.

(Read before the Canadian Institute, Dec. 15, 1877.)

In the eleventh book of the Odyssey there is given a description of the visit which Ulysses made to Hades. Virgil devotes the sixth book of the Æneid to the narration of the descent of Æneas to the *abodes of the dead.* The object of this paper is simply to examine and compare the descriptions which Homer and Virgil give of Hades. Even a casual examination of the account which the poets in question respectively give of the peculiar experiences of the two renowned heroes who visited the realm of Pluto, will suffice to convince any one that the ideas of Homer regarding the dead are vague, indefinite, and to a large extent removed from what is material; while the conceptions of Virgil indicate a very large advancement, and are characterized by a large admixture of what is material, elaborate, and well defined. The many ages that intervened between the respective poets afforded scope enough for the development of minuter details and more diversified views regarding Hades, as well as for enlarging and embellishing the mythological beliefs of a primitive age. It were merely to be expected, therefore, that in Virgil's time the Greeks and Romans would be in possession of more refined and elaborate theories regarding the dead, and Hades, the abode of the dead.

The word Hades, or certain forms of it, occurs very frequently in the poems of Homer. Though it is maintained that the term *Hades* is employed by Homer to designate the god who rules over the infernal regions, it is possible that a double signification ought to be attached to the term. When we consider that such phrases as this are of frequent occurrence, *Ψυχὴ δ' Ἄϊδοσδε κατῆλθεν*, we may suppose that Homer employed the word *Hades*, or certain forms of it, not merely to designate the god or ruler of the infernal regions, but also the place to which the souls of men are supposed to go at death. It is to the house of Hades and of dread Persephone that Ulysses is admonished to go, *εἴς Ἀίδαο δομὸυς καὶ ἐταινῆς Περσεφονείης*. These phrases or epithets, and *Erebus*, are the only words which Homer employs to designate the *abodes of the dead* in connection with the visit of Ulysses to *Hades.* It is to *Erebus* that Ulysses is requested to turn when he is sacrificing the sheep which he conveyed in his ship to Hades. It is out from *Erebus* that the souls of the dead are said to assemble. In the description which Ulysses himself gives of his descent to Hades, there is no mention made either of *Tartarus* or *Elysium.* Homer elsewhere employs the term Tartarus. In Iliad VIII. Jupiter is represented as threatening the gods on Olympus in this manner: "Whomsoever of the gods I shall discover, having gone apart from [the rest], wishing to aid either the Trojans or the Greeks, disgracefully smitten shall he return to Olympus; or, seizing, I will hurl him into *gloomy Tartarus,* very far hence; where there is a very deep gulf beneath the earth, and iron portals, and a brazen threshold, as far below Hades as heaven is from earth." In Iliad XVIII. Juno is represented as swearing "by all the gods who dwell under Tartarus (*τοὺς ὑποταρταρίους*), that are called Titans." In his Theogony (vv. 719, 720), Hesiod thus alludes to Tartarus: "As far under earth as heaven is from the earth; for equal is the space from beneath earth to murky Tartarus." In Æneid VI. Virgil thus describes Tartarus:

> "Tum Tartarus ipse
> Bis patet in præceps tantum, tenditque sub umbras,
> Quantus ad ætherium cœli suspectus Olympum."

It is reasonable to maintain that, in the description which he gives of Tartarus, Hesiod followed Homer very closely; and that Virgil is indebted to both of the Greek poets for the view which he entertained respecting the locality of Tartarus, and those who were imprisoned in it:

> "Hic genus antiquum Terræ, Titania pubes,
> Fulmine dejecti, fundo volvuntur in imo."

Though no mention is made of Elysium in connection with the descent of Ulysses to Hades, it is clear that Homer was acquainted with the term, for in Odyssey IV. (vv. 563–568), Proteus, the old man of the sea (γέρων ἅλιος), says to Menelaus: "But for thee it is not decreed to die . . . in horse-pasturing Argos, but the immortals will send thee to the Elysian plain (Ἠλύσιον πεδίον) and the boundaries of the earth, where is the auburn-haired Rhadamanthus."

1. With regard to the reason which induced Ulysses to descend to Hades, it may be observed that, after detailing at great length to Alcinous, the King of the Phæacians, the many hardships and strange experiences which he and his companions had on their return from Troy, and in their eagerness to reach their much-loved Ithaca, Ulysses proceeds to inform his Phæacian hearers how he and his companions came to Ææa, the home of Circe, "a goddess, possessing human speech;" how those of his companions who went to her dwelling were metamorphosed by her into swine; how he, enraged in consequence of the dismal fate of his companions, hastened to the house of Circe, and met Mercury, by whom he was instructed how to resist the goddess, and from whom he received (μῶλυ) a potent remedy; how he successfully opposed the command of the goddess, Ἔρχεο νῦν συφέονδε μέτ' ἄλλων λέξο ἑτάιρων; how he and his companions, after their restoration, remained with Circe "all the days for a full year, feasting upon abundance of flesh and sweet wine," until, impelled by his companions, he asked her to send him home to Ithaca, and received this reply: "You must first perform another voyage, and come to the house of Hades and awful Persephone, to consult the soul of Tiresias the Theban, a blind prophet, whose mind is firm, to whom, even when dead, Persephone has given understanding alone to be prudent, but the rest flit about as shades." Tiresias was one of the most renowned soothsayers of ancient times. The belief was current that he, as Circe herself avers, was the only one who retained in Hades the power of perception. It was accordingly with the object of consulting Tiresias as to how he and his companions could return to Ithaca that Ulysses went to Hades at the suggestion of Circe. Virgil narrates that Æneas, while sailing from Carthage to Italy, was compelled by a severe storm to land in Sicily; and that he there, by various games and feats of arms, celebrated the anniversary of his father's death. As he is bewildered, owing to the burning of his fleet by the Trojan matrons, the form of Anchises (*facies Anchisæ*) appears to him, and urges him to follow the advice of Nantes, and "to carry with him to Italy the choice of

the youth, the stoutest hearts." He receives this additional command from the *form* of Anchises:

> "Ditis tamen ante
> Infernas accede domos, et Averna per alta
> Congressus pete, nate, meos: non me impia namque
> Tartara habent: tristesve umbræ, sed amœna piorum
> Concilia Elysiumque colo: Huc casta Sibylla
> Nigrarum multo pecudum te sanguine ducet.
> Tum genus omne tuum, et quæ dentur mœnia, disces."

Æneas accordingly descended to Hades that he might consult the *form* of his father in Elysium; that he might ascertain what the future had in store for him, and that he might learn to what glory and greatness his descendants were to come, and with what success they were to be favoured.

2. As to the course which Ulysses and Æneas were to adopt, in order to come to Hades, it has to be remarked concerning the former, that perplexed, in consequence of the communication which Circe made to him, he asks the question: "Who will conduct me on this voyage? No one has yet come to Hades in a black ship." He is informed that he is to have no guide, but that he is to erect his mast and to spread his white sails, and "to let the blast of the north wind (πνοὴ Βορέαο) carry him." "He reached the extreme boundaries of the deep-flowing ocean, where are the people and the city of the Cimmerians." It is impossible to ascertain with accuracy where the island of Ææa, the home of Circe, was situated. It seems to be necessary to suppose that it was in the neighbourhood of Sicily, in order that anything like coherence may be observed in the topography of the Odyssey. The opinion of Gladstone cannot be correct when he affirms, in an article in the *Contemporary Review*, June, 1874, that "the dwelling of Kirkè and the ἀντολαί Ἠελίοιο are evidently in the Euxine." The ship of Ulysses must have sailed in a southerly direction, seeing that the blast of the north wind bore it along. A large portion of a day was consumed in reaching the extreme boundaries of the ocean.

According to Homer, the ocean is a vast river, flowing entirely round the earth, and the source of all other streams. In Iliad XXI. these words occur: "Nor the mighty strength of deep-flowing ocean, from which flow all rivers, and every sea, and all fountains and deep wells." In Iliad XVIII. and Odyssey XX., the epithet ἀψόρροος, or back-flowing, is applied to Oceanus. It is to the land of the Cimmerians that Ulysses came—a land "covered with shadows and vapour." Various theories have been advanced with the view of determining who the Cimmerians, to whom Homer refers, were, and where their residence in all probability was. It was sought, among other places, to assign to them a habitation in Italy, near Lake Avernus.

In all likelihood this is the theory which Virgil accepted, inasmuch as, imitating Homer very closely as he does in other respects, he affirms that at or near Lake Avernus, Æneas descended into Hades. Ulysses then, alone, with his companions, sailed from Ææa in a southerly direction, and came to the extreme boundaries of ocean; where, according to the ideas which Homer had, Hades was.

Æneas, following the instructions of his father, proceeded, whenever he arrived in Italy, to find out the Sibyl who was to guide him to Hades. The derivation which is commonly assigned to the word *Σίβυλλα*, is seemingly correct: *Διὸς βουλή*, Dor. *Σιὸς βόλλα*, *i.e.*, She that tells the will of Jove. There is a legend that, in the early days of Rome, one of the kings purchased what was subsequently designated *Sibyllini Libri*, from a Sibyl, or prophetic woman, who offered them for sale. Regarding the Sibyls, Grote thus writes: "From the Teukrian region of Gergis, and from the Gergithites, near Kymè, sprang the original Sibylline prophecies, and the legendary Sibyl, who plays so important a part in the tale of Æneas. The mythe of the Sibyl whose prophecies are supposed to be heard in the hollow blast, bursting out from obscure caverns and apertures in the rocks, was indigenous among the Gergithian Teukrians, and passed from the Kymæans in Æolis along with the other circumstances of the tale of Æneas, to their brethren, the inhabitants of Cumæ, in Italy. The date of the Gergithian Sibyl, or rather of the circulation of her supposed prophecies, is placed during the reign of Crœsus—a period when Gergis was thoroughly Teukrian. Her prophecies, though embodied in Greek verses, had their root in a Teukrian soil and feelings; and the promises of future empire which they so liberally made to the fugitive hero escaping from the flames of Troy into Italy, become interesting from the remarkable way in which they were realized by Rome."* Æneas was directed by the Sibyl to make very elaborate preparations for his descent to Hades. He was to search

* History of Greece. Vol. I., p 328.

for the golden bough which Proserpine had ordered to be presented to her as her peculiar gift. The entrance to Hades was through the cave of the Sibyl, who, after Æneas had secured the golden bough, went as his guide to the lower regions.

3. When Ulysses had reached "the extreme boundaries of the deep-flowing ocean," he, carrying out the instructions of Circe, "dug a trench the width of a cubit each way. He and his companions poured around it libations to all the dead, first with mixed honey, then with sweet wine; and again, a third time, with water. He entreated the powerless heads of the dead much, and promised that if he would return to Ithaca, he would offer in his palace a barren heifer, whichever was the best, and fill a pyre with excellent things; and that he would sacrifice to Tiresias alone a sheep all black, which excelled among his sheep." He killed the male sheep and the black female which Circe gave him; and their blood flowed into the trench the width of a cubit each way.

Æneas made vows and offered prayers. Apart from the sheep whose blood flowed into the trench, Ulysses contented himself by making promises that, in the event of his returning to Ithaca, he would offer certain sacrifices. Before Æneas and the Sibyl began their arduous journey, they offered many sacrifices. The Sibyl sacrificed in honour of Hecate, who is unknown to Homer. Æneas offered sacrifices "to the mother of the Furies, and her great sister, and to Proserpine and the Stygian King." Ulysses neither offered nor promised to offer sacrifices to any of the gods. Not only did Æneas offer sacrifices before Hades was approached, but many more sacrifices were offered by him and by the Sibyl than Ulysses contemplated, were it ever to be his good fortune to return to Ithaca. No sooner had Ulysses completed the sacrifices which he was instructed to offer, than the souls of the dead were assembled out from Erebus. Another and a more difficult experience had to be encountered by Æneas and his guide before they entered Hades.

The same rivers are mentioned by Homer and Virgil. Homer knows nothing of Charon, whom Virgil thus describes:

> "Portitor has horrendus aquas et flumina servat
> Terribili squalore Charon."

It was Charon who ferried over the souls of those whose bodies had been interred.

Nor is there any reference in Homer to Cerberus, so far as the descent to Hades is concerned. This is the description of Virgil:

> "Cerberus hæc ingens latratu regna trifauci
> Personat."

Among those whom Ulysses encountered in Hades was Hercules, an image (εἴδωλον), who adverted to his having been sent to bring Cerberus to the upper regions, "because it was thought that there was no contest more difficult than this." Hesiod in his Theogony refers to Cerberus as "a fierce dog, that keeps guard in front of the mansions of the infernal god; a ruthless dog, the irresistible and ineffable flesh-devourer; Cerberus, dog of hell, with brazen voice and with fifty heads."

4. A difference is easily observable in the manner of conversing with the souls of the dead, so far as regard is had to the narrative of Homer and of Virgil. Achilles (Iliad XXIII. 103) employed this language respecting the dead:

> *Καὶ εἰν 'Αΐδαο δόμοισιν*
> *ψυχή καί εἴδωλον, ἀτὰρ φρὲνες οὐκ ἔνι πάμπαν.*

By φρένες, we may understand the power of reason and judgment. Achilles, accordingly, affirmed that in the dwellings of Hades, "the dead are a spirit and an image," but that they have no power of reason and judgment. Others, with seemingly little reason, regard φρὲνες as the body, or perhaps the vitals. Circe said respecting Tiresias: τοῦτε φρένες ἐμπεδοί ἐισιν. Brown thus writes: "Homer evidently entertained some vague notion of the impossibility of the soul existing in a state of activity unless united to some immortal body. The blood of the slaughtered victim is the device resorted to in order to supply that bodily vigour which is necessary to the activity of the spiritual principle."* An American editor of the Odyssey says: "In the time of Homer, the two main causes of life were considered to be the breath (ψυχὴ) and the blood. As the shades in Hades were destitute of blood, their existence was only a kind of half-life; but when the corporeal element was added (*i.e.*, when they drank blood), sense and the power of reflection returned."† Even though it is said of Tiresias that his power of reason and

* Greek Classical Literature, p 95.
† Owen's Odyssey, p. 412.

judgment (φρένες) were entire or steadfast, still, while recognizing Ulysses, he asked to be allowed to drink the blood, that he might tell what is unerring (καί τοι νημερτέα εἴπω). It plainly appears that it was because his body had not then been interred that Elpenor was able to converse with Ulysses. The opinion was evidently held by Homer and Virgil that, until the body was buried, the soul could not rest in peace. Though Ulysses easily recognized his mother Anticlea, he could not obtain any recognition from her. He, consequently, thus addressed Tiresias: "I behold this, the soul of my deceased mother. She sits near the blood in silence; neither does she dare to look openly at her son, nor to speak to him." Tiresias replied: "Whomsoever of the dead thou sufferest to come near the blood, he will tell thee the truth; but to whomsoever thou grudgest it, he will go back again." When Anticlea drank of the blood in the trench, she entered into conversation with her son. It was in reference to her that Ulysses used the affecting words which Virgil translated with very great faithfulness:

> "τρὶς μὲν ἐφωρμήθην ἑλέειν τέ με θυμὸς ἀνώγει,
> τρὶς δέ μοι ἐκ χειρῶν σκιῇ εἴκελον ἢ καὶ ὀνείρῳ
> ἔπτατ'."

> "Ter conatus ibi collo dare brachia circum;
> Ter frustra comprensa manus effugit imago,
> Par levibus ventis, volucrique simillima somno."

It does not appear that Ulysses conversed with any of the dead until they had first drunk of the blood. An exception has to be made in the case of Hercules. With regard to him, however, it is said that it was an image (εἴδωλον) of him that was in Hades. Homer distinctly states that the souls of the dead came to Ulysses after he had prepared the trench. No mention whatever is made of any divisions of Hades. It is said that Ulysses beheld Minos, Orion, Tityus, Tantalus and Sisyphus. Inasmuch as the poet distinctly states that Tityus, Tantalus and Sisyphus were suffering punishment which must have confined them to a definite locality, it must be admitted that Ulysses changed his position. Hence it has been sought, with the aim of preserving the poet's consistency, to regard as spurious that portion of the narrative which details the names and fortunes of the heroes in question.

If we now turn to Æneas, we shall find an entirely different state of things. The conception which Virgil had of Hades was altogether vaster and more elaborate than that of Homer. There is in the conception of the Latin poet a much nearer approximation to earthly and material ideas. As soon as Æneas and his guide passed Cerberus, they speedily wended their way onward. Æneas addressed the souls of the dead and received an immediate answer:

> "Circumstant animæ dextra lævaque frequentes,
> Nec vidisse semel satis est: juvat usque morari,
> Et conferre gradum, et veniendi discere causas."

Æneas and the Sibyl came to a place where the path hitherto pursued by them divided itself into two ways. "The right is what leads beneath great Pluto's walls. By this our way to Elysium lies. But the left carries on the punishment of the wicked, and conveys to Tartarus." They reached the gates where they are to deposit the golden bough—an offering peculiar to Proserpine. "Aurumque adverso in limine figit." They afterwards entered Elysium. When the form of Anchises appeared to Æneas in Sicily, he thus alluded to his own place in Hades:

> "Non me impia namque
> Tartara habent; tristesve umbræ, sed amœna piorum
> Concilia Elysiumque colo."

As well in the case of Ulysses as in the case of Æneas, it was found that the souls of the dead remembered the varied occurrences of their lives on the earth. Nor were the animosities of the past forgotten; Ajax, the son of Telamon, refused to heed the kindly words of Ulysses, because he still retained the anger which he felt when the arms of Achilles were gained in the contest by Ulysses. Dido disdained the passionate entreaty of Æneas. The souls of the Grecian chiefs whom he was wont to terrify in the strife of arms, hurried away as soon as they recognized who he was. The souls of the dead still felt a deep interest in the welfare of relatives who were alive. The soul of Achilles made minute inquiries about the fortunes of his son and of his father, and was delighted when favourable intelligence was given to him.

5. From the conversation which Ulysses had with the souls of the dead, the inference is easy that they regarded their existence in Hades as gloomy and cheerless in the extreme. Tiresias spoke of Hades as a joyless region. Anticlea informed her son "that the

nerves of the dead no longer have flesh and bones, but the strong force of burning fire subdues them, when first the mind leaves the white bones. But the soul, like a dream flitting, flies away." These were the mournful words of Achilles: "I would rather be a serf on the land of a poor, portionless man, who is not well to do, than rule over all the dead who have come to nought." Plato, in his Republic, thus censured the opinion of Achilles: "And we must beg Homer and the other poets not to be angry if we strike out these and similar passages; not because they are unpoetical or unattractive to the popular ear, but because the greater the charm of them as poetry, the less are they meet for the ears of boys and men who are to be sons of freedom, and are to fear slavery more than death."* Homer had no divisions in Hades. According to him, the condition of the dead was sorrowful in the extreme. The divisions which Virgil introduced into Hades did away with the unbroken gloominess of Homer. Anchises is made to affirm "that he inhabits the delightful seats of the blest, and Elysium." His opinion is thus further expressed:

> "Quisque suos patimur Manes; exinde per amplum
> Mittimur Elysium, et pauci læta arva tenemus."

That sorrows and sufferings and wailings manifold abounded in Hades may be easily inferred from the language of the Sibyl:

> "Non mihi si linguæ centum sint oraque centum,
> Ferrea vox, omnes scelerum comprendere formas,
> Omnia pœnarum percurrere nomina, possim."

6. Regarding the information which Ulysses and Æneas obtained in Hades, it has to be borne in mind that it was in order to consult Tiresias respecting his homeward journey to Ithaca, that Ulysses went to the lower regions. It must be regarded as a weakness on the part of Homer, that he represents Circe, a goddess, as advising Ulysses to go on such an expedition for a purpose in itself so comparatively unimportant.

The epithet δία θεάων is applied to Circe. When Ulysses and his companions were about to sail for Hades, unperceived by them, she went to the black ship and put the sheep on board. In connection with the deed to which reference has just been made, Ulysses remarked: "For who could see with his eyes a god who was unwil-

* Jowett's Plato. Vol. II. p. 210.

ling, going either here or there." The question at once arises, Why could not Circe herself, goddess as she was, give Ulysses all the information which he required; and especially, as she is represented in Odyssey XII. as furnishing him, after his return from Hades, with much ampler details regarding his homeward voyage than Tiresias gave. It does not seem, therefore, that Homer has assigned a purpose sufficiently grand and awful for the descent of Ulysses into Hades.

It was in order to ascertain the future history of his descendants that Æneas was asked to visit the lower regions:

"Tum genus omne tuum, et quæ dentur mœnia, disces."

The manifest design of Virgil was to shed all the honour that was possible on the family of Cæsar, and to trace back, through successive stages of brilliant renown, the Roman race to Æneas and his immediate followers. Well versed as the poet was in the history of Rome, he, with a grandeur of conception which is bold and graphic, represents Anchises in Elysium as busily engaged among those souls "for whom other bodies are destined by fate," and by whom the Roman heroes that are to be are to be animated. Expression is given to pantheistic views respecting the spirit which "nourishes the heavens, the earth and watery plains, and mingles with the vast body of the universe." Recourse is had to the doctrine of metempsychosis, in order to shew how the souls with whom Anchises is actively engaged are, after a sufficient and satisfactory process of purification, to revisit the earth, and to animate those who are to shed immortal honour on the Roman name in the ages that are yet to be. Before the vivid and fertile imagination of the poet, there pass in rapid succession those who were worthiest and bravest and most patriotic among the Romans. This noble advice was given for the guidance of coming generations:

"Tu regere imperio populos, Romane, memento;
Hæ tibi erunt artes; pacisque imponere morem,
Parcere subjectis, et debellare superbos."

The enumeration of the great and good and heroic who were to appear on the scene of Roman life and action as the ages rolled away, terminates with the affecting and memorable allusion to Marcellus, the son of Octavia, the sister of Augustus. It must be granted that

Virgil succeeded in surrounding the descent of Æneas to Hades with a solemnity and a grandeur befitting so peculiar an expedition.

7. As to the time which the descent of Ulysses and Æneas occupied, we may conclude respecting the former that the day must have advanced somewhat before he and his companions sailed. "The sails of the ship passing over the sea were stretched out the whole day: and the sun set and all the ways were overshadowed." The inference, therefore, is plain, that Ulysses arrived at the extreme boundaries of ocean on the evening of the day on which he sailed from Ææa. From Odyssey XII. it appears that when he and his companions returned to the island of Circe, they drew up their ships on the sands, and they themselves disembarked upon the shore of the sea. Lying down to sleep, they awaited the divine morning. As they occupied a day in going to the boundaries of ocean, and as they returned to Ææa when it was dark; that the poet's story may be consistent, it has to be conceded that the voyage to and from Hades occupied two days.

Ulysses must have returned to Ææa on the evening of the second day, when it was too late to inter or burn the body of Elpenor. Early on the morning of the next day the promise which was made to the ghost of Elpenor was faithfully carried out.

It was early in the morning that Æneas and the Sibyl began their journey (primi sub lumine solis et ortus). While Æneas was conversing with Deiphobus, the Sibyl admonished him not to make unnecessary or long delays, because a certain time was granted for their journey.

> "Hac vice sermonum, roseis Aurora quadrigis
> Jam medium ætherio cursu trajecerat axem,
> Et fors omne datum traherent per talia tempus;
> Sed comes admonuit, breviterque affata Sibylla est,
> Nox ruit, Ænea, nos flendo ducimus horas."

An entire day, therefore, was assigned to the descent of Æneas into Hades. He and his companion spent an entire day in their visit to the abodes of the dead.

8. There is a manifest naturalness in the manner of the departure of Ulysses from Hades. Whatever coherence or importance or plausibility belongs to his visit to Hades, is in no way weakened or lessened

by the manner in which his departure is related by the poet. Sudden and strong fear seized him. He hurried to his ships and to his companions, who could not have been far from him, according to the representation of the poet himself. "They quickly embarked, and sat down on the benches. And the wave of the stream carried the ship through the ocean river, first the rowing and afterwards a fair wind."

There is an absence of naturalness in the description which Virgil gives of the departure of Æneas and the Sibyl from Hades. It must be admitted, that the verisimilitude which the poet has hitherto presented with comparative faithfulness and success, is weakened by the manner in which he allows Æneas and the Sibyl to return to the upper regions. In Odyssey XIX., Penelope, before she recognized Ulysses, who had at last arrived at his much-loved Ithaca, informed him, "that there are two portals of unsubstantial dreams: these are made of horn, and those of ivory. Whichever of them comes through the sawn ivory, they deceive, bringing promises which will never be fulfilled; but those which come out of doors through the polished horn accomplish what is true, when any one of mortals sees them." There can be little doubt that Virgil reproduces the words of Penelope, which have just been quoted, when he thus describes the departure of Æneas and the Sibyl:

> "Sunt geminæ Somni portæ; quarum altera fertur
> Cornea, quâ veris facilis datur exitus Umbris;
> Altera, candenti perfecta nitens elephanto;
> Sed falsa ad cœlum mittunt insomnia Manes.
> His ubi tum natum Anchises, unaque Sibyllam,
> Prosequitur dictis, portaque emittit eburna:
> Ille viam secat ad naves, sociosque revisit."

Any one can discern an incongruity in the opinion of the poet, that gates, the object of which is to allow dreams to pass through, can have the texture and capacity which are presupposed by the passing through them of Æneas and the Sibyl. The impression undoubtedly remains, that Virgil either sought to destroy the verisimilitude of his entire story, by the manner in which he describes the return of Æneas and the Sibyl to the earth; or, that he was anxious that his readers should regard the story as purely imaginary—the fiction of his own brain.

INDEX TO VOLUME XV.

MONTHLY METEOROLOGICAL REGISTER, AT THE MAGNETICAL OBSERVATORY, TORONTO, ONTARIO—DECEMBER, 1875.

Latitude—43° 39'4 *North.* *Longitude*—5*h.* 17*m.* 33*s.* *West.* *Elevation above Lake Ontario,* 108 *feet.*

Day.	Barom. at temp. of 32°. 6 A.M.	2 P.M.	10 P.M.	Mean.	Temp. of the Air. 6 A.M.	2 P.M.	10 PM	MEAN	Excess of Mean above Av'rage.	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N.	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Direction of Wind. 6 A.M.	2 P.M.	10 P.M.	Resultant.	Velocity of Wind. 6 A.M.	2 P.M.	10 P.M.	Result't	MEAN	Rain in inches.	Snow in inches.
1	29.886	29.869	29.964	29.9112	°4.8	°12.4	°11.3	°9.45	°—21.08	.051	.066	.064	.059	95	88	90	89	N E	N E	N E	N 28° E	11.5	8.0	7.2	9.97	10.00	...	11.0
2	30.056	30.096	30.046	30.0638	12.7	24.3	25.0	20.80	— 9.25	.062	.104	.089	.085	83	79	66	76	N	E	E	N 78 E	7.4	11.5	16.0	9.47	11.35	...	...
3	29.956	29.895	29.896	29.9133	17.4	30.8	25.0	23.73	— 5.82	.078	.134	.109	.103	82	78	81	80	N E	S	N	N 59 E	7.2	1.5	7.0	2.36	5.68	...	...
4	.813	.772	.709	.7652	26.1	31.9	32.2	29.88	+ 0.78	.124	.165	.169	.151	88	91	93	90	N E	N E	N E	N 35 E	6.8	5.6	4.0	5.78	6.04	...	...
5	.600	.450	.353	.4492	30.0	35.0	32.0	31.83	+ 3.20	—	—	—	—	—	—	—	—	N E	N E	N E	N 60 E	10.6	16.2	11.8	11.91	12.03	.030	...
6	.335	.337	.304	.3310	29.7	30.8	32.6	31.10	+ 2.93	.162	.148	.165	.157	98	86	89	90	N E	N E	E	N 57 E	8.0	7.4	13.9	9.56	9.73	...	0.5
7	.226	.093	.060	.1233	29.7	31.9	31.9	31.65	+ 3.93	.162	.173	.180	.174	98	95	100	97	N E	N E	N E	N 56 E	11.5	12.4	10.1	11.26	11.31	.170	0.1
8	.074	.118	.235	.1543	30.1	30.4	29.1	29.72	+ 2.43	.164	.150	.145	.153	98	88	91	93	N	N E	N	N 23 E	4.0	2.4	1.0	3.35	3.45	.040	1.9
9	.324	.392	.525	.4272	27.2	26.5	25.4	26.05	— 0.82	.124	.126	.118	.122	85	88	86	87	N	N	N	N 23 W	6.2	11.2	11.6	7.91	8.07	...	0.4
10	.608	.665	.633	.6365	25.4	28.2	26.8	26.43	— 0.02	.118	.113	.122	.115	86	73	84	80	N W	W	W	N 71 W	9.0	9.7	6.6	6.75	7.93	...	...
11	.437	.260	.252	.3083	30.4	33.3	31.9	31.98	+ 5.93	.160	.180	.169	.171	95	95	94	95	S W	S	W	S 16 W	3.5	5.5	4.8	3.83	4.83	...	1.3
12	.300	.260	28.900	.1423	23.0	26.0	32.2	27.32	+ 1.69	—	—	—	—	—	—	—	—	W	S W	S W	S 58 W	5.0	13.5	18.0	11.75	13.74	...	0.3
13	28.810	28.999	29.167	.0122	32.2	28.2	20.3	26.67	+ 1.40	.162	.086	.092	.113	89	55	82	76	W	W	N W	S 88 W	21.6	29.5	14.0	21.83	22.71	...	0.1
14	29.307	29.385	.492	.4115	8.8	18.2	10.9	12.57	—12.32	.052	.076	.055	.062	82	78	78	81	N W	W	W	N 66 W	3.0	20.5	5.8	9.70	10.31	...	...
15	.406	.099	.161	.2142	21.0	27.9	33.3	27.82	+ 3.27	.108	.152	.156	.143	96	100	82	93	S W	S E	W	S 42 W	6.5	16.5	29.5	8.15	12.33	...	1.8
16	.355	.279	.216	.2835	24.3	29.7	24.7	25.73	+ 1.50	.111	.103	.099	.103	84	63	75	74	W	S W	W	S 59 W	6.8	12.6	9.4	9.23	9.66	...	...
17	.222	.431	.541	.4233	17.1	10.2	2.6	8.58	—15.32	.086	.048	.037	.053	92	71	78	80	S W	N W	N	N 73 W	15.8	24.5	10.2	14.58	16.10	...	0.1
18	.589	.428	.551	.5303	– 4.5	13.1	10.9	4.55	—19.05	.032	.059	.061	.048	93	76	86	87	N W	S W	N	N 87 W	1.6	18.8	17.4	8.21	10.69	...	...
19	.900	30.078	30.112	30.0448	–12.5	– 8.5	– 6.4	–8.33	—31.65	—	—	—	—	—	—	—	—	N	N	N E	N 13 W	10.4	9.0	10.0	7.90	8.21	...	0.1
20	.945	29.703	29.734	29.7813	15.3	28.3	36.9	27.27	+ 4.20	.076	.126	.175	.129	88	81	79	83	S E	S E	S W	S 37 E	10.5	3.2	7.6	4.63	6.98	...	...
21	.670	.533	.560	.5775	39.1	43.4	40.9	40.70	+17.85	.215	.233	.228	.224	90	83	89	88	S W	S W	S W	S 44 W	12.5	15.0	4.4	10.01	10.22	.150	...
22	.550	.359	.234	.3645	35.1	41.2	45.2	41.23	+18.62	.182	.216	.246	.223	90	83	81	85	S W	S W	S W	S 41 W	5.0	19.0	16.0	12.11	12.55	...	...
23	.215	.442	.769	.5105	40.2	43.4	31.5	36.73	+14.32	.229	.178	.119	.169	92	63	67	76	S W	N W	N	N 77 W	7.0	17.5	12.2	8.24	12.83	...	...
24	.837	.428	.165	.4420	26.1	31.1	36.9	31.67	+ 9.45	.124	.167	.218	.174	88	95	99	95	E	E	E	N 85 E	18.4	28.0	8.8	17.10	17.53	.210	...
25	.060	.466	.670	.4043	40.0	38.7	31.0	36.32	+14.28	—	—	—	—	—	—	—	—	S W	W	N W	N 87 W	8.0	20.0	3.5	11.73	13.59	.180	...
26	.650	28.940	.250	.2817	31.0	40.0	37.0	35.50	+13.62	—	—	—	—	—	—	—	—	E	E	W	N 72 E	15.5	9.8	21.0	5.00	13.50	.860	1.0
27	.754	30.035	30.045	.9708	27.2	22.8	25.0	24.57	+ 2.83	.124	.081	.116	.105	85	66	86	79	N W	N	S E	N 44 W	20.5	6.0	10.0	7.72	12.91	...	0.1
28	.905	29.751	29.808	.8208	26.1	30.8	26.1	27.12	+ 5.50	.124	.118	.124	.118	88	68	88	80	N E	S. E	N	N 75 E	7.0	3.6	4.8	5.57	6.52	...	...
29	.843	.659	.547	.6760	25.4	33.3	38.7	32.98	+11.47	.125	.181	.215	.177	92	94	91	93	N E	E	E	N 65 E	10.8	13.0	10.5	10.07	10.45	Inap.	...
30	.583	.632	.732	.6667	39.8	45.6	35.5	39.93	+18.48	.206	.272	.202	.223	83	89	97	90	E	S	E	S 34 E	1.8	5.0	1.0	1.93	3.31	...	...
31	.714	.555	.575	.6147	39.4	55.3	57.4	50.47	+29.07	.240	.353	.431	.337	99	80	91	90	E	S W	S W	S 42 W	2.0	19.0	11.4	5.76	8.34	Inap.	...
	29.5461	29.4971	29.5228	29.5244	24.44	29.49	28.19	27.16	+ 2.30	131	.146	.150	.142	90	81	86	86	....	....	....	....	8.88	12.75	10.31	......	10.42	1.620	18.7

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR DECEMBER, 1875.

NOTE.—The monthly means of the Barometer and Temperature include Sunday observations. The daily means, excepting those that relate to the wind, are derived from six observations daily, namely, at 6 A.M., 8 A.M., 2 P.M., 4 P.M., 10 P.M., and midnight. The means and resultants for the wind are from hourly observations.

Highest barometer ....30.112 at 10 p.m. on 19th } Monthly range=
Lowest barometer ....28.810 at 6 a.m. on 13th } 1.302.

Self-registering Ther.
- Maximum temperature ....61°0 on 31st } Monthly range=
- Minimum temperature ....—13°2 on 19th } 74°2.
- Mean maximum temperature ....34°07 } Mean daily range=
- Mean minimum temperature ....19°45 } 14°62.
- Greatest daily range........................44°7 from a.m. to p.m. of 20th.
- Least daily range .... 3°8 from a.m. to p.m. of 9th.

Warmest day ....31st; mean temperature................50°47 } Difference=58°80.
Coldest day.................23rd; mean temperature............. —8°33 }

Maximum Radiation { Solar ....104°0 on 31st } Monthly Range=
{ Terrestrial ....—19°8 on 19th } 123°8.

Aurora observed on 1 night, viz., 25th.

Possible to see Aurora on 13 nights; impossible on 18 nights.

Raining on 9 days; depth, 1.620 inches; duration of fall, 43.3 hours.

Snowing on 13 days; depth 18.7 inches; duration of fall, 84.3 hours.

Mean of cloudiness, 0.78.

WIND.

Resultant direction, N 54° W.; resultant velocity, 1.75 miles.

Mean velocity, 10.42 miles per hour.

Maximum velocity, 31.0 miles, from noon to 1 p.m. of 17th

Most windy day, 13th; mean velocity, 22.71 miles per hour.

Least windy day, 30th; mean velocity, 3.31 miles per hour.

Most windy hour, 2 p.m.; mean velocity, 12.75 miles per hour.

Least windy hour, 5 a.m.; mean velocity, 8.70 miles per hour.

Fog on 20th, 30th and 31st.

Solar halo on 16th.

Lightning on 25th and 29th.

Thunder storm on 26th.

Bay open again on 24th.

COMPARATIVE TABLE FOR DECEMBER.

YEAR.	TEMPERATURE. Mean.	Excess above aver'ge	Maximum.	Minimum.	Range.	RAIN. No. of days.	Inches.	SNOW. No. of days.	Inches	WIND. Resultant. Direction.	Velo'y	Mean Velocity.
	°	°	°	°	°					°	°	
1847	30.1	+ 4.3	49.6	0.3	49.3	7	1.135	8	6.8	...	...	0.55 lbs
1848	29.1	+ 3.3	48.8	1.1	47.7	7	2.750	7	16.5	S 83 W	1.12	5.44mls
1849	26.5	+ 0.7	40.8	— 6.5	47.3	5	0.840	12	9.6	N 82 W	2.56	6.23
1850	21.7	— 4.1	48.8	— 9.0	57.8	2	0.190	18	29.5	N 44 W	2.93	7.40
1851	21.5	— 4.3	44.0	—14.8	58.8	6	1.075	15	10.7	N 82 W	4.00	7.37
1852	31.9	+ 6.1	51.0	13.2	37.8	7	3.995	10	20.1	S 69 W	1.03	6.54
1853	25.3	— 0.5	46.4	— 8.4	54.8	4	0.625	13	22.3	N 35 W	2.39	4.98
1854	21.9	— 3.9	44.8	— 7.0	51.8	5	0.590	12	17.2	N 44 W	4.30	8.56
1855	26.8	+ 1.0	47.0	— 5.2	52.2	6	1.845	10	29.5	S 88 W	5.29	11.38
1856	22.9	— 2.9	42.2	— 9.1	51.3	6	1.790	20	16.3	S 87 W	4.62	11.56
1857	31.9	+ 6.1	46.0	4.7	41.3	7	3.205	14	9.0	N 89 W	2.50	6.84
1858	27.4	+ 1.6	45.4	4.2	41.2	11	1.657	18	10.4	N 78 W	1.66	9.36
1859	17.9	— 7.9	54.8	— 6.0	60.8	3	1.035	23	37.4	N 53 W	4.29	10.77
1860	24.0	— 1.8	39.0	— 7.0	46.0	3	1.362	21	13.5	N 62 W	4.66	10.14
1861	31.1	+ 5.3	55.2	5.5	49.7	6	0.560	8	6.8	N 72 W	3.50	7.96
1862	28.8	+ 3.0	50.1	— 3.4	53.5	5	1.945	8	10.4	N 73 W	3.17	7.58
1863	27.0	+ 1.2	53.4	— 1.5	54.9	10	2.960	17	7.1	N 41 W	1.61	9.40
1864	24.7	— 1.1	50.4	—10.4	60.8	9	2.045	18	27.1	S 82 W	4.94	9.98
1865	27.7	+ 1.9	54.2	5.7	48.5	7	1.727	11	5.2	S 81 W	3.07	7.33
1866	25.1	— 0.7	51.0	— 5.0	56.0	7	2.790	13	15.5	S 88 W	4.98	9.91
1867	21.6	— 4.2	49.5	—12.8	62.3	7	1.408	21	13.6	S 81 W	4.82	10.32
1868	22.5	— 3.3	44.2	— 3.2	47.4	1	0.005	18	15.5	N 71 W	4.05	9.80
1869	28.7	+ 2.9	45.0	6.0	39.0	10	2.590	9	7.1	S 80 W	2.31	8.44
1870	26.5	+ 0.7	45.2	— 5.8	51.0	6	2.430	16	15.9	N 89 W	5.06	11.46
1871	19.9	— 5.9	48.2	—21.0	69.2	4	0.940	20	14.2	S 70 W	6.91	11.52
1872	18.7	— 7.1	40.0	—13.8	53.8	3	0.390	4	38.0	N 87 W	5.51	9.06
1873	29.8	+ 4.0	48.2	6.4	41.8	10	0.995	12	19.2	West.	2.95	5.93
1874	25.7	— 0.1	44.0	— 7.5	51.5	5	0.050	15	11.1	S 84 W	5.93	8.72
1875	27.2	+ 1.4	61.0	—13.2	74.2	9	1.620	13	18.7	N 54 W	1.75	10.42
Resu'ts to 1874.	25.75	...	47.40	—3.94	51.34	5.74	1.550	13.89	14.95	N 78 W	3.49	8.66
Excess for '75.	+ 1.36	...	+ 13.60	— 9.26	+ 22.86	+ 3.26	+ 0.070	— 0.89	+ 3.75	...	...	+ 1.76

GENERAL METEOROLOGICAL REGISTER

FOR THE YEAR 1875.

GENERAL METEOROLOGICAL

MAGNETICAL OBSERVATORY,

Latitude 43° 39′ 4″ North. Longitude, 5h. 17m. 33s. West. Elevation above

	JAN.	FEB.	MAR.	APR.	MAY.	JUNE.	JULY.
Mean temperature	16°.07	10°.16	24°.08	36°.35	52°.29	60°.95	66°.57
Difference from average (35 years) ...	− 6.89	−12.74	− 5.20	− 4.49	+ 0.60	− 0.81	− 0.85
Thermic anomaly (Lat. 43° 40′)	−16.73	−24.54	−16.02	−13.85	− 5.81	− 3.65	− 2.13
Highest temperature.....................	39.0	47.6	51.5	62.2	79.2	86.8	88.0
Lowest temperature	− 8.8	− 16.0	− 1.5	10.0	27.0	37.4	46.4
Monthly and annual ranges............	47.8	63.6	53.0	52.2	52.2	49.4	41.6
Mean maximum temperature	23.20	19.17	30.81	44.05	61.45	72.30	77.25
Mean minimum temperature	7.84	−0.65	15.43	28.98	41.65	49.66	55.75
Mean daily range	15.36	19.82	15.38	15.07	19.80	22.64	21.50
Greatest daily range	31.2	46.0	33.0	29.6	31.6	34.8	28.1
Mean height of the barometer..........	29.7593	29.6496	29.6587	29.5872	29.5483	29.6001	29.5898
Difference from average (34 years) ...	+.1152	+.0241	+.0584	−.0026	−.0223	+.0267	−.0030
Highest barometer	30.235	30.194	30.050	30.079	30.019	29.841	29 942
Lowest barometer	29.224	28.916	28.905	28.892	28.751	29.270	29.327
Monthly and annual ranges	1.001	1.278	1.145	1.187	1.268	0.571	0.615
Mean humidity of the air	84	86	81	69	65	68	67
Mean elasticity of aqueous vapour......	0.080	0.076	0.112	0.151	0.263	0.372	0.435
Mean of cloudiness	0.76	0.59	0.63	0.62	0.53	0.56	0.43
Difference from average (22 years)...	+ 0.03	−0.12	+ 0.01	+ 0.03	− 0.02	+ 0.04	− 0.08
Resultant direction of the wind	N. 88° W.	S. 88° W.	N. 23° W.	N. 37° W	N. 46° W.	N. 69° W.	S. 88° W.
" velocity of the wind	4.06	6.67	2.80	3.71	3.44	1.05	1.69
Mean velocity (miles per hour)	9.54	9.91	9.40	10.16	10.07	7.35	6.78
Difference from average (27 years)...	+ 1.16	+ 1.23	+ 0.27	+ 1.90	+ 3.19	+ 2.10	+ 1.75
Total amount of rain	Inapp.	0.470	0.930	1.230	2.980	1.825	1.810
Difference from average (35 years) ...	−1.242	−0.389	−0.658	−1.232	−0.156	−1.058	−1.376
Number of days rain	1	5	3	10	14	7	6
Total amount of snow	32.3	9.1	30.0	2.7	3.1	...	...
Difference from average (32 years)...	+15.27	− 9.55	+17.55	+ 0.17	+ 3.04	...	...
Number of days snow.........	17	9	11	8	2	...	...
Number of fair days	14	16	17	13	14	23	25
Number of auroras observed	0	2	1	1	2	0	2
Possible to see aurora (No. of nights)	14	19	18	16	19	20	24
Number of thunder storms	0	0	0	0	5	6	4

REGISTER FOR THE YEAR 1875.

TORONTO, ONTARIO.

Lake Ontario, 108 feet. Approximate elevation above the sea, 342 feet.

AUG.	SEPT.	OCT.	NOV.	DEC.	1875.	1874.	1873.	1872.	1871.	1870.	1869.
65°.21	55°.46	43°.23	31°.75	27°.16	40°.77	44°.30	42°.94	42°.92	43°.81	45°.93	43°.13
— 1.01	— 2.74	— 2.66	— 4.36	+ 1.41	— 3.31	+ 0.22	— 1.14	— 1.16	— 0.27	+ 1.85	— 0.95
— 3.29	— 6.04	—10.57	—11.45	— 8 84	—10.24	— 6.70	— 8.06	— 8.08	— 7.19	— 5.07	— 7.87
81.9	84.5	63 0	51.0	61.0	88.0	95.0	89.5	96.0	89.5	88.4	89.0
48.0	32.0	27.6	— 5.0	— 13.2	— 16.0	— 7.5	— 18.4	— 13.8	— 21.0	— 6.6	— 5.4
33.9	52.5	35.4	56.0	74.2	104.0	102.5	107.9	109.8	110.5	95.0	94.4
74.39	65.45	50.92	38.02	34.07	...	...	...	...	...	...	...
56.75	46.21	35.88	25.51	19.45	...	...	...	...	...	...	...
17.64	19.24	15.04	12.51	14.62	17.38	17.43	16.93	17.59	16.46	15.71	14.61
27.7	31.8	25.5	37.5	44.7	46.0	46.5	37.9	37.8	34.6	36.2	33.6
29.6140	29.6210	29.5529	29.6756	29.5244	29.6151	29.6452	29.5964	29.6079	29.6066	29.5956	29 5970
—.0101	—.0458	—.0940	+.0652	—.1283	—.0014	+.0287	—.0201	—.0086	—.0099	—.0109	—.0195
30.015	30.082	30.036	30.271	30.112	30.271	30.416	30.246	30.231	30.388	30.212	30.226
29.198	29.102	28.960	29.173	28.810	28.751	28.538	28.797	28.789	28.673	28.186	28.793
0.817	0.980	1.076	1.098	1.302	1.520	1.878	1.449	1.442	1.715	2.046	1.430
76	76	80	79	86	76	74	78	75	73	76	77
0.477	0.346	0.228	0.149	0.142	0.236	0.255	0.257	0.259	9.242	0.279	0.252
0.51	0.54	0.69	0.77	0.78	0.62	0.63	0.60	0.59	0.64	0.62	0.66
+ 0.03	+ 0.04	+ 0.08	+ 0.03	+ 0.02	+ 0.01	+ 0.02	— 0.01	— 0.02	+ 0.03	+ 0.01	+ 0.05
S. 56° E.	S. 88° W.	N. 88° W.	N. 66° W.	N. 54° W.	N. 70° W.	N. 61° W	N. 58° W.	N. 72° W.	N. 72° W.	N. 45° W.	N. 64° W.
1.58	1.89	2.52	3.03	1.75	2.31	2.67	1.98	2.91	2.49	1.61	2.55
6.70	8.09	9.31	9.73	10.42	8.96	8.03	7.96	6.78	8.24	7.33	7.20
+1.43	+2.56	+3.11	+ 2.07	+ 1.76	+ 1.88	+ 0.95	+ 0.88	— 0.30	+ 1.16	+ 0.25	+ 0.12
1.880	2.820	2.415	1.000	1.620	18.980	17.574	20.232	18.588	22.771	33.898	31.182
—1.013	—0.777	+0.035	—1.798	+0.070	—9.594	-11.000	—8.342	—9.986	—5.803	+5.324	+2.608
14	13	15	6	9	103	103	110	115	110	116	115
...	...	3.8	7.8	18.7	107.5	67.7	113.8	67.5	99.6	122.9	84.6
...	...	+3.01	+ 3.81	+ 3.75	+37.05	— 2.75	+43.35	— 2.95	+29.15	+52.45	+14.15
...	...	2	8	13	70	75	79	77	84	77	81
17	17	15	18	12	201	197	170	185	187	185	180
0	6	0	2	1	17	28	60	67	55	77	47
19	20	17	13	13	212	197	203	236	209	206	182
3	4	1	0	3	26	23	22	28	22	34	32

TEMPERATURE.

	1875.	Average of 35 years.	Extremes.	
Mean temperature of the year	40.77	44.08	46.36 in '46	40.77 in '75.
Warmest month	July.	July.	July, 1868.	Aug., 1860.
Mean temperature of the warmest month	66.57	67.42	75.80	64.46
Coldest month	February.	February.	Feb., 1875.	Feb, 1848.
Mean temperature of the coldest month	10.16	22.90	10.16	26.60
Difference between the temperature of the warmest and coldest months	56.41	44.52	...	...
Mean of deviations of monthly means from their respective averages of 35 years, signs of deviation being disregarded	3.65	2.45	3.62 in 1843.	...
Month of greatest deviation without regard to sign	February.	January.	Feb., 1875.	...
Corresponding magnitude of deviation	12.74	3.64	12.74	...
Warmest day	July 4.	...	July 14, '68.	July 31, '44.
Mean temperature of the warmest day	74.25	77.73	84.50	72.75
Coldest day	Dec. 19.	...	Feb. 6, 1855. Jan. 22, 1857.	Dec. 22, '42.
Mean temperature of the coldest day	—8.33	—1.40	—14.38	9.57
Date of the highest temperature	July 26.	...	Aug. 24, 1854	Aug. 19, '40.
Highest temperature	88.0	91.02	99.2	82.4
Date of the lowest temperature	Feb. 13.	...	Jan. 10, 1859.	Jan. 2, 1842.
Lowest temperature	—16.0	—12.45	—26.5	1.9
Range of the year	104.0	103.47	118.2	87.0

BAROMETER.

	1875.	Average of 34 years.	Extremes.	
Mean pressure of the year	29.6151	29.6165	29.6770 in 1849.	29.5602 in 1864.
Month of the highest mean pressure	January.	September	Jan., 1849.	June, 1864.
Highest mean monthly pressure	29.7593	29.6668	29.8046	29.6525
Month of lowest mean pressure	December.	May.	March, 1859.	Nov., 1849.
Lowest mean monthly pressure	29.5244	29.5706	29.4143	29.5886
Date of the highest pressure in the year	Nov. 22.	...	Jan. 8, 1866.	Jan. 14, 1870.
Highest pressure	30.271	30.368	30.940	30.212
Date of the lowest pressure in the year	May 1.	...	Jan. 2, 1870.	Mar. 17, '45.
Lowest pressure	28.751	28.682	28.166	28.939
Range of the year	1.520	1.686	2.133 in 1866.	1.303 in 1845.

RELATIVE HUMIDITY.

	1875.	Average of 33 years.	Extremes.	
Mean humidity of the year	76	77	82 in 1851.	73 in 1858.
Month of greatest humidity	Feb., Dec.	January.	Jan., 1857.	Dec., 1858.
Greatest mean monthly humidity	86	83	89	81
Month of least humidity	May.	May.	Feb., 1843.	April, 1849.
Least mean monthly humidity	65	71	58	76

EXTENT OF SKY CLOUDED.

	1875.	Average of 22 years.	Extremes.	
Mean cloudiness of the year	0.62	0.61	0.66 in 1869.	0.57 in 1856.
Most cloudy month	December.	December.	...	...
Greatest monthly mean of cloudiness	0.78	0.75	0.83	0.73
Least cloudy month	July.	August.	...	...
Least monthly mean of cloudiness	0.43	0.49	0.29	0.50

WIND.

	1875.	Result of 27 years.	Extremes.	
Resultant direction	N. 70° W.	N. 62° W.	...	...
Resultant velocity in miles	2.31	1.97	...	...
Mean velocity without regard to direction	8.96	7.08	8.55 in '60.	5.10 in '53.
Month of greatest mean velocity	December.	March.	March, 1874.	Jan., 1848.
Greatest monthly mean velocity	10.42	9.13	13.24	5.82
Month of least mean velocity	August.	July.	Aug., 1852,	Sept., 1860.
Least monthly mean velocity	6.70	5.03	3.30	5.79
Day of greatest mean velocity	May 2.	...	Nov. 15, '71.	Dec. 2, 1848.
Greatest daily mean velocity	26.67	23.90	32.16	15.30
Day of least mean velocity	Sept. 15.	...	...	...
Least daily mean velocity	1.86	...	...	...
Hour of greatest absolute velocity	May 2, 1 to 2 & 2 to 3 p.m.	...	Dec. 27, '61. 9 to 10 a m.	Mar. 14, 1853 11 a.m. to n.
Greatest velocity	40.0	40.0	46.0	25.6

RAIN.

	1875.	Average of 35 years.	Extremes.	
Total depth of rain in inches	18.980	28.574	43.555 in '43.	17.574 in '74.
Number of days in which rain fell	103	109	130 in '61.	80 in 1841.
Month in which the greatest depth of rain fell.	May.	September	Sept., 1843.	Sept., 1848.
Greatest depth of rain in one month	2.980	3.597	9.760	3.115
Month in which the days of rain were most frequent	October.	October.	June, 1869. October, '64.	May, '41.
Greatest number of rainy days in one month	15	13	22	11
Day in which the greatest amount of rain fell	Sept. 16.	...	Sept. 14, 1843	Sept. 14, '48
Greatest amount of rain in one day	1.360	2.004	3.455	1.000

SNOW.

	1875.	Average of 32 years.	Extremes.	
Total depth of snow in inches	107.5	70.5	122.9 in '70.	38.4 in '51.
Number of days in which snow fell	70	64	87 in 1859.	33 in 1848.
Month in which the greatest depth of snow fell	January.	February.	March, 1870.	Dec., 1851.
Greatest depth of snow in one month	32.3	18.6	62.4	10.7
Month in which the days of snow were most frequent	January.	January.	Dec., 1872.	Feb., 1848.
Greatest number of days of snow in one month	17	14	24	8
Day in which the greatest amount of snow fell.	December.	...	Feb. 5, '63. Mar. 27, '70	Jan. 10, 1857.
Greatest fall of snow in one day	11.0	9.8	16.0	5.5

DIFFERENCE OF CERTAIN METEOROLOGICAL ELEMENTS FROM THEIR NORMAL VALUES FOR EACH QUARTER AND FOR THE YEAR.

Quarters.	Barometer.	Temperature	Rain.	Days Rain	Snow.	Days Snow.	Velocity of Wind.	Clouded Sky.
		°	in.		in.		miles.	
Winter	+.0659	−8.28	−2.289	−5.94	+23.27	+0.14	+0.88	−0.03
Spring	+.0006	−1.57	−2.446	−2.52	+ 3.21	+5.91	+2.40	+0.02
Summer	−.0196	−1.53	−3.166	+0.08	...	...	+1.91	0.00
Autumn	−.0524	−1.87	−1.693	+2.04	+10.57	−0.09	+2.31	+0.04
Year	−.0014	−3.31	−9.594	−6.34	+37.09	+5.96	+1.88	+0.01

PERIODICAL OR OCCASIONAL EVENTS, 1875.

January... 8. At 3.45 p.m., shock of an earthquake felt in Toronto.
March...... 12. Robins seen.
" 14. First lightning. 15th. First thunder storm.
" 15. Crows seen. 31st. Wild pigeons.
April...... 2. Blue birds. 5th. Butterflies seen.
" 13. Bay open. 14th. First schooner arrived.
" 20. First vessel left with cargo.
" 26. First steamer to Niagara.
" 27. "Ontario" frozen over from Lighthouse to entrance of Niagara River. Ice from ¼ to ½ inch in thickness.
May......... 1. Furious snow storm. 2nd Last snow of season.
" 5. Swallows seen. 8th. Frogs heard.
" 17. May bugs. 21st. Yellow birds. 19th Last frost.
" 21. Humming birds. Mosquitoes.
" 23. Baltimore birds. Wild strawberries in flower.
" 24. Plum trees in flower. 28th. Apple trees in flower.
June....... 11. Fireflies.
July....... 24. Humming birds numerous.
August.... 29. Swallows gone.
" 31. Night hawks numerous.
September 11. First frost of season.
" 20. First ice of season.
October.... 17. First snow of season.
November 29. Bay frozen. 30th. First sleighing.
December. 24. Bay open again.
" 26. Thunder storm. 29th. Lightning.

MONTHLY METEOROLOGICAL REGISTER, AT THE MAGNETICAL OBSERVATORY, TORONTO, ONTARIO—JANUARY, 1876.

Latitude—43° 39′ 4″ North. Longitude—5h. 17m. 33s. West. Elevation above Lake Ontario, 108 feet.

Day.	Barom. at temp. of 32°.				Temp. of the Air.				Excess of Mean above Normal	Tension of Vapour.				Humidity of Air.				Direction of Wind.				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.	10 PM	MEAN		6 A. M.	2 P. M.	10 P. M.	M'N.	6 A. M.	2 P. M.	10 P.M.	M'N.	6 A. M.	2 P. M.	10 P. M.	Res'l-tant.	6 A. M.	2 P. M.	10 P. M.	Res'l-tant.	MEAN.		
1	29.716	29.637	29.444	29.5822	° 44.5	° 40.5	° 38.0	° 40.33	° +19.00	.278	.248	.224	.242	94	98	98	96	N	E	E	° N 53 E	5.0	17.4	11.0	6.72	9.02	.160	...
2	.240	.380	.550	.4217	43.0	46.0	37.0	42.17	+20.87	—	—	—	—	—	—	—	—	S W	N W	W	N 88 W	16.0	26.0	8.0	10.26	14.00	...	...
3	.686	.640	.882	.7553	33.3	39.4	18.5	29.98	+ 8.73	.163	.101	.058	.106	86	41	58	61	W	S W	N W	N 89 W	10.6	21.2	26.0	14.19	16.96	...	...
4	30.119	30.155	30.089	30.1267	13.8	19.6	21.0	17.95	— 3.28	.063	.065	.096	.071	78	62	84	72	N	N	E	N 16 W	10.2	4.2	7.6	5.66	8.45	...	...
5	29.846	29.514	29.468	29.5908	25.4	39.1	38.3	34.68	+13.47	.118	.155	.208	.162	86	64	89	80	E	S	W	S 59 E	14.0	5.0	2.2	4.93	10.34	.180	...
6	.686	.892	.987	.8730	31.1	26.5	25.0	27.17	+ 5.95	.153	.111	.109	.119	87	77	81	80	N W	N W	N W	N 48 W	18.0	11.8	3.6	13.18	13.32	...	S
7	.800	.763	.777	.7858	28.6	34.8	28.6	30.53	+ 9.32	.138	.146	.138	.141	87	70	87	83	S W	W	S W	S 52 W	8.2	6.0	2.4	6.23	6.77	...	...
8	.600	.325	.208	.3627	29.0	38.0	36.9	35.47	+14.25	.147	.186	.218	.192	92	81	99	92	E	S	S W	S 7 E	3.8	10.2	2.0	3.36	4.75	.100	...
9	.220	.145	28.703	.0252	42.0	46.0	44.0	43.67	+22.43	—	—	—	—	—	—	—	—	S W	E	S W	S 24 W	6.0	5.4	18.5	6.21	8.79	.090	...
10	.239	.443	29.669	.4850	26.5	18.1	14.6	18.40	— 2.87	.111	.062	.060	.076	77	63	71	74	S W	W	N W	S 80 W	30.0	29.0	24.0	27.62	28.88	...	0.1
11	.787	.681	.623	.6850	12.4	18.5	17.8	15.93	— 5.38	.066	.065	.084	.070	88	65	87	79	W	W	S W	S 81 W	6.6	21.0	13.0	14.23	15.07	...	...
12	.573	.625	.761	.6592	16.0	17.8	12.7	14.92	— 6.45	.074	.066	.053	.063	83	68	67	73	N	W	W	N 65 W	7.2	15.0	8.0	9.23	10.43	...	...
13	.922	.985	.924	.9432	6.6	14.9	20.0	13.85	— 7.57	.047	.056	.081	.062	82	67	74	74	N	W	S W	N 50 W	7.7	8.6	11.0	4.74	7.71	...	...
14	.756	.681	.801	.7395	21.0	24.3	27.2	24.47	+ 3.02	.096	.111	.124	.113	83	84	84	84	S W	S W	W	S 35 W	20.0	15.6	10.4	14.09	14.33	...	0.1
15	.785	.560	.462	.5898	27.2	34.4	37.3	32.97	+11.47	.124	.145	.195	.159	84	74	87	83	S W	S	S W	S 32 W	10.2	17.5	16.0	10.88	11.63	R	...
16	.650	.717	.640	.6678	30.0	39.6	36.0	34.77	+13.21	—	—	—	—	—	—	—	—	S W	W	S E	S 48 W	3.8	11.0	10.0	6.48	7.99	...	...
17	.453	.435	.468	.4537	35.5	39.8	34.0	37.17	+15.55	.206	.206	.171	.201	99	84	87	91	S W	S W	S W	S 34 W	6.0	18.0	4.6	8.57	9.44	.120	...
18	.391	.032	28.981	.1220	36.2	42.7	42.7	41.43	+19.75	.209	.260	.269	.253	98	95	98	96	S W	N E	S W	S 26 W	2.2	9.5	6.5	1.47	6.07	.620	...
19	.161	.125	29.299	.2068	37.6	40.2	33.3	35.90	+14.15	.200	.157	.120	.156	88	63	62	73	S W	W	W	S 75 W	2.5	25.0	20.6	14.01	14.94	R	S
20	.529	.716	.779	.6993	26.5	26.8	26.5	26.35	+ 4.53	.126	.088	.106	.102	88	61	72	71	W	W	W	S 87 W	24.0	16.0	15.0	20.29	20.81	...	...
21	30.011	30.131	30.216	30.1283	18.5	21.0	13.8	17.53	— 4.35	.077	.063	.063	.067	76	55	77	69	N W	N W	N	N 61 W	21.0	13.0	4.8	13.55	15.78	...	...
22	30.131	29.909	29.651	29.8697	13.5	25.0	30.1	23.40	+ 1.47	.072	.123	.157	.120	91	92	93	92	N E	E	E	N 72 E	12.4	22.0	13.8	12.87	14.24	.010	2.5
23	29.510	.660	.760	.6483	32.0	36.0	31.0	32.67	+10.67	—	—	—	—	—	—	—	—	E	N W	N W	N 58 W	0.6	18.0	8.0	5.18	7.44	.140	...
24	.852	.900	.924	.8973	27.5	24.6	25.4	25.12	+ 3.05	.135	.107	.125	.116	90	81	91	85	W	N W	S W	N 66 W	12.0	6.9	7.0	6.94	7.92	...	S
25	.739	.431	.595	.5870	25.0	28.6	20.0	24.65	+ 2.53	.123	.144	.087	.114	91	92	80	85	S W	S W	N W	S 74 W	8.0	15.1	9.0	9.98	11.47	...	0.3
26	.793	.750	.507	.6623	18.5	25.7	30.1	24.72	+ 2.53	.085	.094	.134	.109	84	67	80	80	N W	S	S E	S 4 E	1.4	10.4	13.0	4.74	6.51	...	...
27	.111	.369	.590	.3763	36.2	42.0	35.8	37.65	+15.42	.209	.177	.181	.189	98	66	86	84	S W	W	N W	S 71 W	8.6	16.4	1.0	5.28	8.51	.430	...
28	.602	.388	.224	.3855	35.8	35.5	36.7	36.20	+13.88	.189	.194	.217	.200	90	93	99	94	E	E	E	N 69 E	9.0	16.0	7.5	9.70	9.95	.110	...
29	.165	.470	.967	.5772	41.2	27.2	17.8	26.67	+ 4.28	.235	.112	.078	.132	90	75	80	83	S W	W	W	S 84 W	20.0	31.5	28.0	22.34	24.00	...	0.2
30	30.140	30.067	.900	30.0228	14.0	20.4	26.0	20.92	— 1.51	—	—	—	—	—	—	—	—	W	S	S	S 27 W	3.0	14.4	10.7	7.53	10.75	...	...
31	29.761	29.659	.569	29.6507	27.2	36.9	32.2	32.47	+ 9.98	.118	.134	.154	.135	80	60	85	74	S W	S	S E	S 21 W	8.6	10.8	1.2	8.73	9.19	...	...
	29.6443	29.6189	29.6264	29.6316	27.60	31.29	28.65	29.03	+ 7.35	.137	.130	.135	.134	87	73	83	81	....	....	....	....	10.21	15.09	10.46	......	11.79	1.960	3.2

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR JANUARY, 1876.

NOTE.—The monthly means of the Barometer and Temperature include Sunday observations. The daily means, excepting those that relate to the wind, are derived from six observations daily, namely, at 6 A.M., 8 A.M., 2 P.M., 4 P.M., 10 P.M. and midnight. The means and resultants for the wind are from hourly observations.

Highest Barometer ....30.216 at 10 p.m. on 21st } Monthly range=
Lowest Barometer ....28.703 at 10 p.m. on 9th } 1.513.

Self-registering Ther.:
- Maximum temperature ....57°5 on 1st } Monthly range=
- Minimum temperature .... 5.1 on 13th } 52°4
- Mean maximum temperature ....36°85 } Mean daily range=
- Mean minimum temperature ....22°47 } 14°38
- Greatest daily range..........37°0 from a.m. to p.m. of 10th.
- Least daily range .... 3°4 from a.m. to p.m. of 28th.

Warmest day .... 9th; mean temperature 43°67 } Difference=29°82.
Coldest day .... 13th; mean temperature 13°85 }

Maximum Radiation { Solar ....104°2 on 27th } Monthly range=
{ Terrestrial ....—2.0 on 11th and 13th } 106°2.

No Aurora observed.

Possible to see Aurora on 9 nights; impossible on 22 nights.

Raining on 12 days; depth, 1.960 inches; duration of fall, 52.9 hours.

Snowing on 9 days; depth 3.2 inches; duration of fall 37.2 hours.

Mean of Cloudiness, 0.78.

WIND.

Resultant direction, S. 79° W.; Resultant Velocity, 6.31 miles.

Mean Velocity, 11.79 miles per hour.

Maximum Velocity, 39.5 miles from noon to 1 p.m. of 10th.

Most Windy day, 10th; Mean Velocity, 28.88 miles per hour.

Least Windy day, 7th; Mean Velocity, 4.75 miles per hour.

Most Windy hour, 2 p.m.; Mean Velocity, 15.09 miles per hour.

Least Windy hour, 3 a.m.; Mean Velocity, 9.71 miles per hour.

Fog on 1st, 7th, 8th, 9th, 18th and 19th.

Solar halos on 15th and 31st.

Lunar halos on 4th, 7th, 12th and 31st.

Large Meteor in N. W. at 9.35 p.m. of 25th.

COMPARATIVE TABLE FOR JANUARY.

YEAR.	TEMPERATURE. Mean.	Excess above Average.	Maximum.	Minimum.	Range.	RAIN. No. of days.	Inches.	SNOW. No. of days.	Inches.	WIND. Resultant. Direction.	V'lo-ity.	Mean Velocity.
1848	28.7°	+ 5.9°	51.1°	—11.4°	62.5°	7	2.245	8	7.1	N 82° W	2.03	5.82
1849	18.5	— 4.3	39.5	—14.2	53.7	4	1.175	10	9.2	N 63 W	3.06	6.71
1850	29.7	+ 6.9	46.4	9.9	36.5	5	1.250	8	5.2	N 37 W	0.69	5.80
1851	25.5	+ 2.7	43.4	—12.8	56.2	4	1.275	10	7.8	S 77 W	3.26	7.69
1852	18.4	— 4.4	37.3	—10.6	47.9	0	0.000	19	30.9	N 68 W	3.14	7.67
1853	23.0	+ 0.2	40.9	— 9.7	50.6	1	0.290	6	7.5	N 27 W	2.52	6.34
1854	23.6	+ 0.8	46.4	— 5.4	51.8	7	1.270	11	7.5	N 77 W	2.44	6.91
1855	25.9	+ 3.1	49.0	— 5.4	54.4	5	0.525	13	23.3	N 73 W	1.91	7.26
1856	16.0	— 6.8	34.4	—12.0	46.4	0	0.000	14	13.6	N 75 W	5.24	10.69
1857	12.8	—10.0	37.2	—20.1	57.3	3	Inap.	16	21.8	N 70 W	4.96	10.31
1858	30.0	+ 7.2	47.4	6.5	40.9	6	1.152	11	4.0	N 71 W	2.33	7.40
1859	26.4	+ 3.6	43.2	—26.5	69.7	6	1.449	19	16.4	S 81 W	3.17	8.76
1860	23.4	+ 0.6	46.4	— 6.8	53.2	6	0.740	16	8.7	N 89 W	6.09	9.37
1861	19.9	— 2.9	37.0	—11.2	48.2	4	0.685	23	20.6	N 86 W	2.92	9.30
1862	21.7	— 1.1	44.5	— 2.6	47.1	5	0.115	19	27.4	N 26 W	2.69	8.83
1863	28.1	+ 5.3	47.0	—14.0	61.0	10	1.122	17	20.6	N 61 W	1.13	7.23
1864	22.8	0.0	44.2	— 9.0	53.2	5	1.165	14	26.3	S 73 W	6.00	10.22
1865	17.7	— 5.1	37.2	— 9.0	46.2	1	0.440	18	14.8	N 85 W	4.80	9.39
1866	20.7	— 2.1	44.0	—14.0	58.0	4	0.522	19	10.3	N 75 W	2.98	9.34
1867	17.6	— 5.2	43.8	— 4.8	48.6	1	Inap.	21	42.0	N 55 W	3.27	6.96
1868	19.0	— 3.8	39.0	— 7.0	46.0	2	Inap.	21	14.6	S 83 W	3.97	8.91
1869	27.7	+ 4.9	45.0	— 1.0	46.0	4	0.887	12	9.8	N 72 W	3.40	9.21
1870	24.4	+ 1.6	45.0	— 3.2	48.2	8	3.412	18	21.3	S 89 W	2.63	8.98
1871	21.3	— 1.5	46.4	—13.2	59.6	8	0.864	23	43.6	S 49 W	2.56	9.84
1872	22.4	— 0.4	41.8	— 2.5	44.3	5	0.220	15	3.9	S 87 W	4.73	8.87
1873	17.7	— 5.1	46.0	—18.4	64.4	4	1.110	17	39.2	N 78 W	2.96	10.01
1874	24.8	+ 2.0	57.5	— 4.0	61.5	13	2.820	15	12.2	N 61 W	3.42	8.58
1875	16.1	— 6.7	39.0	— 8.8	47.8	1	Inap.	17	32.3	N 88 W	4.06	9.54
1876	29.0	+ 6.2	57.5	5.1	52.4	12	1.960	9	3.2	S 79 W	6.31	11.79
Res'lts to 1874.	22.77	......	43.57	—8.61	52.18	4.72	1.206	14.19	17.49	N 79 W	3.20	8.43
Excess for 1875	+ 6.26	......	+ 13.93	+ 13.71	— 0.22	+ 7.28	+ 0.754	— 5.19	— 14.29	...	...	+ 3.36

MONTHLY METEOROLOGICAL REGISTER, AT THE MAGNETICAL OBSERVATORY, TORONTO, ONTARIO—FEBRUARY, 1876.

Latitude—43° 39′4 North. Longitude—5h. 17m. 33s. West. Elevation above Lake Ontario, 108 feet.

Day.	Barom. at temp. of 32°. 6 A.M.	2 P.M.	10 P.M.	MEAN.	Temp. of the Air. 6 A.M.	2 P.M.	10 PM	MEAN	Excess of Mean above aver'ge	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N.	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Direction of Wind. 6 A.M.	2 P.M.	10 P.M.	Res'l-tant.	Velocity of Wind. 6 A.M.	2 P.M.	10 P.M	Res'l-tant.	MEAN	Rain in inches.	Snow in inches.
1	29.414	29.170	28.863	29.1380	35.8	36.2	17.8	29.40	+ 6.85	.173	.193	.084	.148	82	90	86	87	S	S	N W	S 1 W	8.0	5.6	23.0	4.70	8.85	.100	4.0
2	.372	.778	29.993	.7542	3.0	3.4	—0.6	1.82	—20.80	.050	.034	.038	.038	100	68	85	80	N W	N W	N W	N 54 W	25.0	29.5	4.2	21.44	21.53	...	1.0
3	.932	.726	.556	.7267	7.7	18.3	18.9	15.30	— 7.37	.051	.093	.100	.082	85	94	97	91	S W	S	S W	S 38 W	8.0	12.0	11.6	7.65	8.64	...	5.0
4	.667	.887	30.185	.9502	14.9	14.9	—0.6	8.72	—14.00	.080	.075	.036	.059	95	87	84	88	N W	W	W	N 85 W	5.0	22.5	4.6	11.53	12.40	...	0.5
5	30.347	30.267	30.067	30.2105	—2.0	22.5	28.2	15.82	— 6.97	.035	.078	.131	.076	90	64	82	77	N	S	S	S 18 W	9.8	15.0	8.0	2.71	9.31	...	...
6	29.946	29.739	29.675	29.7798	25.0	40.0	37.5	35.00	+12.16	—	—	—	—	—	—	—	—	S W	S	S W	S 31 W	17.9	16.1	13.8	13.40	13.73	...	...
7	.853	.912	30.039	.9448	36.9	39.4	32.6	34.33	+11.43	.200	.151	.142	.154	91	62	77	78	N W	W	W	S 81 W	13.0	14.5	2.4	7.90	8.88	...	...
8	30.030	.976	29.966	.9885	28.2	35.8	31.5	31.78	+ 8.82	.136	.157	.151	.147	87	74	85	82	W	N	N E	N 22 W	4.0	4.0	2.2	2.73	4.15	...	...
9	29.833	.440	.361	.5340	29.0	27.9	26.8	27.17	+ 4.13	.140	.145	.137	.137	88	95	94	93	E	N E	N	N 65 E	18.0	20.0	14.0	12.82	14.06	.400	1.0
10	.673	.685	.508	.6092	23.2	30.1	33.3	28.87	+ 5.80	.102	.150	.181	.146	82	89	95	89	N	E	E	N 64 E	7.0	10.4	15.5	7.69	9.75	.150	...
11	.190	.195	.478	.3090	37.6	41.2	36.2	39.00	+15.83	.225	.245	.184	.221	100	94	86	92	N W	N W	W	S 78 W	6.0	10.8	12.2	4.00	9.33	.730	...
12	.672	.611	.615	.6325	30.1	38.7	38.0	35.30	+12.05	.142	.143	.152	.143	85	60	66	69	S W	S W	S W	S 44 W	10.0	20.0	11.5	10.80	11.56	...	...
13	.661	.606	.491	.5760	31.0	38.0	30.5	32.77	+ 9.45	—	—	—	—	—	—	—	—	N	E	E	N 63 E	9.8	15.0	22.0	10.16	12.52	...	...
14	.193	.320	.344	.2905	31.9	39.1	34.0	35.05	+11.65	.181	.205	.180	.190	100	86	92	93	E	N E	N E	N 72 E	12.0	1.4	6.6	8.56	8.85	.720	...
15	.141	28.973	.083	.0662	33.3	33.3	30.1	31.83	+ 8.33	.180	.150	.105	.142	95	78	63	78	N W	N W	W	N 70 W	10.0	25.0	26.0	16.01	18.44	.030	0.5
16	.192	29.296	.385	.3015	27.5	25.4	24.3	25.00	+ 1.42	.129	.097	.111	.107	86	71	85	79	W	W	W	S 76 W	24.0	25.5	18.0	25.16	25.19	...	0.1
17	.441	.579	.676	.5805	21.4	23.9	23.2	22.48	— 1.22	.104	.109	.102	.103	90	84	82	85	N W	W	W	N 82 W	11.4	21.0	3.6	11.25	12.05	...	1.2
18	.729	.748	.693	.7195	21.0	32.4	29.7	28.63	+ 4.83	.098	.137	.125	.124	87	75	75	79	W	W	S W	S 70 W	4.2	14.0	10.2	6.45	8.03	...	0.1
19	.530	.476	.611	.5415	32.2	37.3	29.0	32.83	+ 8.93	.162	.088	.133	.125	88	39	83	69	S W	W	W	S 62 W	15.6	29.5	14.4	15.82	17.50	...	0.3
20	.802	.927	30.006	.9242	20.0	27.0	19.0	22.17	— 1.88	—	—	—	—	—	—	—	—	W	W	N	N 61 W	17.0	8.2	7.6	7.77	8.82	...	...
21	.900	.583	29.296	.5920	24.7	32.6	32.6	29.17	+ 4.95	.113	.067	.165	.115	84	36	89	72	E	E	W	N 73 E	13.0	18.5	37.8	5.57	14.00	.170	...
22	.623	.485	.595	.5755	22.1	27.2	10.2	19.10	— 5.22	.102	.124	.052	.089	86	84	76	81	W	S W	N W	N 85 W	13.0	14.0	20.0	18.28	21.31	...	0.1
23	.783	.809	.820	.8095	—0.2	5.9	7.0	4.65	—19.83	.038	.038	.048	.042	85	68	82	78	N W	N W	N W	N 51 W	11.0	13.0	5.0	15.37	15.44	...	0.1
24	.832	.778	.833	.8158	4.4	15.6	8.8	9.62	—15.00	.045	.060	.050	.052	85	69	78	77	N W	N W	N W	N 50 W	9.8	9.2	6.0	8.72	8.96	...	...
25	.825	.802	.809	.8125	9.5	21.0	21.4	17.48	— 7.28	.053	.089	.097	.080	81	78	84	80	N	E	N E	N 42 E	7.6	7.0	8.6	6.07	7.75	...	S
26	.808	.835	.871	.8368	22.1	20.0	20.3	20.62	— 4.38	.102	.067	.050	.069	86	62	45	61	E	N E	N E	N 55 E	13.4	19.0	16.0	13.58	13.83	...	...
27	.870	.750	.650	.7410	14.5	19.0	16.0	16.42	— 8.76	—	—	—	—	—	—	—	—	N E	N E	N E	N 53 E	15.5	16.0	17.0	16.54	16.58	...	2.2
28	.467	.417	.557	.4757	20.0	18.9	16.0	17.37	— 8.03	.100	.087	.087	.087	92	84	97	92	N E	N E	N E	N 45 E	23.2	10.0	7.0	12.24	12.92	...	4.0
29	.713	.840	.881	.8252	16.0	24.1	23.6	21.23	— 4.25	.074	.093	.105	.092	83	71	82	80	N W	W	W	N 67 W	5.2	7.0	8.0	6.45	6.79	...	...
	29.6703	29.6417	29.6518	29.6573	21.41	27.21	23.29	23.76	+ 0.12	.113	.115	.110	.111	89	74	82	81	...	...	...	...	11.98	14.96	12.23	...	12.45	2.300	20.1

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR FEBRUARY, 1876.

NOTE.—The monthly means of the Barometer and Temperature include Sunday observavations The daily means, excepting those that relate to the wind, are derived from six observations daily, namely, at 6 A.M., 8 A.M., 2 P.M., 4 P.M., 10 P.M., and midnight. The means and resultants of the wind are from hourly observations.

Highest Barometer..........30.350 t 8 a.m. on 5th. } Monthly range
Lowest Barometer..........28.863 at 10 p.m. on 1st. } 1.487.

Self-registering Ther.
- Maximum temperature..........44°1 on 11th. } Monthly range
- Minimum temperature.......... —3.9 on 5th. } 48°0.
- Mean maximum temperature..........30°17 } Mean Daily range
- Mean minimum temperature..........16°07 } 14°10.
- Greatest daily range..........42°3 from a.m. of 1st to a.m. of 2nd.
- Least daily range.......... 5°2 from a.m. to p.m. of 26th.

Warmest day.......... 11th; mean temperature......39°00 } Difference=37°18.
Coldest day.......... 2nd; mean temperature...... 1°82 }

Maximum Radiation { Solar..........129°8 on 29th. } Monthly range
{ Terrestrial.......... —15.0 on 4th. } 144°8.

Aurora observed on 2 nights, viz., 18th and 19th.

Possible to see Aurora on 11 nights; impossible on 18 nights.

Raining on 7 days; depth, 2.300 inches; duration of fall, 43.5 hours.

Snowing on 15 days; depth, 20.1 inches; duration of fall, 87.1 hours.

Mean of cloudiness, 0.73.

WIND.

Resultant direction, N. 63° W.; resultant velocity, 3.71 miles.

Mean velocity, 12.45 miles per hour.

Maximum velocity, 39.0 miles, from 11.30 p.m. of 21st to 0.30 a.m. of 22nd.

Most windy day, 15th; mean velocity, 25.19 miles per hour.

Least windy day, 8th; mean velocity, 4.15 miles per hour.

Most windy hour, noon; mean velocity, 15.34 miles per hour.

Least windy hour, 8 p.m.; mean velocity, 10.65 miles per hour.

Fog on 8th.

Thunder storms on 10th and 14th.

Solar halos on 8th and 23rd.

Lunar halos on 2nd, 7th, 8th, and 12th.

COMPARATIVE TABLE FOR FEBRUARY.

	TEMPERATURE.					RAIN.		SNOW.		WIND.		
										Resultant.		
YEAR.	Mean.	Excess above Average.	Maximum.	Minimum.	Range.	No. of days.	Inches.	No. of days.	Inches.	Direction.	V'locity.	Mean Velocity.
1848	26.6	+ 4.0	46.6	0.0	46.6	4	0.775	8	10.8	N 65 W	2.53	5.69
1849	19.5	— 3.1	40.6	— 9.8	50.4	2	0.240	13	19.2	N 41 W	1.48	6.58
1850	26.0	+ 3.4	49.6	2.2	47.4	7	1.235	9	23.1	N 80 W	3.48	7.61
1851	27.6	+ 5.0	50.2	2.0	48.2	7	2.600	4	2.4	N 64 W	1.99	6.94
1852	23.4	+ 0.8	41.2	— 6.2	47.4	3	0.650	11	13.0	S 75 W	3.34	6.42
1853	24.1	+ 1.5	43.4	— 1.4	44.8	4	1.030	15	12.6	N 49 W	2.51	7.30
1854	21.1	— 1.5	42.8	—10.8	53.6	5	1.460	15	18.0	N 7 E	1.73	6.91
1855	15.4	— 7.2	39.0	—25.4	64.4	2	1.770	14	21.8	N 40 W	4.34	8.17
1856	15.7	— 6.9	37.8	—18.7	56.5	0	0.000	8	9.7	N 81 W	7.70	10.71
1857	28.5	+ 5.9	52.4	— 5.9	58.3	11	3.050	11	11.7	S 78 W	3.68	9.82
1858	17.0	— 5.6	42.4	— 7.3	49.7	1	Inap.	16	26.7	N 72 W	3.22	9.12
1859	26.0	— 3.4	46.2	2.1	44.1	6	0.455	14	8.3	N 54 W	2.72	8.50
1860	22.8	+ 0.2	50.2	— 8.5	58.7	7	1.330	13	18.8	N 61 W	3.28	8.73
1861	26.1	+ 3.5	46.0	—20.8	66.8	4	0.815	17	29.7	N 77 W	3.86	10.58
1862	22.5	— 0.1	37.8	— 5.2	43.0	3	0.180	17	23.1	N 55 W	3.93	8.52
1863	22.4	— 0.2	41.5	—19.8	61.3	7	1.450	12	22.0	N 23 W	2.27	10.13
1864	24.3	+ 1.7	45.0	—15.0	60.0	2	0.397	14	9.5	S 84 W	6.48	10.11
1865	22.4	— 0.2	42.2	—10.0	52.2	5	0.810	11	16.8	N 23 W	3.95	8.23
1866	22.5	— 0.1	45.0	— 8.0	53.0	3	0.830	12	16.9	S 80 W	5.14	9.40
1867	28.9	+ 6.3	44.0	0.2	43.8	8	1.328	13	13.4	N 57 W	1.58	8.85
1868	17.2	— 5.4	45.0	—11.5	56.5	1	0.040	16	32.8	N 69 W	3.23	10.84
1869	25.0	+ 2.4	46.0	— 1.0	47.0	2	0.165	19	39.7	N 34 W	4.18	10.04
1870	21.5	— 1.1	40.6	— 6.6	47.2	2	0.520	18	20.1	N 29 W	2.84	8.10
1871	24.3	+ 1.7	48.0	—15.8	63.8	3	0.040	15	23.0	N 70 W	4.26	9.87
1872	20.7	— 1.9	45.2	— 3.6	48.8	5	0.350	9	7.3	N 61 W	3.32	8.93
1873	21.5	— 1.1	43.0	—10.5	53.5	0	0.000	11	10.4	N 68 W	4.29	10.21
1874	22.8	+ 0.2	42.0	0.4	41.6	6	1.150	15	19.1	N 24 W	2.46	8.12
1875	10.2	—12.4	47.6	—16.0	63.6	5	0.470	9	9.1	S 88 W	6.67	9.91
1876	23.8	+ 1.2	44.1	— 3.9	48.0	7	2.300	15	20.1	N 63 W	3.71	12.45
Res'lts to 1875.	22.55	......	44.33	—8.25	52.58	4.00	0.848	12.39	18.36	N 67 W	3.24	8.73
Excess for 1876	+ 1.21	......	— 0.23	— 4.35	— 4.58	+ 3.00	+ 1.452	+ 2.61	+ 1.74	...	...	+ 3.72

MONTHLY METEOROLOGICAL REGISTER, AT THE MAGNETICAL OBSERVATORY, TORONTO, ONTARIO—MARCH, 1876.

Latitude—43° 39'4 *North*. *Longitude*—5*h*. 17*m*. 33*s*. *West*. *Elevation above Lake Ontario*, 108 *feet*.

Day.	Barom. at temp. of 32°. 6 A.M.	2 P.M.	10 P.M.	Mean.	Temp. of the Air. 6 A.M.	2 P.M.	10 P.M.	MEAN	Excess of Mean above Average	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N.	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Direction of Wind. 6 A.M.	2 P.M.	10 P.M.	Res'l-tant.	Velocity of the Wind. 6 A.M.	2 P.M.	10 P.M.	Res'l-tant.	MEAN	Rain in inches	Snow in inches.
1	29.865	29.773	29.759	29.7978	19.6	23.2	12.9	18.85	— 6.72	.097	.090	.056	.081	92	72	71	78	W	N	N	N 34 W	5.2	8.5	16.8	7.10	8.50	...	S
2	.861	.911	.972	.9215	10.6	20.0	10.9	13.78	—12.02	.057	.060	.055	.057	83	56	78	72	N	N W	N W	N 28 W	14.0	22.8	11.5	15.63	16.02	...	...
3	.952	.919	.965	.9490	8.4	27.9	22.1	20.37	— 5.65	.054	.097	.088	.079	87	62	75	72	N W	S	W	N 79 W	7.0	13.2	6.4	5.98	8.13	...	...
4	30.001	.919	.898	.9317	17.1	34.0	25.4	26.17	— 0.08	.073	.141	.111	.109	79	72	81	77	W	S	S	S 34 W	4.2	12.7	2.0	5.87	6.89	...	...
5	29.881	.783	.764	.8048	21.5	40.5	44.0	35.25	+ 8.73	—	—	—	—	—	—	—	—	S	S	S W	S 18 W	2.2	11.4	11.4	5.16	5.53	.050	...
6	.779	.685	.581	.6732	37.6	49.2	39.8	42.68	+15.92	.217	.263	.172	.215	96	75	69	78	S	S	S	S 11 W	2.0	6.0	0.8	3.74	4.27	.100	...
7	.449	.284	.285	.3450	42.3	47.2	42.7	43.10	+16.10	.219	.275	.234	.240	81	85	85	85	S E	S	W	S 12 W	6.8	10.0	16.8	2.20	6.32	.050	...
8	.534	.650	.746	.6602	21.0	25.7	22.8	22.95	— 4.35	.096	.101	100	.098	84	73	82	80	N W	W	N	N 60 W	18.0	14.0	9.0	12.81	13.78	...	S
9	.766	.738	.743	.7523	20.0	28.3	26.5	25.10	— 2.45	.093	.105	.119	.108	86	68	83	80	N	S E	E	N 67 E	4.6	7.3	5.0	2.32	5.17	...	...
10	.730	.666	.660	.6827	29.3	33.1	32.8	31.72	+ 3.85	.129	.130	.155	.137	79	68	83	76	E	E	E	N 74 E	11.5	20.0	20.0	14.71	14.75	...	...
11	.632	.600	.628	.6058	31.0	35.8	39.1	36.17	+ 8.03	.154	.173	.226	.187	88	82	94	86	E	N E	N E	N 70 E	14.0	12.0	2.8	9.95	10.27	.200	...
12	.552	.425	.367	.4498	41.0	38.0	34.0	36.83	+ 8.36	—	—	—	—	—	—	—	—	N	N	N W	N 26 W	4.4	13.8	13.2	8.34	8.83	.320	0.3
13	.542	.746	.984	.7853	16.0	20.7	12.0	15.62	—13.15	.081	.065	.054	.065	90	60	73	74	N W	W	N W	N 67 W	30.0	27.5	10.0	21.91	22.89	...	1.7
14	30.104	30.102	30.128	30.1055	8.0	20.3	13.8	14.17	—14.92	.048	.091	.051	.065	78	82	63	76	N W	S	N	N 39 W	6.0	5.6	10.2	6.55	7.73	...	...
15	30.138	30.090	29.967	30.0558	9.5	19.2	23.6	18.50	—10.92	.053	.062	.078	.068	80	80	61	66	N	N E	E	N 56 E	7.5	11.6	16.0	10.10	11.73	...	...
16	29.669	29.152	28.928	29.2218	21.4	24.8	27.2	24.77	— 4.98	.097	.125	.142	.124	84	94	96	93	E	E	E	N 74 E	28.0	31.0	13.0	24.14	24.21	...	4.1
17	28.943	28.985	[illegible].285	.0915	32.6	32.6	14.9	26.10	— 3.98	.149	.158	.063	.123	81	85	73	81	S W	W	N W	N 69 W	9.5	15.5	19.0	7.85	12.92	...	0.2
18	29.547	29.77[illegible]	.940	.7830	0.8	4.4	6.2	3.17	—27.27	.032	.036	.035	.036	74	69	61	72	N W	N W	N W	N 35 W	24.0	22.6	12.0	20.85	21.08	...	...
19	30.061	30.075	30.042	30.0578	2.5	22.0	16.0	14.50	—16.27	—	—	—	—	—	—	—	—	N W	W	N	N 67 W	4.8	10.0	6.0	5.46	6.87	...	...
20	29·878	29.568	29.234	29.5273	20.3	22.1	23.9	22.95	— 8.17	.091	.102	.128	.109	82	86	100	88	E	E	E	S 81 E	17.5	19.0	22.0	16.69	17.63	...	9.0
21	.041	.165	.370	.2107	23.6	27.2	20.0	22.20	— 9.27	.126	.097	.087	.097	99	65	80	81	N	N W	W	N 40 W	11.0	22.0	10.3	8.54	14.60	...	6.5
22	.568	.656	.708	.6503	22.8	28.4	22.8	24.38	— 7.45	.100	.084	.081	.085	82	53	66	66	W	W	W	N 89 W	12.9	22.0	4.5	13.53	13.61	...	...
23	.705	.689	.770	.7270	22.1	35.5	27.2	27.90	— 4.30	.088	.109	.112	.102	76	72	75	67	W	S W	N W	S 77 W	6.4	15.0	2.4	8.48	9.33	...	...
24	.834	.782	.573	.7130	18.9	34.0	31.5	29.10	— 3.47	.087	.141	.141	.127	84	72	79	78	N	N E	E	N 62 E	5.6	17.0	22.5	10.29	11.79	...	0.5
25	.323	.188	.157	.2132	32.6	32.9	32.9	32.87	— 0.07	.179	.181	.181	.180	97	97	97	96	E	E	N E	N 71 E	24.0	24.5	9.5	19.96	20.00	.530	4.5
26	.130	.202	.393	.2580	32.0	39.0	33.0	34.00	+ 0.70	—	—	—	—	—	—	—	—	E	S W	W	S 74 W	2.4	7.5	10.0	5.55	7.69	...	0.4
27	.491	.614	.658	.6028	29.3	30.4	27.5	28.95	— 4.73	.145	.102	.112	.116	89	61	74	73	W	W	W	N 77 W	6.5	19.0	7.3	13.21	13.31	...	...
28	.574	.295	28.873	.2078	26.1	26.8	29.0	27.67	— 6.38	.109	.137	.154	.134	77	94	97	89	N W	N E	N E	N 47 E	3.2	21.0	11.5	9.63	11.62	...	10.5
29	28.729	28.909	29.029	28.8995	27.2	28.2	22.8	25.37	— 9.08	.139	.107	.100	.114	94	68	82	82	S W	S W	S W	S 62 W	14.0	19.4	10.3	12.06	14.79	...	5.7
30	29.000	29.112	.412	29.1955	22.1	32.9	29.1	28.70	— 6.12	.102	.168	.129	.133	86	90	86	86	S W	N W	W	S 72 W	13.0	14.0	6.4	9.34	11.48	...	0.7
31	.564	.676	.832	.7038	30.1	36.7	31.9	32.82	— 2.37	.150	.128	.122	.135	89	59	67	72	W	N W	N	N 67 W	9.2	13.0	12.6	10.29	11.44	..	...
	29.6078	29.5848	29.6016	29.5994	22.49	29.71	25.75	26.02	— 3.95	.110	.123	.114	.116	85	73	79	79	...	...	...	...	10.63	15.77	10.68	...	12.04	1.250	44.1

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR MARCH, 1876.

NOTE.—The monthly means of the Barometer and Temperature include Sunday observations. The daily means, excepting those that relate to the wind, are derived from six observations daily, namely, at 6 A.M., 8 A.M., 2 P.M., 4 P.M., 10 P.M., and midnight. The means and resultants for the wind are from hourly observations.

Highest Barometer............................ 30.168 at 7 a.m. on 15th. } Monthly range
Lowest Barometer............................. 28.729 at 6 a.m. on 29th. } 1.439.

Self-registering Ther.
Maximum temperature................................ 50°5 on 6th. } Monthly range
Minimum temperature.............................. —2°9 on 18th. } 53°4.
Mean maximum temperature ....33°35. } Mean daily range
Mean minimum temperature ....18°85. } 14°50.
Greatest daily range...........41°9 from a.m. of 17th to a.m. of 18th.
Least daily range................ 5°4 from a.m. to p.m. of 28th.

Warmest day ....7th ; mean temperature ....43°10 } Difference=39°93.
Coldest day...........[illegible]h; mean temperature .... 3°17 }

Maximum Radiation { Solar ....130°0 on 23rd. } Monthly range
{ Terrestrial .... —14°2 on 19th. } 144.2.

Aurora observed on 1 night, viz., 30th.

Possible to see Aurora on 14 nights; impossible on 17 nights.

Snowing on 14 days; depth 44.1 inches; duration of fall 97.0 hours.

Raining on 6 days; depth, 1.250 inches; duration of fall 31.5 hours.

Mean of cloudiness, 0.70.

WIND.

Resultant direction N. 29° W.; resultant velocity 3.43 miles.

Mean velocity 12.04 miles per hour.

Maximum velocity 31.0 miles, from noon to 1 p.m. of 16th.

Most windy day 16th; mean velocity 24.21 miles per hour.

Least windy day 6th; mean velocity 4.27 miles per hour.

Most windy hour 2 p.m.; mean velocity 15.77 miles per hour.

Least windy hour 6 a.m.; mean velocity 10.11 miles per hour.

Fog on 7th.

Solar halos on the 4th, 9th, 14th, 15th, 18th and 24th.

Lunar halos on the 1st and 6th.

COMPARATIVE TABLE FOR MARCH.

YEAR.	TEMPERATURE. Mean.	Excess above aver'ge	Maximum.	Minimum.	Range.	RAIN. No. of days.	Inches	SNOW. No. of days.	Inches.	WIND. Resultant. Direction.	Vel'y	Mean Velocity.
1848	28.6	— 0.5	58.6	0.0	58.6	5	1.220	6	9.7	N 66 W	2.03	5.80
1849	33.5	+ 6.4	53.0	15.1	37.9	7	1.525	2	2.3	N 3 W	1.48	5.37
1850	29.8	+ 0.7	46.5	7.2	39.3	2	0.745	7	11.2	N 52 W	2.62	7.62
1851	32.4	+ 3.3	59.3	12.0	47.3	3	0.770	9	8.8	N 21 W	1.93	7.65
1852	27.7	— 1.4	44.8	— 7.4	52.2	8	3.080	12	19.5	N 8 W	0.71	5.81
1853	30.6	+ 1.5	56.3	0.0	56.3	6	1.080	8	7.1	N 58 W	2.60	5.96
1854	30.7	+ 1.6	55.1	7.4	47.7	9	2.425	3	2.8	N 53 W	3.39	8.03
1855	28.5	— 0.6	49.4	— 2.9	52.3	5	1.485	11	18.1	N 88 W	4.76	9.95
1856	23.1	— 6.0	41.4	—14.0	55.4	0	0.000	12	16.2	N 71 W	7.68	11.39
1857	27.8	— 1.3	57.6	— 5.5	63.1	4	0.335	15	11.3	N 63 W	6.63	10.84
1858	28.4	— 0.7	55.4	— 5.5	60.9	10	0.917	6	0.2	N 58 W	5.45	8.56
1859	36.3	+ 7.2	54.2	9.8	44.4	15	4.054	8	1.0	N 64 W	1.96	10.89
1860	34.5	+ 5.4	67.0	12.8	54.2	5	0.882	11	2.4	N 64 W	7.61	12.41
1861	26.9	— 2.2	47.4	— 5.2	52.6	8	2.125	14	7.1	N 54 W	4.33	10.56
1862	28.8	— 1.0	43.2	8.0	35.2	8	2.560	11	18.5	N 12 W	2.50	9.38
1863	25.8	— 3.3	42.2	— 4.0	46.2	4	0.687	17	11.4	N 27 W	2.62	9.27
1864	29.1	0.0	50.2	3.0	47.2	9	1.620	12	3.7	N 53 W	2.29	8.41
1865	33.6	+ 4.5	55.6	— 3.5	59.1	10	3.050	12	18.9	N 61 W	2.16	8.80
1866	27.6	— 1.5	45.8	7.5	38.3	8	1.915	18	7.2	N 78 W	6.84	11.51
1867	26.6	— 2.5	46.8	3.0	43.8	6	0.617	14	33.4	N 34 W	2.12	8.52
1868	31.3	+ 2.2	59.0	—15.6	74.6	7	2.660	5	4.2	N 21 W	2.12	8.58
1869	23.1	— 6.0	46.8	— 5.4	52.2	3	0.985	9	15.0	N 52 W	2.86	8.02
1870	26.3	— 2.8	44.0	5.2	38.8	2	0.755	18	62.4	N 18 E	4.73	10.13
1871	34.7	+ 5.6	58.5	17.0	41.5	8	2.782	12	13.0	N 31 W	2.59	8.31
1872	19.9	— 9.2	46.4	—10.8	57.2	2	0.700	14	16.3	N 66 W	5.36	10.48
1873	26.6	— 2.5	45.0	— 6.0	51.0	5	1.756	15	25.2	N 61 W	5.91	11.47
1874	28.7	— 0.4	57.0	5.5	51.5	10	1.390	10	2.6	N 65 W	7.47	13.24
1875	24.1	— 5.0	51.5	— 1.5	53.0	3	0.930	11	30.0	N 23 W	2.80	9.40
1876	26.0	— 3.1	50.5	— 2.9	53.4	6	1.250	14	44.1	N 29 W	3.43	12.04
Res'lts to 1875.	29.14	...	51.36	0.94	50.42	6.07	1.569	10.28	12.98	N 51 W	8.36	9.14
Excess for '76.	— 3.12	...	— 0.86	— 3.84	+ 3.98	— 0.07	— 0.319	+ 3.82	+ 31.12	...	...	+ 2.90

MONTHLY METEOROLOGICAL REGISTER, AT THE MAGNETICAL OBSERVATORY, TORONTO, ONTARIO—APRIL, 1876.

Latitude—43° 39′ 4″ North. Longitude—5h. 17m. 33s. West. Elevation above Lake Ontario, 108 feet.

Day.	Barom. at temp. of 32°. 6 A.M.	2 P.M.	10 P.M.	Mean.	Temp. of the Air. 6 A.M.	2 P.M.	10 PM	MEAN	Excess of Mean above Normal	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N.	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	M'N.
1	29.935	30.004	30.096	30.0257	24.6	30.8	23.5	27.30	— 8.30	.114	.098	.092	.104	85	56	64	70
2	30.108	29.983	29.898	29.9200	21.8	34.9	33.5	31.55	— 4.42	—	—	—	—	—	—	—	—
3	29.580	.429	.368	.4428	33.7	38.4	35.1	35.73	— 0.63	.186	.194	.198	.194	97	83	97	93
4	.387	.472	.573	.4895	34.4	41.6	35.8	36.97	+ 0.23	.191	.182	.173	.183	96	69	82	83
5	.472	.273	.457	.4040	31.5	39.1	38.4	37.35	+ 0.22	.169	.210	.122	.154	96	88	52	70
6	.518	.564	.515	.5282	31.8	42.3	36.0	38.53	+ 1.03	.132	.096	.154	.127	65	35	72	55
7	.316	.449	.642	.4700	36.9	35.5	33.3	35.30	— 2.60	.209	.132	.150	.159	95	63	78	77
8	.700	.717	.786	.7360	31.1	34.4	24.6	30.20	— 8.08	.153	.107	.082	.112	87	53	60	65
9	.831	.826	.825	.8275	22.2	35.0	28.8	29.63	— 9.03	—	—	—	—	—	—	—	—
10	.854	.812	.768	.8113	26.5	41.6	36.9	36.08	— 2.95	.106	.123	.134	.130	73	46	60	62
11	.735	.702	.644	.6885	29.9	36.8	35.2	34.52	+ 1.48	.137	.101	.137	.119	74	31	54	47
12	.630	.506	.524	.5817	41.2	38.7	39.1	39.97	+ 0.17	.128	.220	.234	.199	49	93	98	81
13	.414	.245	.141	.2492	38.0	40.2	43.8	41.73	+ 1.55	.212	.238	.274	.254	92	95	96	95
14	.095	28.939	.161	.0710	39.8	50.7	42.0	45.05	+ 4.49	—	—	—	—	—	—	—	—
15	.190	29.224	.179	.1975	38.0	47.0	40.5	41.52	+ 0.58	.157	.149	.216	.160	69	46	86	66
16	.218	.230	.350	.2743	33.8	42.7	34.6	37.20	— 4.12	—	—	—	—	—	—	—	—
17	.370	.479	.631	.5080	32.4	36.6	32.8	33.83	— 7.87	.167	.126	.119	.135	91	57	63	69
18	.681	.723	.783	.7385	31.9	38.0	32.0	34.30	— 7.75	.125	.113	.134	.126	69	49	74	64
19	.854	.907	.934	.9010	30.8	39.4	34.4	35.77	— 6.67	.149	.160	.174	.154	85	65	88	74
20	.904	.667	.496	.6792	29.7	38.4	38.5	38.08	— 4.73	.147	.165	.198	.169	89	70	82	73
21	.551	.733	.792	.7030	41.6	44.9	38.4	41.90	— 1.28	.182	.173	.173	.174	69	57	74	66
22	.736	.665	.621	.6628	31.9	42.9	39.7	38.17	— 2.68	.168	.199	.228	.197	90	57	89	78
23	.603	.676	.718	.6712	37.8	46.6	37.2	41.53	— 1.42	—	—	—	—	—	—	—	—
24	.736	.748	.748	.7457	38.7	48.5	43.4	44.77	+ 0.47	.169	.166	.178	.177	71	48	63	60
25	.786	.823	.822	.8132	40.5	48.8	43.0	44.77	+ 0.10	.208	.240	.193	.209	82	69	69	70
26	.843	.752	.706	.7588	40.7	55.7	42.7	47.35	+ 2.33	.146	.150	.179	.157	56	33	65	50
27	.671	.554	.379	.5123	42.0	49.5	46.3	46.33	+ 0.92	.206	.199	.223	.208	77	56	71	67
28	.152	.285	.514	.3308	46.3	55.3	38.4	46.23	+ 0.47	.301	.204	.147	.215	96	46	63	69
29	.514	.384	.402	.4235	33.7	52.2	36.9	41.70	— 4.40	.158	.109	.097	.133	82	28	43	53
30	.422	.521	.639	.5322	30.0	34.0	35.0	33.92	—12.55	—	—	—	—	—	—	—	—
	29.5935	29.5766	29.5986	29.5889	34.21	42.01	36.76	38.24	— 2.85	.167	.161	.167	.165	81	58	73	69

Day.	Direction of Wind. 6 A.M.	2 P.M.	10 P.M.	Res'l-tant.	Velocity of Wind. 6 A.M.	2 P.M.	10 P.M.	Res'l-tant.	MEAN.	Rain in inches.	Snow in inches.
1	N W	N	N	N 35° W	11.0	13.0	9.0	11.68	12.21	...	...
2	N W	N E	E	N 53 E	7.8	10.4	14.5	9.04	11.15	...	...
3	E	N E	N W	N 69 E	7.8	7.4	4.0	6.77	7.31	.350	...
4	N W	W	N W	N 73 W	3.6	6.2	1.0	3.51	3.74	...	...
5	S E	S W	S W	S 30 W	6.4	12.8	13.0	7.47	11.17	.070	S
6	S W	W	S W	S 59 W	23.5	21.0	12.6	17.48	17.98	...	...
7	S W	N W	W	N 73 W	7.0	29.5	8.6	12.08	14.94	.190	...
8	N W	N W	N W	N 44 W	10.5	13.0	11.6	12.70	13.79	...	...
9	N	N	N W	N 18 W	5.0	6.6	6.0	5.63	6.70	...	...
10	N	S	N W	N 31 W	7.2	2.8	4.0	1.41	3.86	...	...
11	N	E	E	N 59 E	5.8	11.5	9.0	5.53	6.55	...	...
12	N E	N E	N E	N 50 E	5.0	11.0	3.8	6.60	6.73	.250	...
13	E	E	W	N 40 E	3.0	5.2	4.0	2.69	3.63	.125	...
14	N E	S W	S W	S 39 W	4.2	21.4	20.0	8.70	12.80	.120	...
15	S W	W	S W	S 69 W	11.8	27.0	10.6	14.96	15.72	.030	0.3
16	W	W	W	S 89 W	4.0	22.0	11.0	11.69	12.42	...	...
17	W	W	N W	N 80 W	10.4	22.0	8.4	13.29	13.67	...	...
18	W	W	N W	N 65 W	8.6	10.0	4.4	6.55	6.76	...	...
19	N W	S W	S W	N 77 W	8.0	7.2	1.8	3.14	6.35	...	...
20	S W	E	N W	N 76 E	2.0	13.4	3.8	4.63	7.56	.010	...
21	W	N W	N W	N 78 W	19.8	24.0	5.4	16.50	17.21	...	...
22	W	S E	W	S 24 E	1.2	12.0	6.7	0.63	5.29	.250	...
23	N W	S	N	N 28 W	4.0	6.4	5.8	2.80	5.62	R	...
24	N	E	N	N 53 E	5.8	13.4	7.2	6.60	8.67	...	...
25	N W	S	S W	S 30 W	2.6	12.6	2.2	4.43	5.58	...	...
26	N W	S E	S	S 14 W	3.6	10.0	2.4	2.90	7.04	...	...
27	S W	E	E	S 88 E	1.6	14.5	7.2	6.26	7.14	.010	...
28	S W	W	N W	N 69 W	9.5	29.0	6.0	9.86	14.28	.360	...
29	S	W	N	S 81 W	4.0	25.5	3.8	7.61	11.05	.040	...
30	N W	N W	N W	N 37 W	19.0	28.0	10.0	19.76	19.87	...	S
	....	....	....	....	7.46	14.96	7.26	....	9.89	1.805	...

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR APRIL, 1876.

NOTE.—The monthly means of the Barometer and Temperature include Sunday observations. The daily means, excepting those that relate to the wind, are derived from six observations daily, namely, at 6 A.M., 8 A.M., 2 P.M., 4 P.M., 10 P.M. and midnight. The means and resultants for the wind are from hourly observations.

Highest Barometer ....30.109 at midnight on 1st } Monthly range=
Lowest Barometer ....28.939 at 2 p.m. on 14th } 1.170.

Self-registering Ther.:
- Maximum temperature ....57°2 on 26th } Monthly range=
- Minimum temperature ....17.0 on 2nd } 40°2
- Mean maximum temperature ....45°59 } Monthly range=
- Mean minimum temperature ....31°73 } 14°42
- Greatest daily range........................21°5 from a.m. to p.m. of 29th.
- Least daily range .... 4°4 from a.m. to p.m. of 12th.

Warmest day .... 26th; mean temperature 47°35 } Difference=20°05.
Coldest day .... 1st; mean temperature 27°30 }

Maximum Radiation { Solar .... 123°2 on 2nd } Monthly range=
{ Terrestrial........................ 6.0 on 2nd } 117°2.

Aurora observed on three nights, viz, 19th, 23rd and 24th.

Possible to see Aurora on 17 nights; impossible on 13 nights.

Snowing on 3 days; depth 0.3 inches; duration of fall 2.5 hours.

Raining on 13 days; depth, 1.805 inches; duration of fall, 53.2 hours.

Mean of Cloudiness, 0.61.

WIND.

Resultant direction, N. 69° W.; Resultant Velocity, 4.11 miles.

Mean Velocity, 9.89 miles per hour.

Maximum Velocity, 33.0 miles from noon to 1 p.m. of 7th.

Most Windy day, 30th; Mean Velocity, 19.87 miles per hour.

Least Windy day, 13th; Mean Velocity, 3.63 miles per hour.

Most Windy hour, 2 p.m.; Mean Velocity, 14.96 miles per hour.

Least Windy hour, 1 a.m.; Mean Velocity, 6.62 miles per hour.

Fog on 3rd, 12th, 13th and 14th.

Lightning on 12th.

Thunder on 14th and 22nd.

Solar halos on 9th and 10th.

Lunar halo on 6th.

COMPARATIVE TABLE FOR APRIL.

YEAR.	TEMPERATURE.					RAIN.		SNOW.		WIND.		
	Mean.	Excess above Average.	Maximum.	Minimum.	Range.	No. of days.	Inches.	No. of days.	Inches.	Resultant. Direction.	Resultant. V'locity.	Mean Velocity.
1848	41.3°	+ 0.6°	65.1°	22.7°	42.4°	5	1.455	1	0.5	N 77° W	1.46	4.89
1849	39.0	— 1.7	72.0	15.5	56.5	10	2.655	2	1.7	N 43 W	3.14	7.50
1850	37.9	— 2.8	65.7	18.0	47.7	7	4.720	2	1.1	N 50 E	1.12	7.64
1851	41.3	+ 0.6	59.3	25.8	33.5	11	2.295	3	1.2	N 14 E	2.52	8.07
1852	38.2	— 2.5	53.8	20.0	33.8	6	1.990	4	9.4	N 23 E	2.44	6.68
1853	41.9	+ 1.2	65.7	25.0	40.7	10	2.625	1	1.0	N 12 W	1.95	5.20
1854	41.0	+ 0.3	64.5	20.2	44.3	12	2.685	4	2.7	N 50 E	2.57	6.81
1855	42.4	+ 1.7	69.4	10.7	58.7	8	2.030	3	1.6	N 36 W	3.99	7.57
1856	42.3	+ 1.6	72.2	14.2	58.0	13	2.780	3	0.1	N 29 E	1.64	6.05
1857	35.3	— 5.4	52.0	5.9	46.1	10	1.755	11	12.9	N 60 W	4.15	10.24
1858	41.5	+ 0.8	65.2	21.8	43.4	13	1.642	2	0.1	N 14 W	1.64	9.57
1859	39.5	— 1.2	64.8	22.6	42.2	9	2.527	8	1.2	N 36 W	2.33	10.79
1860	39.5	— 1.2	61.8	19.5	42.3	11	1.282	5	0.3	N 37 W	4.10	10.39
1861	42.0	+ 1.3	67.0	23.8	43.2	12	1.619	4	6.9	N 37 E	2.31	8.90
1862	39.6	— 1.1	68.0	14.5	53.5	10	2.235	4	0.2	N 50 E	2.48	9.77
1863	42.0	+ 1.3	69.0	8.6	60.4	8	2.210	4	1.6	N 14 E	3.75	9.20
1864	40.9	+ 0.2	59.4	28.1	31.3	16	3.633	3	3.5	N 41 E	3.39	7.77
1865	43.1	+ 2.4	62.5	23.0	39.5	17	3.972	6	2.0	N 84 W	2.11	8.39
1866	43.9	+ 3.2	71.0	28.5	42.5	7	1.675	2	Inap.	N 42 W	3.34	7.95
1867	39.5	— 1.2	65.5	25.4	40.1	12	2.147	5	7.2	N 51 W	2.68	7.89
1868	38.0	— 2.7	64.0	9.2	54.8	7	0.990	10	5.3	N 63 W	2.43	9.24
1869	40.1	— 0.6	72.2	16.6	55.6	9	2.965	6	0.5	N 59 W	4.03	8.91
1870	44.6	+ 3.9	67.0	29.6	37.4	9	2.145	2	0.1	N 40 E	3.55	7.03
1871	43.0	+ 2.3	72.8	26.4	46.4	17	3.318	2	1.3	N 48 W	1.86	8.85
1872	40.5	— 0.2	70.0	22.7	47.3	9	0.910	5	0.7	N 68 W	3.84	9.12
1873	38.6	— 2.1	61.2	24.4	36.8	13	3.975	3	Inap.	N 18 E	2.89	9.05
1874	34.2	— 6.5	60.8	9.5	51.3	4	1.240	7	11.0	N 39 W	4.09	9.64
1875	36.4	— 4.3	62.2	10.0	52.2	10	1.230	8	2.7	N 37 W	3.71	10.16
1876	38.2	— 2.5	57.2	17.0	40.2	13	1.805	3	0.3	N 69 W	4.11	9.89
Res'lts to 1875.	40.72	......	65.14	19.36	45.78	9.89	2.428	3.86	2.53	N 22 W	2.19	8.33
Excess for 1876	— 2.48	......	— 7.94	— 2.36	— 5.58	+ 3.11	— 0.623	— 0.86	— 2.23	...	...	+ 1.56

MONTHLY METEOROLOGICAL REGISTER, AT THE MAGNETICAL OBSERVATORY, TORONTO, ONTARIO—MAY, 1876.

Latitude—43° 39′4 *North*. *Longitude*—5*h*. 17*m*. 33*s*. *West*. *Elevation above Lake Ontario*, 108 *feet*.

Day.	Barom. at temp. of 32°. 6 A.M.	2 P.M.	10 P.M.	Mean.	Temp. of the Air. 6 A.M.	2 P.M.	10 PM	MEAN	Excess of Mean above Av'rage.	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N.	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Direction of Wind. 6 A.M.	2 P.M.	10 P.M.	Resultant.	Velocity of Wind. 6 A.M.	2 P.M.	10 P.M.	Result't	MEAN	Rain in inches.	Snow in inches.
1	29.677	29.658	29.677	29.6795	32.2°	48.1°	36.9°	39.32°	— 7.53°	.162	.190	.192	.170	89	56	87	73	N W	N W	N W	N 43° W	19.7	24.0	5.2	16.16	16.35	...	...
2	.640	.594	.582	.6013	37.4	49.2	43.0	43.67	— 3.52	.139	.194	.169	.169	62	54	60	59	N	S W	N	N 36 W	10.9	8.0	6.2	6.18	8.31	...	...
3	.568	.557	.552	.5588	38.0	55.3	43.0	45.73	— 1.82	.170	.183	.193	.183	73	42	69	61	N W	S	S E	S 8 W	2.6	10.5	4.4	3.98	6.51	...	...
4	.510	.503	.667	.5623	39.8	53.5	44.8	45.50	— 2.40	.217	.168	.224	.204	88	41	75	69	E	W	N	S 83 W	9.0	23.0	2.0	3.59	10.66	.110	...
5	.712	.669	.546	.6258	40.2	44.9	43.4	42.80	— 5.47	.221	.255	.275	.248	88	85	98	90	E	E	E	N 73 E	11.8	16.0	9.0	11.89	12.10	.240	...
6	.560	.656	.638	.6245	45.0	56.4	50.6	52.28	+ 3.63	.294	.300	.265	.294	98	66	72	76	S W	W	N E	N 84 W	6.8	10.0	6.0	5.56	8.32	R	...
7	.435	.413	.429	.4203	45.8	55.8	50.1	50.85	+ 0.87	—	—	—	—	—	—	—	—	E	S	E	N 77 E	15.0	6.2	3.2	5.39	7.27	.200	...
8	.327	.326	.443	.3688	49.9	55.3	52.2	53.40	+ 4.07	.352	.387	.265	.325	98	88	67	80	N E	S W	W	S 73 W	5.4	15.5	11.0	5.64	8.94	.100	...
9	.421	.381	.385	.3972	47.4	48.5	43.0	46.27	— 3.42	.268	.263	.256	.257	82	77	92	82	N	S E	S	S 46 W	2.2	4.0	1.8	1.75	3.27	.050	...
10	.346	.421	.592	.4633	40.9	45.6	44.5	44.37	— 5.68	.248	.260	.228	.246	96	85	77	84	N E	N W	N W	N 24 W	2.4	10.4	10.0	5.84	8.23	.220	...
11	.727	.758	.728	.7425	41.2	57.5	49.2	50.22	— 0.18	.170	.165	.225	.195	65	35	64	54	N W	W	S W	N 67 W	15.0	7.4	12.0	7.77	10.17	R	...
12	.609	.645	.685	.6418	43.8	47.4	45.6	46.13	— 4.58	.260	.272	.218	.246	91	83	71	79	N E	S	W	N 79 W	3.8	7.4	6.6	2.74	7.08	.290	...
13	.704	.794	.900	.8048	42.3	53.9	44.1	46.78	— 4.32	.202	.182	.196	.192	74	44	68	61	N W	N W	N	N 48 W	16.0	19.0	3.2	14.57	15.46	...	...
14	.905	.819	.776	.8295	36.8	51.7	49.2	48.55	— 2.88	—	—	—	—	—	—	—	—	W	S	N W	S 40 W	2.6	3.8	2.2	2.50	4.12	...	...
15	.823	.846	.908	.8670	45.6	41.6	43.0	43.05	— 8.75	.186	.248	.233	.224	60	94	84	81	E	N E	N E	N 53 E	8.0	13.0	6.0	4.88	8.47	.350	...
16	.975	.958	.894	.9313	45.2	51.0	47.0	47.62	— 4.52	.155	.179	.177	.167	51	48	54	50	E	E	E	N 74 E	14.8	21.0	16.0	14.82	14.95	...	...
17	.876	.681	.618	.7067	46.1	56.4	51.0	50.85	— 1.65	.285	.365	.332	.331	91	80	89	89	N W	E	S E	S 86 E	3.5	11.0	2.8	5.03	6.31	.300	...
18	.650	.653	.695	.6740	57.5	66.7	56.8	60.13	+ 7.32	.418	.471	.300	.385	88	71	65	73	N W	S	N W	N 81 W	9.5	6.0	4.0	3.24	7.12	...	...
19	.752	.741	.695	.7292	52.4	66.8	55.7	59.57	+ 6.40	.303	.366	.348	.325	77	56	78	64	W	S E	N	N 89 E	1.8	6.0	3.8	0.98	4.55	...	...
20	.662	.602	.508	.5785	53.0	60.5	53.5	57.00	+ 3.47	.349	.444	.411	.409	89	84	100	88	E	E	E	N 78 E	3.4	10.0	1.6	4.95	5.78	.490	...
21	.467	.391	.323	.3843	50.2	73.0	61.0	63.28	+ 9.42	—	—	—	—	—	—	—	—	S W	S W	S W	S 36 W	3.8	16.6	8.6	4.83	7.31	.620	...
22	.305	.504	.755	.5445	58.5	55.3	45.2	52.60	— 1.60	.451	.234	.126	.262	92	53	42	61	S W	N	N	N 33 W	2.8	22.0	13.0	12.28	13.95	...	...
23	.932	.942	.880	.9168	38.0	48.4	43.3	44.57	— 9.98	.144	.238	.238	.210	63	70	85	70	N	S	S	S 31 W	9.2	12.0	1.2	2.52	6.13	...	...
24	.856	.731	.694	.7678	46.3	68.0	53.5	57.42	+ 2.52	.251	.338	.299	.288	79	49	72	63	S W	S W	S W	S 50 W	2.5	9.6	3.8	6.72	7.32	...	...
25	.698	.745	.743	.7332	54.2	57.1	49.5	54.08	— 1.15	.269	.296	.290	.299	64	63	82	72	N	S E	S E	N 55 E	9.2	12.0	2.6	1.13	7.56	...	...
26	.745	.647	.571	.6443	45.9	60.7	50.6	53.72	— 1.85	.201	.248	.307	.256	64	47	83	63	N E	S E	S E	S 75 E	4.6	8.0	1.8	3.34	5.00	...	...
27	.550	.486	.497	.5090	52.6	81.3	62.5	65.92	+10.02	.328	.276	.374	.332	83	26	66	59	S W	W	S W	S 58 W	3.8	19.0	3.0	6.33	6.94	...	...
28	.525	.464	.483	.4920	58.0	80.0	68.0	69.33	+13.11	—	—	—	—	—	—	—	—	S W	W	W	N 58 W	2.4	14.8	5.0	6.89	7.42	...	...
29	.477	.512	.672	.5573	60.9	61.1	52.8	58.17	+ 1.62	.444	.355	.276	.351	83	66	69	71	N	E	N E	N 34 E	1.4	7.0	10.4	5.43	7.83	.260	...
30	.798	.785	.688	.7532	44.5	48.1	41.2	44.97	—11.90	.164	.172	.154	.163	56	50	58	54	N E	E	N E	N 78 E	12.0	10.5	5.6	8.97	9.83	...	...
31	.708	.680	.592	.6588	46.6	64.3	61.8	57.33	+ 0.17	.191	.399	.373	.321	60	66	67	66	E	E	N E	N 78 E	6.6	12.0	5.0	5.83	6.42	...	...
—	29.6439	29.6319	29.6398	29.6377	46.33	56.87	49.57	51.47	— 0.62	.253	.276	.257	.261	78	62	74	70	....	....	....	....	7.17	12.12	5.71	....	8.36	3.230	....

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR MAY, 1876.

NOTE.—The monthly means of the Barometer and Temperature include Sunday observations. The daily means, excepting those that relate to the wind, are derived from six observations daily, namely, at 6 A.M., 8 A.M., 2 P.M., 4 P.M., 10 P.M., and midnight. The means and resultants for the wind are from hourly observations.

Highest barometer ....29.988 at 7 a.m. on 16th } Monthly range=
Lowest barometer ....29.271 at midnight on 21st } 0.717.

Self-registering Ther.
- Maximum temperature..............................81°9 on 27th } Monthly range=
- Minimum temperature..............................30°4 on 1st } 51°5.
- Mean maximum temperature ....60°42 } Mean daily range=
- Mean minimum temperature..............................41°85 } 18°57.
- Greatest daily range..............................35°5 from a.m. to p.m. of 27th.
- Least daily range .... 7°4 from a.m. to p.m. of 15th.

Warmest day ....28th; mean temperature..............69°33 } Difference=30°01.
Coldest day.............. 1st; mean temperature..............39°32 }

Maximum Radiation { Solar ....134°0 on 28th } Difference=116°0.
{ Terrestrial .... 18°0 on 23rd }

No Aurora observed.

Possible to see Aurora on 17 nights; impossible on 14 nights.

Raining on 13 days; depth, 3.230 inches; duration of fall, 53.3 hours.

Mean of cloudiness, 0.53.

WIND.

Resultant direction, N. 22° W.; resultant velocity, 1.41 miles.

Mean velocity, 8.36 miles per hour.

Maximum velocity, 29.0 miles, from 3 to 4 p.m. of 1st.

Most windy day, 1st; mean velocity, 16.35 miles per hour.

Least windy day, 9th; mean velocity, 3.27 miles per hour.

Most windy hour, noon; mean velocity, 12.32 miles per hour.

Least windy hour, 3 a.m.; mean velocity, 5.46 miles per hour.

Fog on 6th, 8th and 20th.

Dew recorded on 12 mornings.

Ice on 1st, 2nd and 11th.

Lightning on 13th, 17th, 20th, 21st and 28th.

Thunder on 13th, 17th, 20th, 21st and 29th.

Solar halos on 2nd, 11th and 14th.

Lunar halos on 2nd and 4th.

COMPARATIVE TABLE FOR MAY.

YEAR.	TEMPERATURE.					RAIN.		SNOW.		WIND.		
	Mean.	Excess above aver'ge	Maxi-mum.	Mini-mum.	Range.	No. of days.	Inches.	No. of days.	Inches	Resultant. Direction.	Resultant. Velo'y	Mean Velocity.
1848	54°.1	+ 2°.4	78°.0	31°.3	46°.7	13	2.520	0	0.0	N 40° W	1.31	4.93
1849	48.0	— 3.7	72.2	27.9	44.3	16	5.115	0	0.0	N 51 E	1.97	5.33
1850	47.6	— 4.1	77.8	27.5	50.3	7	0.545	1	S	N 61 W	2.05	6.32
1851	51.8	— 0.4	73.3	28.0	45.3	12	2.950	1	0.5	N 32 W	1.59	6.31
1852	51.4	— 0.3	73.3	32.0	41.3	7	1.125	1	S	N 2 W	0.99	4.00
1853	50.9	— 0.8	78.4	32.2	46.2	17	4.420	1	S	East.	0.83	5.16
1854	52.2	+ 0.5	71.4	25.2	46.2	11	4.630	0	0.0	N 1 W	0.40	5.38
1855	53.1	+ 1.4	77.5	33.0	44.5	6	2.565	2	0.9	N 4 E	2.76	5.93
1856	50.6	— 1.2	82.2	31.2	51.0	14	4.580	1	S	N 23 W	3.99	9.81
1857	48.9	— 0.8	74.8	26.0	48.8	15	4.145	1	S	N 42 E	1.14	8.13
1858	48.9	— 0.8	69.8	31.0	38.8	17	6.367	0	0	N 72 E	3.33	9.30
1859	55.2	+ 3.5	79.6	39.5	40.1	11	3.410	0	0	N 26 E	1.59	5.70
1860	55.5	+ 3.8	74.5	32.5	42.0	16	1.815	0	0	N 47 W	2.66	7.17
1861	47.5	— 4.2	73.0	28.0	45.0	12	3.380	1	0.5	N 52 W	3.60	9.17
1862	52.2	+ 0.5	78.5	32.4	46.1	8	1.427	0	0.0	N 56 W	2.80	7.87
1863	54.3	+ 2.6	79.0	36.4	42.6	14	3.362	1	0.1	N 56 E	0.41	5.89
1864	54.8	+ 3.1	79.0	32.2	46.8	18	4.070	0	0.0	N 7 W	1.86	5.61
1865	52.3	+ 0.6	79.0	30.0	49.0	11	4.005	0	0.0	N 3 W	1.65	5.48
1866	48.3	— 3.4	73.4	33.4	40.0	13	2.820	0	0.0	N 46 W	4.49	9.26
1867	46.5	— 5.2	65.0	24.6	40.4	18	3.220	1	S	N 51 W	3.55	8.40
1868	51.8	+ 0.1	73.0	33.2	39.8	16	7.670	0	0.0	N 38 E	3.16	6.87
1869	50.8	— 0.9	74.2	31.4	42.8	16	2.805	1	S	N 20 W	2.38	6.55
1870	56.3	+ 4.6	81.2	38.8	42.4	10	1.150	0	0.0	N 23 E	1.09	5.48
1871	54.2	+ 2.5	85.0	32.4	52.6	7	2.302	0	0.0	N 23 W	2.53	7.70
1872	51.9	+ 0.2	78.8	32.0	46.8	14	1.934	0	0.0	N 52 W	2.25	6.49
1873	51.9	+ 0.2	76.4	30.0	46.4	13	2.205	0	0.0	N 26 E	2.69	8.88
1874	52.5	+ 0.8	86.0	25.3	60.7	8	1.492	0	0.0	N 49 W	2.64	8.45
1875	52.3	+ 0.6	79.2	27.0	52.2	14	2.980	2	3.1	N 46 W	3.34	10.07
1876	51.5	— 0.2	81.9	30.4	51.5	13	3.230	0	0.0	N 22 W	1.41	8.36
Resu'ts to 1875.	51.69	...	76.55	30.87	45.68	11.92	3.132	0.15	0.39	N 16 W	1.70	6.99
Excess for '76.	— 0.22	...	+ 5.35	— 0.47	+ 5.82	+ 1.08	+ 0.098	— 0.15	— 0.39	...	...	+ 1.37

MONTHLY METEOROLOGICAL REGISTER, AT THE MAGNETICAL OBSERVATORY, TORONTO, ONTARIO—JUNE, 1876.

Latitude—43° 39′ 4″ *North.* *Longitude*—5*h.* 17*m.* 33*s.* *West.* *Elevation above Lake Ontario,* 108 *feet.*

Day.	Barom. at temp. of 32°.				Temp. of the Air.				Excess of Mean above Normal	Tension of Vapour.				Humidity of Air.				Direction of Wind.				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.	10 PM	MEAN		6 A. M.	2 P. M.	10 P. M.	M'N.	6 A. M.	2 P. M.	10 P.M.	M'N.	6 A. M.	2 P. M.	10 P. M.	Res'l-tant.	6 A. M.	2 P. M.	10 P. M.	Res'l-tant.	MEAN.		
1	29.607	29.496	29.455	29.5148	° 57.1	° 67.7	° 61.8	° 62.43	+ ° 4.93	.397	.470	.469	.444	85	69	85	79	S	E	N E	S 78° E	2.8	11.0	0.6	3.88	5.00	...	...
2	.416	.380	.432	.4095	58.6	71.2	63.6	64.93	+ 7.13	.432	.621	.433	.505	88	81	74	81	S E	S	N	S 59 W	1.6	6.0	1.2	0.65	3.98	...	...
3	.458	.413	.426	.4355	58.9	57.5	57.5	58.80	+ 0.67	.362	.429	.453	.425	72	91	95	86	N W	N E	E	N 45 E	6.6	10.0	1.4	3.66	5.33	.550	...
4	.415	.410	.460	.4333	51.0	68.0	57.0	58.50	+ 0.05	—	—	—	—	—	—	—	—	S E	S W	W	S 57 W	3.8	14.3	3.6	5.98	7.02	...	...
5	.524	.539	.598	.5588	52.4	57.8	49.2	53.72	— 5.05	.308	.319	.294	.303	78	67	84	74	W	W	W	W	8.0	15.6	3.0	6.59	7.42	...	...
6	.653	.654	.662	.6557	47.0	62.9	55.7	55.32	— 3.77	.254	.276	.359	.306	78	48	81	71	N W	S	S	S 33 W	4.8	7.5	0.8	3.91	6.09	.080	...
7	.698	.711	.672	.6918	53.5	61.4	56.0	58.15	— 1.25	.333	.389	.321	.352	81	71	71	72	N W	E	N E	N 81 E	3.4	9.0	6.0	4.16	5.91	...	...
8	.648	.573	.525	.5728	53.9	67.7	64.3	62.48	+ 2.75	.344	.477	.474	.440	82	70	78	77	N E	S E	S	S 41 E	1.8	7.4	5.0	2.78	5.32	R	...
9	.516	.470	.566	.5260	66.1	74.4	61.8	67.08	+ 7.05	.479	.549	.495	.516	74	64	89	78	S W	S W	S	S 26 W	11.0	16.0	2.0	9.75	9.83	.350	...
10	.641	.651	.669	.6568	62.5	76.4	62.2	68.12	+ 7.75	.504	.647	.515	.562	89	71	92	82	S W	S E	N E	S 23 E	3.0	7.5	2.5	2.59	4.22	...	...
11	.710	.720	.735	.7275	62.0	75.0	64.0	66.83	+ 6.14	—	—	—	—	—	—	—	—	S W	E	N E	S 86 E	1.4	8.0	3.8	4.32	5.92	...	...
12	.744	.735	.699	.7205	63.2	75.5	67.6	69.32	+ 8.32	.489	.621	.538	.566	84	70	80	79	E	E	N E	N 76 E	5.6	8.0	6.4	4.97	5.63	...	...
13	.665	.619	.623	.6347	62.9	77.3	66.8	68.55	+ 7.22	.548	.735	.561	.602	95	78	86	86	E	E	W	S 89 E	6.7	9.0	5.2	4.54	5.63	...	...
14	.631	.594	.630	.6208	62.9	78.0	69.7	70.87	+ 9.20	.533	.723	.566	.610	93	76	77	81	E	S E	N E	S 80 E	0.4	7.0	8.0	2.86	4.28	...	...
15	.664	.660	.649	.6552	66.1	71.9	65.8	68.65	+ 6.67	.586	.610	.548	.582	91	78	86	83	N E	E	N E	N 78 E	6.0	11.0	5.3	6.47	7.04	...	...
16	.607	.536	.481	.5368	68.3	75.5	66.8	70.33	+ 8.63	.598	.606	.549	.578	86	69	83	78	S E	E	E	S 72 E	5.0	8.0	5.6	4.81	5.12	...	...
17	.470	.415	.371	.4112	66.0	68.7	62.5	66.05	+ 3.45	.566	.625	.532	.576	88	89	94	90	E	E	E	S 78 E	7.8	11.6	8.0	7.73	8.54	.460	...
18	.370	.410	.490	.4283	61.0	70.0	62.0	64.33	+ 1.34	—	—	—	—	—	—	—	—	S E	E	E	S 53 E	9.2	8.0	1.8	5.48	6.60	...	...
19	.554	.513	.507	.5228	58.6	69 0	58.9	63.05	— 0.15	.425	.398	.416	.415	86	56	83	73	E	S	E	S 33 E	5.4	9.5	4.8	5.12	5.86	...	...
20	.494	.459	.490	.4893	60.7	68.5	59.6	63.13	— 0.38	.447	.368	.412	.406	84	63	81	72	S	S W	S W	S 38 W	4.8	15.0	2.6	7.25	8.20	.020	...
21	.529	.546	.588	.5560	57.8	66.5	60.7	60.83	— 2.97	.426	.448	.484	.428	88	69	91	81	W	S W	W	S 78 W	6.8	7.4	7.6	5.47	6.22	.120	...
22	.634	.626	.609	.6258	56.4	69.4	62.2	63.25	— 0.85	.395	.421	.412	.405	86	58	74	71	W	S	N W	S 48 W	4.8	9.0	4.2	3.79	5.35	...	...
23	.585	.472	.381	.4657	59.6	75.2	67.2	68.37	+ 3.98	.412	.603	.606	.551	81	69	91	79	W	S W	S W	S 40 W	2.6	12.5	4.0	5.46	5.98	...	...
24	.409	.358	.348	.3703	66.1	85.6	68.6	74.17	+ 9.55	.571	.339	.511	.472	89	28	73	61	S W	W	S W	S 82 W	8.0	24.5	5.4	9.01	9.55	...	...
25	.315	.270	.310	.2958	67.0	86.0	73.0	75.22	+10.33	—	—	—	—	—	—	—	—	S W	W	N	W	4.0	18.8	9.0	6.09	7.98	.010	...
26	.405	.403	.356	.3880	64.7	73.7	64.7	68.83	+ 3.70	.443	470	.498	.491	72	56	81	70	N E	E	E	S 85 E	3.2	7.6	3.8	3.84	5.35	...	...
27	.325	.370	.494	.4082	65.4	85.6	70.5	73.83	+ 8.45	.554	.594	.615	.594	89	48	82	73	N	W	W	S 79 W	0.2	20.0	7.6	7.56	8.29	...	...
28	.609	.640	.644	.6368	65.0	74.1	65.8	67.45	+ 1.80	.408	.470	.441	.443	65	56	69	66	W	W	N W	S 57 W	3.8	9.6	4.8	2.99	5.03	...	...
29	.649	.592	.574	.6055	61.1	75.9	63.2	67.15	+ 1.28	.436	.482	.469	.470	81	54	81	72	N W	S E	N	S 7 E	2.4	12.0	2.2	3.47	5.74	...	...
30	.613	.637	.690	.6505	60.7	74.8	60.7	66.12	0.00	.447	.362	.398	.386	84	42	75	62	N W	W	N E	N 59 W	4.6	9.0	2.6	6.44	7.20	...	...
	29.5519	29.5291	29.5378	29.5402	60.55	72.04	62.98	65.53	+ 3.52	.450	.502	.476	.478	83	65	82	76	....	....	....	....	4.65	10.99	4.29	....	6.32	1.590	...

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR JUNE, 1876.

NOTE.—The monthly means of the Barometer and Temperature include Sunday observations. The daily means, excepting those that relate to the wind, are derived from six observations daily, namely, at 6 A.M., 8 A.M., 2 P.M., 4 P.M., 10 P.M. and midnight. The means and resultants for the wind are from hourly observations.

Highest Barometer..........29.763 at 7 a.m. on 11th } Monthly range=
Lowest Barometer ....29.237 at 4 p.m. on 25th } 0.526.

Self registering Ther.
- Maximum temperature ....87°2 on 27th } Monthly range=
- Minimum temperature ....44.2 on 6th } 43°0
- Mean maximum temperature ....74°39 } Mean daily range=
- Mean minimum temperature ....56°30 } 18°09
- Greatest daily range..........29°2 from p.m. of 25th to a.m. of 26th.
- Least daily range .... 9°9 from a.m. to p.m. of 17th.

Warmest day .... 25th; mean temperature 75°22 } Difference=21°50.
Coldest day .... 5th; mean temperature 53°72 }

Maximum Radiation { Solar ....147°0 on 25th } Monthly range=
{ Terrestrial.......... 31.0 on 6th } 116°0.

No Aurora observed.

Possible to see Aurora on 18 nights; impossible on 12 nights.

Raining on 8 days; depth, 1.590 inches; duration of fall, 18.1 hours.

Mean of Cloudiness, 0.58.

WIND.

Resultant direction, S. 7° W.; Resultant Velocity, 1.51 miles.

Mean Velocity, 6.32 miles per hour.

Maximum Velocity, 24.5 miles from 2 to 3 p.m. of 24th.

Most Windy day, 9th; Mean Velocity, 9.83 miles per hour.

Least Windy day, 2nd; Mean Velocity, 3.98 miles per hour.

Most Windy hour, 2 p.m.; Mean Velocity, 10.99 miles per hour.

Least Windy hour, 5 a.m.; Mean Velocity, 3.07 miles per hour.

Fog on 2nd, 4th, 13th and 19th.

Solar halo on 28th.

Lunar halo on 2nd.

Thunder on 1st, 2nd, 6th, 9th, 17th and 25th.

Lightning on 6th, 9th, 12th, 13th, 14th, 17th, 24th and 26th.

COMPARATIVE TABLE FOR JUNE.

YEAR.	TEMPERATURE. Mean.	Excess above Average.	Maximum.	Minimum.	Range.	RAIN. No. of days.	Inches.	SNOW. No. of days.	Inches.	WIND. Resultant. Direction.	V'locity.	Mean Velocity.
1848	62.9	+ 1.2	92.0	37.4	54.6	8	1.810	...	...	N 61 W	1.90	4.51
1849	63.2	+ 1.5	84.4	35.2	49.2	7	2.020	...	...	S 71 E	0.49	3.32
1850	64.3	+ 2.6	85.6	34.2	51.4	10	3.345	...	...	S 60 W	0.38	4.54
1851	59.2	— 2.5	79.2	37.0	42.2	11	2.695	...	...	S 2 W	1.26	4.42
1852	60.8	— 0.9	86.1	37.2	48.9	10	3.160	...	...	S 76 W	1.49	4.09
1853	65.5	+ 3.8	89.5	39.2	50.3	9	1.550	...	...	N 1 W	0.10	3.73
1854	64.1	+ 2.4	92.5	35.2	57.3	9	1.460	...	...	N 24 E	0.71	4.15
1855	59.9	— 1.8	91.5	36.2	55.3	17	4.070	...	...	N 69 W	1.33	5.70
1856	62.1	+ 0.4	89.2	42.0	47.2	13	3.200	...	...	S 21 W	0.90	5.30
1857	56.9	— 4.8	76.0	35.0	41.0	21	5.060	...	...	N 49 W	1.15	7.60
1858	66.2	+ 4.5	90.2	42.5	47.7	12	2.943	...	...	S 20 E	0.25	5.53
1859	58.3	— 3.4	86.4	32.2	54.2	16	4.085	2	Inap.	N 77 E	1.95	7.19
1860	63.2	— 1.5	81.6	49.2	32.4	14	2.136	...	...	N 44 W	3.13	7.61
1861	61.3	— 0.4	87.8	41.6	46.2	13	2.329	...	...	N 39 W	2.29	6.11
1862	60.5	— 1.2	85.8	39.4	46.4	10	1.007	...	...	N 26 W	1.77	5.98
1863	60.1	— 1.6	84.8	37.4	47.4	13	1.662	...	...	N 50 W	2.26	5.24
1864	63.0	+ 1.3	93.4	34.8	58.6	5	0.570	...	...	N 55 W	1.72	4.53
1865	64.5	+ 2.8	90.2	43.0	47.2	7	2.005	...	...	S 30 W	0.60	4.06
1866	60.2	— 1.5	90.5	40.0	50.5	15	2.720	...	...	S 15 W	0.71	5.09
1867	64.3	+ 2.6	88.6	44.0	44.6	8	0.885	...	...	S 84 E	0.48	4.13
1868	62.0	+ 0.3	84.2	38.0	46.2	11	2.217	...	...	N 16 E	0.85	5.26
1869	58.4	— 3.3	81.4	36.4	45.0	22	4.373	...	...	N 80 W	1.77	5.23
1870	67.3	+ 5.6	88.4	50.0	38.4	16	8.090	...	...	N 17 E	0.40	5.14
1871	61.4	— 0.3	83.0	41.8	41.2	13	3.340	...	...	N 80 W	2.04	6.57
1872	63.7	+ 2.0	88.0	41.8	46.2	8	3.148	...	...	N 69 W	0.76	3.80
1873	63.7	+ 2.0	89.5	40.0	49.5	10	0.680	...	...	N 18 E	1.00	6.43
1874	62.5	+ 0.8	88.0	44.2	43.8	13	1.795	...	...	N 44 W	1.68	6.52
1875	61.0	— 0.7	86.8	37.4	49.4	7	1.825	...	...	N 69 W	1.05	7.35
1876	65.5	+ 3.8	87.2	44.2	43.0	8	1.590	...	...	S 7 W	1.51	6.32
Res'lts to 1875.	61.73	......	86.95	39.37	47.58	11.64	2.854	...	...	N 60 W	0.84	5.33
Excess for 1876	+ 3.80	......	— 0.25	+ 4.83	— 4.58	— 3.64	— 1.264	...	...	...	...	+ 0.99

MONTHLY METEOROLOGICAL REGISTER, AT THE MAGNETICAL OBSERVATORY, TORONTO, ONTARIO—JULY, 1876.

Latitude—43° 39'4 *North.* *Longitude*—5*h.* 17*m.* 33*s.* *West.* *Elevation above Lake Ontario,* 108 *feet.*

Day.	Barom. at temp. of 32°.				Temp. of the Air.				Excess of Mean above Average	Tension of Vapour.				Humidity of Air.				Direction of Wind.				Velocity of the Wind.					Rain in inches	Snow in inches.
	6 A.M.	2 P.M.	10 P.M.	Mean.	6 A.M.	2 P.M.	10 P.M.	MEAN		6 A.M.	2 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.	Res'ltant.	6 A.M.	2 P.M.	10 P.M.	Res'ltant.	MEAN		
1	29.668	29.560	29.502	29.5647	° 57.8	° 60.4	° 60.0	° 61.10	° — 5.22	.366	.488	.518	.482	76	93	100	89	N E	E	N	° N 50 E	3.7	10.8	1.8	5.90	6.79	.090	...
2	.484	.440	.375	.4247	62.0	68.0	66.0	65.33	— 1.19	—	—	—	—	—	—	—	—	W	E	S	N 83 E	2.0	10.2	8.7	3.48	5.61	.260	...
3	.343	.435	.487	.4257	67.6	78.8	69.4	72.63	+ 5.93	.607	.518	.583	.571	91	52	81	73	S W	W	S W	S 47 W	10.5	22.5	4.2	10.99	11.48	.150	...
4	.496	.526	.595	.5395	65.0	65.0	60.4	64.45	— 2.43	.559	.559	.488	.542	91	91	93	89	S W	N W	S W	S 39 W	7.4	1.0	2.0	3.39	4.17	.230	...
5	.581	.261	.491	.4327	61.4	65.4	65.1	64.50	— 2.57	.542	.608	.479	.527	99	97	77	87	S	S	W	S 67 W	3.6	8.0	12.0	5.12	11.52	.420	...
6	.648	.660	.650	.6548	60.0	76.6	61.8	66.62	— 0.62	.432	.577	.457	.483	83	63	83	75	W	S E	S E	S 17 W	4.0	6.3	0.6	3.13	5.22	...	...
7	.670	.617	.598	.6165	62.5	71.9	65.0	67.33	— 0.03	.501	.685	.588	.592	88	88	95	88	N E	S E	E	S 68 E	0.6	3.4	0.4	2.05	2.44	.800	...
8	.630	.563	.575	.5892	76.2	87.4	77.0	80.63	+13.10	.756	.859	.762	.77[illegible]	84	66	82	75	S W	S W	W	S 67 W	3.3	6.2	2.0	3.91	5.76	...	...
9	.590	.530	.550	.5567	76.0	91.0	79.0	82.67	+ 5.01	—	—	—	—	—	—	—	—	N W	S	W	S 55 W	7.6	5.4	1.6	4.32	5.49	...	...
10	.504	.557	.594	.5805	77.0	80.6	71.5	76.52	+ 8.73	.811	.883	.645	.745	88	85	83	81	W	N E	N	N 61 W	4.6	4.2	7.5	2.63	5.42	.310	...
11	.645	.657	.647	.6463	67.6	75.3	67.6	71.17	+ 3.27	.654	.700	.626	.668	97	80	92	88	C	S	S W	S 36 W	0.0	4.5	3.4	0.85	3.77	.570	...
12	.658	.637	.613	.6362	65.0	86.0	75.1	74.90	+ 6.90	.600	.850	.820	.768	97	68	94	89	N W	S E	N W	S 14 W	1.2	8.6	4.0	1.96	2.90	.450	...
13	.645	.620	.610	.6128	74.1	83.1	69.5	76.33	+ 8.25	.670	.712	.661	.673	79	63	92	75	N W	S W	S W	S 51 W	1.4	6.9	2.5	2.38	4.03	.150	...
14	.556	.516	.561	.5438	70.8	84.2	63.4	73.28	+ 5.10	.564	.648	.442	.498	75	55	75	62	N W	S	W	N 53 W	1.6	6.6	2.0	4.37	5.48	...	...
15	.595	.642	.695	.6488	63.6	77.7	68.6	70.35	+ 2.10	.446	.459	.445	.450	76	48	63	61	N W	S	N W	N 24 W	8.4	6.2	5.3	1.68	5.66	...	...
16	.780	.740	.760	.7667	62.0	80.0	67.0	70.17	+ 1.88	—	—	—	—	—	—	—	—	W	S	N	S 25 W	2.0	7.2	2.0	1.53	3.70	...	...
17	.751	.664	.616	.6642	64.3	81.5	72.8	73.80	+ 5.45	.490	.649	.606	.588	81	60	75	70	E	S E	S W	S 27 E	0.2	7.0	2.8	2.72	4.15	...	...
18	.635	.649	.678	.6558	72.3	77.7	67.9	73.65	+ 5.27	.649	.801	.635	.688	82	85	93	83	W	S W	S W	S 53 W	3.0	4.8	3.0	2.28	3.21	.020	...
19	.686	.653	.503	.6065	67.6	81.3	72.6	75.02	+ 6.60	.586	.559	.652	.613	87	52	81	72	N W	S	S E	S 6 E	0.5	7.2	1.0	2.63	3.67	...	...
20	.396	.392	.547	.4397	71.0	80.9	65.1	72.23	+ 3.78	.682	.677	.479	.608	90	64	77	75	S W	W	W	N 88 W	8.0	19.5	6.2	11.07	13.10	.020	...
21	.636	.751	.784	.7352	60.7	71.9	59.6	64.97	— 3.50	.387	.298	.242	.325	73	38	47	54	N W	S W	N W	N 32 W	2.0	7.2	5.4	6.58	8.44	...	...
22	.749	.603	.514	.6143	54.6	64.0	59.6	61.02	— 7.45	.362	.507	.486	.457	85	84	95	85	N	E	N	N 42 E	1.8	6.5	0.6	2.17	4.31	.130	...
23	.550	.620	.600	.5967	57.0	70.0	59.0	61.67	— 6.78	—	—	—	—	—	—	—	—	N	N W	N W	N 15 W	13.5	11.0	9.5	11.86	12.32	...	...
24	.580	.548	.618	.5835	54.2	66.8	56.4	59.75	— 8.70	.324	.341	.316	.328	77	52	69	65	N W	N W	N W	N 51 W	9.5	22.0	6.2	11.10	11.49	...	...
25	.643	.625	.657	.6410	51.7	62.9	56.4	57.78	—10.63	.317	.346	.328	.332	83	60	71	70	W	N E	N	N 47 W	4.4	3.5	5.0	1.21	4.75	...	...
26	.780	.809	.813	.8045	50.1	64.7	57.1	58.50	— 9.87	.313	.394	.397	.364	86	64	84	75	N W	S	S W	S 3 W	4.0	11.0	0.4	2.11	6.09	...	..
27	.787	.618	.486	.6113	55.3	65.0	64.3	62.82	— 5.55	.364	.439	.568	.479	83	71	94	83	N E	E	S E	N 88 E	3.3	12.0	5.2	5.91	6.58	.030	...
28	.384	.417	.549	.4695	65.2	75.2	61.8	67.30	— 1.00	.616	.505	.445	.500	99	58	80	76	S W	N W	N W	N 75 W	6.2	18.0	5.0	8.52	10.73	.160	...
29	.610	.627	.637	.6292	60.7	72.1	62.5	65.85	— 2.38	.441	.491	.435	.456	83	62	77	72	N	S	N W	S 44 W	4.6	8.6	3.2	1.67	5.06	...	...
30	.645	.640	.600	.6225	61.0	76.0	66.0	68.33	+ 0.14	—	—	—	—	—	—	—	—	N	S E	N	N 48 E	9.2	8.8	2.2	2.86	5.39	...	...
31	.573	.589	.646	.6083	64.7	77.7	70.1	71.37	+ 3.25	.456	.416	.397	.429	75	44	54	57	N	S E	N	N 14 E	9.0	6.3	9.1	4.75	6.76	...	...
	29.6115	29.5860	29.5984	29.5975	63.84	74.81	65.73	68.78	+ 0.87	.519	.576	.519	.536	85	67	81	76	...	...	...	...	4.56	8.75	4.03	...	6.31	3.290	...

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR JULY, 1876.

NOTE.—The monthly means of the Barometer and Temperature include Sunday observations. The daily means, excepting those that relate to the wind, are derived from six observations daily, namely, at 6 A.M., 8 A.M., 2 P.M., 4 P.M., 10 P.M., and midnight. The means and resultants for the wind are from hourly observations.

Highest Barometer..........29.813 at 10 p.m. on 26th. } Monthly range
Lowest Barometer.......... 29.343 at 6 a.m. on 3rd. } 0.470.

Self-registering Ther. {
Maximum temperature ....92°9 on 8th. } Monthly range
Minimum temperature..........46°2 on 26th } 46°7.
Mean maximum temperature ....78°30. } Mean daily range
Mean minimum temperature ....58°75. } 19°55.
Greatest daily range..........31°4 from a.m. to p.m. of 8th.
Least daily range..........10°4 from a.m. to p.m. of 2nd.

Warmest day .... 9th ; mean temperature ....82°67 } Difference=24°89.
Coldest day..........25th; mean temperature ....57°78 }

Maximum Radiation { Solar ....144°5 on 10th. } Monthly range
{ Terrestrial .... 33°4 on 26th. } 111.1.

Aurora observed on 3 nights, viz., 16th, 18th, 19th.

Possible to see Aurora on 24 nights; impossible on 7 nights.

Raining on 15 days; depth, 3.290 inches; duration of fall 35.3 hours.

Mean of cloudiness, 0.50.

WIND.

Resultant direction N. 78° W.; resultant velocity 1.63 miles.

Mean velocity 6.31 miles per hour.

Maximum velocity 31.5 miles, from 5 to 6 p.m. of 5th.

Most windy day 20th; mean velocity 13.10 miles per hour.

Least windy day 7th; mean velocity 3.44 miles per hour.

Most windy hour noon; mean velocity 9.25 miles per hour.

Least windy hour 10 p.m.; mean velocity 4.03 miles per hour.

Fog on 1st, 2nd, 4th, 5th, 12th, 22nd and 28th.

Thunder on 2nd, 5th, 6th, 10th, 12th, 13th, 18th and 20th.

Lightning on 1st, 3rd, 6th, 9th, 10th, 12th, 13th, 17th, 18th, 19th, 20th, 22nd, 25th, 30th.

Solar halo on 31st.

Lunar halo on 29th.

Dew on 12 mornings.

Rainbow on 3rd.

COMPARATIVE TABLE FOR JULY.

YEAR.	TEMPERATURE. Mean.	Excess above aver'ge	Maxi-mum.	Mini-mum.	Range.	RAIN. No. of days.	Inches	SNOW. No. of days.	Inches.	WIND. Resultant. Direction.	Vel'y	Mean Velocity. Miles.
1848	° 65.5	° — 1.9	° 82.2	° 44.1	° 38.1	10	1.890	...	...	N ° 14 W	0.18	4.94
1849	68.4	+ 1.0	88.6	45.2	43.4	4	3.415	...	...	S 5 W	0.75	3.52
1850	68.9	+ 1.5	86.2	51.6	34.6	12	5.270	...	...	N 81 E	0.59	4.56
1851	65.0	— 2.0	82.7	46.5	36.2	12	3.625	...	...	N 60 W	0.88	4.13
1852	66.8	— 0.6	90.1	48.5	41.6	8	4.025	...	...	N 43 W	0.93	3.33
1853	65.6	— 1.8	91.3	41.6	49.7	10	0.915	...	...	S 58 E	0.24	3.69
1854	72.5	+ 5.1	98.0	42.5	55.5	9	4.805	...	...	S 49 W	0.37	4.03
1855	67.9	+ 0.5	92.8	49.2	43.6	13	3.245	...	...	S 19 W	0.73	6.47
1856	69.9	+ 2.5	96.6	49.5	47.1	8	1.120	...	...	N 79 W	1.57	5.84
1857	67.8	+ 0.4	86.6	47.0	39.6	5	3.475	...	...	S 68 E	0.81	4.74
1858	67.9	+ 0.5	85.0	52.0	33.0	13	3.072	...	...	N 15 E	1.13	5.76
1859	66.9	— 0.5	88.0	44.7	43.3	12	2.611	...	...	N 56 W	1.48	5.81
1860	63.9	— 3.5	88·0	43.8	44.2	13	4.356	...	...	N 60 W	2.15	7.29
1861	65.4	— 2.0	84.5	47.0	37.5	16	2.635	...	...	N 74 W	1.43	4.66
1862	66.7	— 0.7	95.5	48.2	47.3	15	5.344	...	...	S 89 W	1.42	5.80
1863	67.6	+ 0.2	83.5	48.0	35.5	15	3.408	...	...	N 18 W	0.40	3.89
1864	69.7	+ 2.3	90.2	49.0	41.2	8	1.332	...	...	N 61 W	2.23	6.00
1865	65.0	— 2.4	83.0	45.8	37.2	11	2.470	...	...	N 86 W	2.28	5.34
1866	70.4	+ 3.0	94.0	47.8	46.2	16	5.390	...	...	S 79 W	0.94	4.17
1867	68.2	+ 0.8	94.0	48.2	45.8	12	1.965	...	...	N 48 W	1.40	5.45
1868	75.8	+ 8.4	93.4	59.0	34.4	5	0.510	...	...	S 87 E	0.72	4.66
1869	64.5	— 2.9	84.9	49.8	35.1	13	4.610	...	...	S 67 W	2.01	5.07
1870	68.8	+ 1.4	87.4	48.0	39.4	16	1.896	...	...	S 78 W	1.59	4.82
1871	66.0	— 1.4	88.4	47.8	40.6	11	1.255	...	...	N 88 W	1.55	5.67
1872	70.2	+ 2.8	96.0	52.2	43.8	13	2.297	...	...	N 67 W	1.19	3.56
1873	68.4	+ 1.0	87.5	47.5	40.0	11	1.913	...	...	S 75 W	1.71	6.11
1874	67.9	+ 0.5	83.5	44.4	39.1	11	3.350	...	...	N 58 W	1.26	6.55
1875	66.6	— 0.8	88.0	46.4	41.6	6	1.810	...	...	S 88 W	1.69	6.78
1876	68.8	+ 1.4	92.9	46.2	46.7	15	3.290	...	...	N 78 W	1.63	6.31
Res'lts to 1875.	67.39	...	88.72	47.69	41.23	10.61	3.148	...	...	N 78 W	0.86	5.09
Excess for '76.	+ 1.39	...	+ 4.18	— 1.49	+ 5.47	+ 4.39	— 0.142	...	...	...	...	+ 1.22

MONTHLY METEOROLOGICAL REGISTER, AT THE MAGNETICAL OBSERVATORY, TORONTO, ONTARIO—AUGUST, 1876.

Latitude—43° 39'4 *North*. *Longitude*—5*h*. 15*m*. 33*s*. *West*. *Elevation above Lake Ontario*, 108 *feet*.

Day.	Barom. at temp. of 32°.				Temp. of the Air.				Excess of Mean above Av'rage.	Tension of Vapour.				Humidity of Air.				Direction of Wind.				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.	10 PM	MEAN		6 A. M.	2 P. M.	10 P. M.	M'N.	6 A. M.	2 P. M.	10 P. M.	M'N.	6 A.M.	2 P.M.	10 P.M.	Resultant.	6 A. M.	2 P. M.	10 P. M.	Result't	MEAN		
1	29.722	29.766	29.809	29.7735	66.5	75.5	65.6	69.90	+ 1.83	.369	.385	.322	.362	57	43	51	49	N	S E	N E	N 70° E	3.0	7.8	8.0	4.86	7.20	...	...
2	.853	.845	.802	.8347	62.9	77.3	69.0	71.05	+ 3.03	.309	.450	.422	.414	55	48	60	55	N E	E	N E	N 73 E	6.3	12.0	4.4	6.36	7.32	...	...
3	.797	.761	.721	.7582	67.6	74.4	69.0	70.22	+ 2.30	.551	.591	.561	.558	82	69	79	76	N E	E	N	S 80 E	2.4	9.5	1.8	4.32	5.59	...	...
4	.734	.692	.677	.6973	67.6	80.4	71.0	73.73	+ 5.88	.545	.692	.673	.653	80	66	89	79	N	S E	N E	S 68 E	1.8	9.0	4.7	3.22	4.99	...	...
5	.711	.687	.705	.6980	68.6	84.5	75.9	77.62	+ 9.85	.640	.744	.744	.734	92	63	83	78	N E	S E	N W	S 47 E	0.2	9.5	4.5	2.77	4.53	...	...
6	.744	.720	.710	.7240	73.0	84.5	76.0	77.75	+10.08	—	—	—	—	—	—	—	—	S	S	S W	S 19 W	3.6	10.8	4.0	5.69	6.56	...	...
7	.721	.677	.733	.7137	71.5	84.5	62.5	73.28	+ 5.73	.736	.471	.381	.532	95	39	67	66	S W	N W	N W	W	4.0	19.0	2.8	6.12	7.94	...	...
8	.776	.755	.698	.7403	57.1	77.7	67.9	68.63	+ 1.20	.374	.518	.575	.675	80	55	84	69	W	S	S	S 5 W	1.6	9.4	1.2	3.70	4.72	...	...
9	.747	.729	.702	.7263	59.8	81.3	69.4	71.98	+ 4.67	.434	.442	.542	.487	84	41	76	64	N W	S E	E	S 33 E	2.2	8.0	3.6	2.09	4.58	...	...
10	.756	.735	.740	.7420	66.1	82.9	71.2	73.95	+ 6.78	.479	.575	.635	.591	74	51	82	71	N E	S E	N E	N 79 E	5.5	6.6	2.4	3.84	5.26	...	...
11	.765	.716	.699	.7223	66.8	81.3	73.7	75.45	+ 8.40	.549	.805	.754	.738	83	75	91	83	N	S E	E	S 66 E	2.6	4.4	4.0	2.60	4.63	...	...
12	.733	.738	.746	.7288	71.2	82.0	74.1	76.00	+ 9.10	.740	.795	.769	.749	97	73	91	84	S	S	E	S 27 E	1.8	7.0	3.6	4.93	5.78	...	...
13	.770	.740	.710	.7350	71.0	84.5	72.0	76.42	+ 9.67	—	—	—	—	—	—	—	—	N E	S E	E	S 64 E	1.6	8.2	1.0	3.94	4.71	...	...
14	.697	.619	.538	.6068	69.0	86.7	71.9	76.83	+10.25	.649	.664	.700	.663	92	52	89	75	N E	S	S W	S 31 E	1.6	9.4	1.6	3.00	5.01	...	...
15	.501	.528	.633	.5610	67.0	79.1	64.3	70.45	+ 4.02	.587	.500	.434	.509	88	50	72	69	W	N W	N	N 44 W	2.6	20.0	5.2	9.40	10.06	...	...
16	.691	.675	.675	.6835	58.2	73.3	65.2	66.00	— 0.25	.328	.408	.455	.405	67	50	73	64	N E	S E	N E	N 89 E	6.2	10.5	4.5	2.67	5.77	...	...
17	.686	.658	.656	.6618	63.6	74.8	67.9	69.85	+ 3.78	.496	.415	.481	.495	84	48	70	69	N E	S E	E	S 76 E	3.6	6.5	2.9	3.35	4.13	R	...
18	.598	.493	.361	.4685	66.5	73.7	69.4	70.52	+ 4.60	.549	.558	.658	.582	83	67	92	78	N E	E	E	S 88 E	3.5	9.5	2.2	5.56	5.94	R	...
19	.346	.384	.429	.3775	65.8	82.0	67.8	72.77	+ 7.08	.548	.572	.508	.539	86	52	74	68	W	N	N	N 50 W	1.8	10.4	8.0	3.93	6.68	...	...
20	.580	.740	.820	.7383	56.0	69.0	59.0	61.33	— 4.16	—	—	—	—	—	—	—	—	N W	N	N	N 19 W	10.6	12.0	10.2	12.73	13.25	...	...
21	.878	.762	.727	.7822	50.6	69.4	55.0	59.42	— 5.87	.275	.261	.282	.286	76	36	65	59	N	S	N W	S 4 W	6.2	12.6	1.4	1.30	7.49	...	...
22	.725	.658	.614	.6627	49.2	73.3	68.3	64.45	— 0.60	.254	.382	.508	.354	73	46	74	58	W	S	W	S 28 W	2.6	9.5	4.2	2.45	5.01	...	...
23	.657	.663	.677	.6622	65.8	77.7	68.6	70.77	+ 5.92	.366	.445	.580	.462	58	47	83	62	N	S	S E	S 42 E	2.2	6.6	7.0	2.37	4.96	...	...
24	.701	.656	.592	.6438	65.0	75.5	67.9	69.55	+ 4.95	.579	.353	.603	.525	84	40	89	74	N E	E	E	S 85 E	4.4	8.0	1.0	4.51	4.79	...	...
25	.517	.475	.640	.5498	70.1	82.7	58.9	69.45	+ 5.10	.694	.510	.300	.499	94	46	60	68	S W	N W	N W	S 81 W	4.5	20.5	4.6	7.51	10.67	...	...
26	.670	.571	.655	.6365	50.3	73.0	59.3	61.63	— 2.47	.300	.213	.290	.280	82	26	57	55	W	W	N W	N 79 W	3.2	25.2	16.2	13.25	13.54	...	...
27	.700	.690	.720	.7083	48.0	75.0	58.0	60.67	— 3.17	—	—	—	—	—	—	—	—	W	N W	N W	N 64 W	10.0	15.0	3.4	10.57	10.64	...	...
28	.773	.706	.694	.7203	46.1	73.3	64.7	63.58	+ 0.02	.239	.279	.262	.276	77	34	42	49	W	S	N	S 37 W	2.5	9.0	6.0	2.33	6.15	...	...
29	.730	.669	.638	.6717	52.1	73.3	67.9	67.73	+ 4.43	.297	.408	.455	.410	76	50	66	61	Calm.	S	N W	S 20 W	0.0	6.3	6.4	2.01	5.25	...	...
30	.609	.545	.545	.5637	65.0	78.7	68.6	71.12	+ 8.05	.494	.323	.552	.465	80	32	79	63	N W	S	S W	S 2 W	1.2	5.5	3.8	1.64	4.37	...	...
31	.539	.474	.448	.4893	65.1	80.9	75.2	75.18	+12.38	.544	.677	.671	.604	88	64	77	70	S W	S	S W	S 14 W	2.4	10.4	2.0	4.78	6.05	...	...
	29.6912	29.6605	29.6617	29.6704	62.68	78.14	67.59	70.24	+ 4.28	.476	.498	.523	.505	80	50	75	67	....	....	....	....	3.41	10.58	4.41	......	6.57	R	......

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR AUGUST, 1876.

NOTE.—The monthly means of the Barometer and Temperature include Sunday observations. The daily means, excepting those that relate to the wind, are derived from six observations daily, namely, at 6 A.M., 8 A.M., 2 P.M., 4 P.M., 10 P.M., and midnight. The means and resultants for the wind are from hourly observations.

Highest barometer ....29.889 at 8 a.m. on 21st } Monthly range=
Lowest barometer ....29.334 at 2 p.m. on 19th } 0.555.

Self-registering Ther.
- Maximum temperature.......................................88°8 on 14th } Monthly range=
- Minimum temperature.......................................45°0 on 28th } 43°8.
- Mean maximum temperature ....80°39 } Mean daily range=
- Mean minimum temperature...................................59°06 } 20°73.
- Greatest daily range..........................32°2 from a.m. to p.m. of 25th.
- Least daily range ....10°8 from a.m. to p.m. of 3rd.

Warmest day .... 6th; mean temperature..................77°75 } Difference=18°33.
Coldest day.................21st; mean temperature..................59°42 }

Maximum Radiation { Solar ....153°0 on 15th } Monthly Range=
{ Terrestrial .... 31°6 on 28th } 121°4.

Aurora observed on 2 nights, viz., 12th and 26th.

Possible to see Aurora on 24 nights; impossible on 7 nights.

Rain on 2 days; depth inappreciable; duration of fall, 0.2 hours.

Mean of cloudiness, 0.46.

WIND.

Resultant direction, S. 31° W.; resultant velocity, 0.23 miles.

Mean velocity, 6.57 miles per hour.

Maximum velocity, 25.7 miles, from 4 to 5 p.m. of 26th.

Most windy day, 26th; mean velocity, 13.54 miles per hour.

Least windy day, 17th; mean velocity, 4.13 miles per hour.

Most windy hour, 2 p.m.; mean velocity, 10.58 miles per hour.

Least windy hour, 2 a.m.; mean velocity, 4.14 miles per hour.

Lightning on 5th, 11th, 18th, 19th and 31st.

Thunder on 11th and 31st.

Fog on 7th.

It will be seen from the Comparative Table that this month was the driest August during the past 37 years, only a few drops having fallen since the morning of 28th July.

COMPARATIVE TABLE FOR AUGUST.

YEAR.	TEMPERATURE. Mean.	Excess above aver'ge	Maximum.	Minimum.	Range.	RAIN. No. of days.	Inches.	SNOW. No. of days.	Inches.	WIND. Resultant. Direction.	Velo'y	Mean Velocity.
1848	69.2	+ 3.0	87.0	48.7	38.3	8	0.855	...	...	S 21 E	0.98	4.55
1849	66.3	+ 0.1	79.0	49.0	30.0	10	4.970	...	...	N 71 W	0.60	3.76
1850	66.8	+ 0.6	85.0	41.0	44.0	13	4.355	...	...	N 15 W	0.35	4.46
1851	63.6	— 2.6	79.8	42.0	37.8	10	1.360	...	...	N 63 W	0.40	4.63
1852	65.9	— 0.3	81.2	45.8	35.4	9	2.695	...	...	N 70 E	0.56	3.30
1853	68.6	+ 2.4	94.9	42.5	52.4	11	2.575	...	...	S 36 E	0.30	4.26
1854	68.0	+ 1.8	99.2	45.6	53.6	5	0.455	...	...	N 64 W	1.76	4.60
1855	64.1	— 2.1	83.5	40.0	43.5	7	1.455	...	...	N 63 W	1.04	6.97
1856	63.6	— 2.6	82.7	41.5	41.2	12	1.680	...	...	N 50 W	2.88	7.03
1857	65.3	— 0.9	88.2	46.0	42.2	13	5.265	...	...	N 77 W	1.51	6.36
1858	67.6	+ 1.4	84.0	44.0	40.0	11	3.890	...	...	N 69 W	1.57	6.50
1859	66.6	+ 0.4	82.2	45.8	36.4	11	3.900	...	...	N 36 W	1.62	5.96
1860	64.5	— 1.7	87.0	46.8	40.2	14	3.405	...	...	N 70 W	1.83	5.80
1861	65.5	— 0.7	85.2	47.0	38.2	15	2.953	...	...	N 8 E	0.46	4.21
1862	67.6	+ 1.4	89.5	42.8	46.7	15	3.483	...	...	N 78 W	1.67	5.96
1863	66.6	+ 0.4	88.0	42.4	45.6	12	2.208	...	...	S 61 W	1.80	4.89
1864	68.6	+ 2.4	94.0	47.0	47.0	16	5.060	...	...	N 70 W	1.38	4.75
1865	65.2	— 1.0	87.8	44.4	43.4	8	1.990	...	...	N 60 W	1.55	5.07
1866	60.8	— 5.4	77.0	42.4	34.6	14	4.457	...	...	N 59 W	2.58	5.16
1867	68.1	+ 1.9	95.2	42.2	53.0	10	2.440	...	...	N 76 W	1.25	4.52
1868	67.2	+ 1.0	84.4	46.8	37.6	13	1.562	...	...	S 58 W	1.01	6.15
1869	63.6	— 2.6	89.0	43.5	45.5	11	4.273	...	...	N 42 W	1.98	5.13
1870	67.1	+ 0.9	84.0	40.0	44.0	14	3.422	...	...	N 75 W	1.80	5.92
1871	67.4	+ 1.2	89.5	46.0	43.5	8	2.800	...	...	N 52 W	1.09	6.86
1872	69.6	+ 3.3	91.8	51.0	40.8	19	2.405	...	...	N 51 W	1.43	3.73
1873	66.6	+ 0.4	85.0	46.4	38.6	12	1.913	...	...	N 84 E	1.35	5.56
1874	67.1	+ 0.9	95.0	48.0	47.0	4	0.380	...	...	N 23 E	0.70	6.16
1875	65.2	— 1.0	81.9	48.0	33.9	14	1.880	...	...	S 56 E	1.58	6.70
1876	70.2	+ 4.0	88.8	45.0	43.8	2	R	...	...	S 31 W	0.23	6.57
Resu'ts to 1875.	66.20	...	86.82	44.88	41.94	10.97	2.864	...	...	N 61 W	0.90	5.32
Excess for '76.	+ 4.04	...	+ 1.98	+ 0.12	+ 1.86	— 8.97	— 2.864	...	...	...	...	+ 1.25

MONTHLY METEOROLOGICAL REGISTER, AT THE MAGNETICAL OBSERVATORY, TORONTO, ONTARIO—SEPTEMBER, 1876.

Latitude—43° 39′4 *North.* *Longitude*—5*h.* 17*m.* 33*s. West.* *Elevation above Lake Ontario*, 108 *feet.*

Day.	Barom. at temp. of 32°.				Temp. of the Air.				Excess of Mean above aver'ge	Tension of Vapour.				Humidity of Air.				Direction of Wind.				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.	10 PM	MEAN		6 A. M.	2 P. M.	10 P. M.	M'N.	6 A. M.	2 P. M.	10 P. M.	M'N.	6 A. M.	2 P. M.	10 P.M.	Res'l-tant.	6 A.M.	2 P.M.	10 P.M	Res'l-tant.	MEAN		
1	29.483	29.483	29.455	29.4518	° 64.7	° 74.4	° 62.5	° 67.68	° + 5.13	.563	.519	.363	.436	92	64	64	65	N W	N E	N W	° N 30 W	5.0	7.6	9.0	6.39	8.40	.120	...
2	.538	.574	.682	.6088	52.8	68.8	53.1	58.87	— 3.38	.308	.219	.238	.249	77	30	58	53	N W	N W	W	N 57 W	13.0	16.0	8.7	13.30	13.43	...	...
3	.690	.690	.550	.6033	51.0	71.0	62.0	62.00	+ 0.03	—	—	—	—	—	—	—	—	N W	S W	S W	S 50 W	2.2	14.5	6.6	5.55	7.47	R	...
4	.517	.548	.722	.6260	62.2	67.9	53.5	60.72	— 0.97	.402	.280	.248	.299	72	40	60	56	W	N	N W	N 46 W	5.0	20.0	11.3	10.85	12.60	...	...
5	.785	.815	.775	.7778	46.3	65.4	54.2	56.82	— 4.57	.240	.186	.258	.224	77	30	61	51	N W	N W	N	N 32 W	10.0	18.2	4.8	10.47	10.69	...	...
6	.792	.793	.615	.6910	47.4	65.8	58.6	58.77	— 2.28	.244	.366	.343	.308	74	58	69	62	N	E	E	N 82 E	3.0	8.4	7.0	4.21	6.49	R	...
7	.549	.572	.467	.5138	56.0	64.7	60.4	61.43	+ 0.72	.366	.443	.451	.425	81	73	86	78	N E	E	N E	N 89 E	3.4	8.7	2.0	4.86	5.16	...	...
8	.463	.473	.612	.5308	62.9	73.7	59.3	64.63	+ 4.28	.492	.349	.356	.387	86	41	70	66	S W	W	N W	N 67 W	2.2	21.0	9.4	8.75	9.35	...	...
9	.665	.695	.770	.7235	54.6	63.2	55.7	58.28	— 1.70	.379	.396	.370	.384	89	68	84	79	N	S E	N E	N 64 E	9.0	6.0	4.8	2.74	5.29	...	...
10	.765	.765	.670	.7017	56.0	59.0	59.0	58.17	— 1.43	—	—	—	—	—	—	—	—	N E	N E	E	N 69 E	7.6	15.5	10.0	10.53	10.67	R	...
11	.574	.572	.578	.5625	55.0	60.7	53.1	56.45	— 2.75	.404	.410	.393	.406	92	76	97	89	N E	E	N W	N 58 E	13.5	12.5	3.8	7.96	8.83	.100	...
12	.658	.699	.781	.7215	48.8	62.2	53.1	54.40	— 4.42	.269	.341	.263	.291	78	61	65	68	N	S	N E	N 23 E	9.5	8.5	9.0	3.27	7.48	...	...
13	.836	.857	.755	.7943	49.2	61.4	52.4	54.63	— 3.78	.294	.340	.327	.305	85	62	83	72	N	S E	N E	N 70 E	6.4	12.8	4.4	5.45	7.19	...	...
14	.599	.574	.415	.4710	56.0	64.0	57.1	59.50	+ 1.48	.377	.453	.446	.427	84	76	96	84	N E	E	N W	N 63 E	8.6	9.0	4.4	6.69	7.83	.005	...
15	.494	.539	.795	.6530	54.2	68.3	53.9	58.97	+ 1.35	.335	.260	.312	.291	80	37	75	61	N	N	N	N 19 W	15.0	12.0	6.0	10.95	11.04	.025	...
16	.922	.965	.907	.9310	49.5	61.1	57.5	56.82	— 0.40	.232	.287	.358	.297	64	53	75	64	N E	E	E	N 67 E	8.0	15.0	4.5	8.38	9.65	...	...
17	.880	.850	.460	.6600	53.0	56.0	54.0	54.50	— 2.28	—	—	—	—	—	—	—	—	N E	E	N	N 48 E	6.4	17.0	19.0	12.23	12.94	.280	...
18	.181	.216	.428	.3208	58.5	63.2	58.9	59.85	+ 3.48	.476	.451	.446	.458	97	78	89	89	E	N	N W	N 23 E	19.0	6.3	7.0	9.41	12.10	1.250	...
19	.470	.474	.509	.4878	55.3	64.0	58.2	59.77	+ 3.83	.398	.427	.455	.435	91	72	94	85	W	N W	S W	N 71 W	5.4	5.6	3.5	3.90	4.65	...	...
20	.548	.582	.669	.6102	54.2	65.0	57.5	59.68	+ 4.13	.389	.471	.441	.429	92	76	93	84	N	E	E	N 76 E	3.2	10.0	5.0	4.09	6.02	...	...
21	.711	.747	.742	.7308	58.0	64.0	61.1	61.35	+ 6.23	.434	.453	.429	.445	90	76	80	82	E	E	E	N 75 E	8.6	15.0	10.5	10.84	11.01	...	...
22	.745	.769	.709	.7227	58.6	63.2	59.6	60.58	+ 5.90	.450	.451	.461	.456	91	78	90	86	E	E	E	N 76 E	8.2	13.1	4.8	10.01	10.08	R	...
23	.635	.626	.606	.6072	57.8	60.7	59.1	59.12	+ 4.85	.461	.459	.481	.470	96	86	96	94	E	N E	N	N 67 E	4.8	8.6	6.0	5.86	6.51	.140	...
24	.620	.640	.650	.6450	59.0	60.5	59.0	59.42	+ 5.59	—	—	—	—	—	—	—	—	N E	E	N	N 54 E	5.0	5.6	4.6	3.55	4.33	.050	...
25	.649	.643	.461	.5418	58.9	66.1	62.5	62.57	+ 9.15	.458	.504	.540	.508	92	79	95	90	N W	S	W	S 21 W	1.4	12.0	1.2	4.17	5.71	.300	...
26	.418	.408	.355	.3748	52.8	57.5	45.2	51.12	— 1.87	.232	.235	.258	.258	70	50	85	70	W	W	W	N 72 W	15.6	27.0	18.5	17.58	17.96	.070	...
27	.405	.435	.521	.4617	41.5	49.9	47.0	46.95	— 5.65	.241	.196	.232	.222	82	54	72	69	N W	W	W	N 69 W	16.5	24.0	13.6	17.66	18.07	.045	...
28	.578	.581	.419	.4832	44.8	57.1	53.9	50.92	— 1.27	.251	.286	.350	.296	85	61	84	79	S W	S W	W	S 50 W	9.2	20.0	7.5	10.64	11.48	.070	...
29	.386	.408	.487	.4408	50.3	56.0	43.6	50.22	— 1.53	.345	.214	.230	.259	94	47	81	72	S W	W	W	S 75 W	5.0	18.5	3.6	6.60	6.76	...	...
30	.503	.536	.599	.5497	43.0	54.2	39.4	45.77	— 5.62	.238	.208	.213	.222	86	49	88	74	N W	W	W	N 88 W	5.4	12.5	3.8	6.82	7.32	...	...
	29.6020	29.6176	29.6055	29.5999	53.84	62.97	55.48	57.46	+ 0.21	.360	.355	.356	.353	85	61	80	74	....	....	....	....	7.84	13..6	6.98	2.97	9.22	2.455	...

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR SEPTEMBER, 1876.

NOTE.—The monthly means of the Barometer and Temperature include Sunday observations. The daily means, excepting those that relate to the wind, are derived from six observations daily, namely, at 6 A.M., 8 A.M., 2 P.M., 4 P.M., 10 P.M., and midnight. The means and resultants of the wind are from hourly observations.

Highest Barometer..............................29.965 at 8 a.m. on 16th. } Monthly range
Lowest Barometer ....29.181 at 6 a.m. on 18th. } 0.784.

Self-registering Ther.
- Maximum temperature..............................77°8 on 1st. } Monthly range
- Minimum temperature..............................38.5 on 30th. } 39°3.
- Mean maximum temperature..............................64°75 } Mean Daily range
- Mean minimum temperature..............................50°39 } 14°36.
- Greatest daily range ....24°2 from a.m. to p.m. of 23rd.
- Least daily range .... 4°8 from a.m. to p.m. of 10th and 24th.

Warmest day .... 1st; mean temperature......67°68 } Difference=21°91.
Coldest day ....30th; mean temperature......45°77 }

Maximum Radiation { Solar ....133°4 on 8th. } Monthly range
Maximum Radiation { Terrestrial .... 26.4 on 30th. } 107°0.

No Aurora observed.

Possible to see Aurora on 12 nights; impossible on 18 nights.

Raining on 16 days; depth, 2.455 inches; duration of fall, 62.0 hours.

Mean of cloudiness, 0.68.

WIND.

Resultant direction, N. 6° W.; resultant velocity, 2.97 miles.

Mean velocity, 9.22 miles per hour.

Maximum velocity, 27.0 miles per hour, from 2 to 3 p.m. of 26th.

Most windy day, 27th; mean velocity, 18.07 miles per hour.

Least windy day, 24th; mean velocity, 4.33 miles per hour.

Most windy hour, 2 p.m.; mean velocity, 13.36 miles per hour.

Least windy hour, 11 p.m.; mean velocity, 6.49 miles per hour.

Fog on 11th. Dew on 3 mornings.

Lightning on 14th.

Solar halo on 6th. Lunar halo on 9th.

COMPARATIVE TABLE FOR SEPTEMBER.

YEAR.	TEMPERATURE. Mean.	Excess above Average.	Maximum	Minimum.	Range	RAIN. No. of days.	Inches	SNOW. No. of days.	Inches	WIND. Resultant. Direction.	V'locity.	Mean Velocity.
1848	54.2°	— 3.9°	80.4°	28.1°	52.3°	11	3.115	...	...	N 71° W	2.38	5.81
1849	58.2	+ 0.1	80.1	32.7	47.4	9	1.480	...	...	N 75 W	0.69	4.23
1850	56.5	— 1.6	76.0	29.5	46.5	11	1.735	...	...	S 65 W	1.02	4.78
1851	60.0	+ 1.9	86.3	32.0	54.3	17	2.665	...	...	N 14 E	1.03	5.45
1852	57.5	— 0.6	81.8	35.8	46.0	10	3.630	...	...	N 77 W	0.53	4.60
1853	58.8	+ 0.7	85.5	33.9	51.6	12	5.140	...	...	North	1.06	4.33
1854	61.0	+ 2.9	93.6	35.8	57.8	14	5.375	...	...	N 22 W	1.33	4.04
1855	59.5	+ 1.4	82.6	33.0	49.6	12	5.585	...	...	N 20 E	1.29	7.61
1856	57.1	— 1.0	78.4	35.0	43.4	13	4.105	...	...	S 79 W	1.98	6.53
1857	58.6	+ 0.5	82.0	34.1	47.9	11	2.640	...	...	N 68 W	1.61	6.55
1858	59.1	+ 1.0	81.4	35.6	45.8	8	0.735	...	...	S 74 W	1.53	5.69
1859	55.2	— 2.9	75.4	35.7	39.7	15	3.525	...	...	N 44 W	1.60	6.36
1860	55.3	— 2.8	75.8	28.7	47.1	14	1.959	...	...	N 71 W	2.63	5.79
1861	59.1	+ 1.0	78.8	37.1	41.7	17	3.607	...	...	N 71 W	1.39	4.81
1862	59.6	+ 1.5	79.4	39.0	40.4	9	2.344	...	...	N 59 W	1.07	5.11
1863	55.9	— 2.2	80.0	31.4	48.6	8	1.235	...	...	N 16 W	0.92	6.46
1864	56.4	— 1.7	73.0	37.8	35.2	11	2.508	...	...	N 38 W	1.89	7.06
1865	64.5	+ 6.4	90.5	42.0	48.5	12	2.450	...	...	S 56 E	0.47	4.12
1866	55.2	— 2.9	80.0	34.4	45.6	15	5.657	...	...	N 33 W	1.45	4.63
1867	57.9	— 0.2	87.0	31.8	55.2	9	1.226	...	...	N 37 W	1.48	5.43
1868	56.6	— 1.5	75.5	36.0	39.5	16	4.239	...	...	N 74 W	0.88	4.68
1869	60.7	+ 2.6	81.0	34.4	46.6	8	4.027	...	...	N 53 W	1.16	4.89
1870	61.8	+ 3.7	78.0	45.8	32.2	11	6.794	...	...	N 29 E	2.26	5.04
1871	54.8	— 3.3	81.8	34.0	47.8	8	1.290	...	...	N 74 W	1.72	5.50
1872	59.1	+ 1.0	84.4	38.2	46.2	16	2.520	...	...	N 79 W	1.47	5.24
1873	57.3	— 0.8	79.0	33.5	45.5	14	3.020	...	...	N 81 W	2.92	7.39
1874	63.3	+ 5.2	88.6	39.5	49.1	11	1.554	...	...	S 14 E	0.09	6.30
1875	55.5	— 2.6	84.5	32.0	52.5	13	2.820	...	...	S 88 W	1.89	8.09
1876	57.5	— 0.6	77.8	38.5	39.3	16	2.455	...	...	N 6 W	2.97	9.22
Res'lts to 1875.	58.14	......	81.47	34.89	46.58	11.33	3.575	...	...	N 55 W	1.15	5.62
Excess for 1876	— 0.68	......	— 3.67	+ 3.61	+ 7.28	+ 4.67	— 1.120	...	...	...	...	+ 3.60

MONTHLY METEOROLOGICAL REGISTER, AT THE MAGNETICAL OBSERVATORY, TORONTO, ONTARIO—OCTOBER, 1876.

Latitude—43° 39′ 4″ *North. Longitude*—5*h.* 17*m.* 33*s. West. Elevation above Lake Ontario*, 108 *feet.*

Day.	Barometer cor. to 32°.				Temp. of the Air.				Excess of Mean above Av'rage.	Tension of Vapour.				Humidity of Air.				Direction of Wind.				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.	10 PM	MEAN		6 A. M.	2 P. M.	10 P. M.	M'N.	6 A. M.	2 P. M.	10 P.M.	M'N.	6 A. M.	2 P. M.	10 P. M.	Res'l-tant.	6 A. M.	2 P. M.	10 P. M.	Res'l-tant.	MEAN.		
					°	°	°	°													°							
1	29.580	29.540	29.490	29.5267	36.0	53.0	48.0	45.58	— 5.40	—	—	—	—	—	—	—	—	W	W	S W	S 88 W	4.0	16.6	6.0	8.04	8.25	.020	...
2	.455	.368	.301	.3718	45.9	58.6	50.6	51.33	+ 0.75	.268	.211	.275	.263	86	42	75	71	S W	S W	S W	S 49 W	6.0	12.8	10.4	9.49	10.16	...	...
3	.226	.233	.314	.2593	49.5	51.3	47.7	49.48	— 0.75	.290	.308	.309	.296	82	81	93	83	S W	S W	W	S 38 W	17.0	8.4	5.4	9.66	10.12	.070	...
4	.383	.451	.471	.4425	40.9	49.9	45.9	45.80	— 4.05	.211	.235	.219	.213	82	65	70	69	S W	S W	S W	S 50 W	4.5	9.0	6.6	7.19	7.67	R	...
5	.498	.459	.305	.4072	41.8	51.7	48.5	47.30	— 2.22	.200	.181	.273	.210	75	46	80	65	S W	S	S	S 18 W	6.4	9.2	11.4	7.24	8.23	...	...
6	.077	.032	.156	.0998	49.0	51.2	46.3	48.42	— 0.72	.317	.321	.241	.285	91	85	77	84	S W	S W	S W	S 46 W	7.8	22.0	11.5	10.37	11.60	.240	...
7	.343	.511	.521	.4630	42.3	44.1	41.6	42.32	— 6.47	.202	.161	.173	.174	74	55	66	64	W	W	S W	N 84 W	11.6	21.0	6.2	12.71	13.58	...	S
8	.480	.650	.780	.6467	40.0	44.0	32.0	37.58	—10.88	—	—	—	—	—	—	—	—	W	W	W	S 89 W	19.0	28.0	4.8	16.82	17.46	...	S
9	.796	.601	.280	.5302	29.7	45.6	45.9	41.43	— 6.70	.144	.164	.200	.174	88	53	64	66	W	S	S W	S 29 W	3.5	15.5	15.0	10.01	11.44	...	...
10	.230	.338	.501	.3742	45.9	44.5	35.8	40.93	— 6.88	.200	.127	.164	.152	64	43	78	60	W	W	W	W	14.0	24.5	11.5	14.80	16.52	...	...
11	.662	.856	.958	.8458	30.2	40.9	31.1	34.35	—13.17	.133	.098	.122	.122	80	37	71	64	W	N W	N W	N 52 W	4.0	17.5	4.9	9.20	9.53	...	S
12	.953	.808	.760	.8295	27.9	48.8	34.4	37.97	— 9.22	.124	.162	.174	.155	81	47	87	69	N W	S W	S W	S 74 W	3.2	11.2	2.0	5.63	5.96	...	...
13	.733	.653	.553	.6395	37.3	53.1	45.9	45.45	— 1.45	.179	.222	.228	.211	80	55	74	70	W	S	S W	S 30 W	4.0	9.2	1.2	5.01	5.87	.115	...
14	.368	.538	.750	.5612	42.7	35.1	27.2	34.52	—12.08	.265	.136	.124	.168	97	66	85	80	S W	N W	N W	N 55 W	3.2	25.0	10.0	11.89	13.20	...	0 1
15	.760	.760	.750	.7567	24.5	40.0	35.0	32.75	—13.58	—	—	—	—	—	—	—	—	N W	N W	W	N 63 W	12.0	27.0	9.0	15.75	16.46	...	S
16	.666	.472	.394	.5017	35.1	47.0	45.2	42.68	— 3.38	.157	.132	.164	.151	77	41	54	56	W	W	S W	S 66 W	15.8	23.5	12.0	15.47	15.51	...	...
17	.462	.662	.776	.6575	42.7	46.1	32.6	38.92	— 6.87	.183	.114	.148	.146	66	36	81	64	N	N W	N W	N 47 W	10.3	15.4	3.3	9.23	10.40	...	...
18	.831	.778	.723	.7732	27.5	46.5	32.9	36.68	— 8.85	.135	.188	.175	.169	90	59	94	79	N W	S	N E	S 3 W	4.4	5.5	4.6	1.36	4.23	...	...
19	.716	.632	.596	.6430	33.3	49.9	43.4	43.10	— 2.17	.170	.226	.188	.196	89	62	66	71	N E	E	N E	N 63 E	7.0	6.0	4.0	4.66	5.32	.040	...
20	.535	.446	.354	.4387	41.6	54.4	52.8	49.83	+ 4.78	.224	.267	.305	.270	85	63	76	75	N E	E	E	N 70 E	4.8	10.5	3.6	7.26	7.47	.020	...
21	.361	.304	.375	.3492	50.8	60.4	48.8	53.03	+ 8.23	.369	.365	.269	.317	99	69	78	79	E	S E	E	S 52 E	3.2	7.0	2.1	3.81	5.73	R	...
22	.410	.390	.280	.3517	48.0	57.0	55.0	53.50	+ 8.96	—	—	—	—	—	—	—	—	N E	E	E	N 85 E	2.0	7.0	8.0	4.14	4.69	.690	...
23	.193	28.929	.247	.1257	54.2	57.5	48.1	52.28	+ 7.97	.413	.453	.283	.369	98	96	84	93	N E	S W	S W	S 82 W	3.0	6.0	8.6	1.65	7.60	.110	...
24	.265	29.141	.221	.2083	38.0	48.8	42.5	43.67	— 0.38	.212	.320	.236	.252	92	93	86	88	S W	S W	S W	S 59 W	2.8	5.0	7.0	5.31	5.94	...	...
25	.243	.273	.366	.3032	39.8	45.6	39.8	41.13	— 2.67	.179	.204	.196	.191	73	67	80	74	S W	S W	W	S 70 W	10.6	16.5	8.5	12.23	12.46	...	...
26	.452	.607	.811	.6422	36.2	41.6	34.8	37.83	— 5.75	.183	.139	.161	.159	86	53	79	70	W	W	W	N 77 W	8.0	19.0	5.5	12.08	12.40	...	...
27	.926	.957	.907	.9328	33.8	42.0	35.5	37.07	— 6.28	.174	.172	.160	.169	89	65	77	77	W	S	S W	S 87 W	3.2	6.6	2.8	3.21	4.71	.120	...
28	.792	.751	.796	.7753	34.4	39.1	33.7	35.53	— 7.57	.191	.189	.153	.180	96	79	78	86	S	N E	N E	N 67 E	1.0	8.0	6.0	3.92	5.40	...	...
29	.810	.820	.820	.8167	28.0	37.0	32.0	32.67	—10.19	—	—	—	—	—	—	—	—	N E	E	N E	N 59 E	6.8	11.5	6.7	8.22	8.37	...	...
30	.776	.732	.701	.7372	35.1	44.3	45.2	42.02	— 0.62	.177	.212	.246	.221	87	73	82	83	N E	E	E	N 64 E	6.5	13.0	7.6	7.12	7.40	.010	...
31	.642	.662	.714	.6738	43.8	54.6	50.6	50.55	+ 8.13	.274	.368	.341	.333	96	86	92	90	S E	S E	S E	S 48 E	2.0	0.6	0.8	0.98	1.23	...	...
	29.5363	29.5275	29.5475	29.5382	38.90	47.86	41.57	42.76	— 3.53	.214	.218	.213	.213	85	62	78	74	....	....	....	....	6.83	13.48	6.68	....	9.19	1.435	0.1

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR OCTOBER, 1876.

NOTE.—The monthly means of the Barometer and Temperature include Sunday observations. The daily means, excepting those that relate to the wind, are derived from six observations daily, namely, at 6 A.M., 8 A.M., 2 P.M., 4 P.M., 10 P.M. and midnight. The means and resultants for the wind are from hourly observations.

Highest Barometer..........................29.976 at 8 a.m. on 27th } Monthly range=
Lowest Barometer ....28.929 at 2 p.m. on 23rd } 1.047.

Self-registering Ther.
- Maximum temperature ....61°6 on 21st } Monthly range=
- Minimum temperature ....23°0 on 13th } 38°6
- Mean maximum temperature ....50°24 } Mean daily range=
- Mean minimum temperature ....34°74 } 15°50
- Greatest daily range..............................24°4 from a.m. to p.m. of 18th.
- Least daily range .... 7°4 from a.m. to p.m. of 7th.

Warmest day .... 22nd; mean temperature 53°50 } Difference=20°83.
Coldest day .... 29th; mean temperature 32°67 }

Maximum Radiation { Solar ....117°0 on 1st } Monthly range=
{ Terrestrial.............................. 12°2 on 12th } 104°8.

Possible to see Aurora on 10 nights; impossible on 21 nights.

Aurora observed on 1 night, viz., 17th.

Raining on 12 days; depth, 1.435 inches; duration of fall, 41.7 hours.

Snowing on 5 days; depth, 0.1 inches; duration of fall, 4.1 hours.

Mean of Cloudiness, 0.70.

WIND.

Resultant direction, S. 81° W.; Resultant Velocity, 4.63 miles.

Mean Velocity, 9.19 miles per hour.

Maximum Velocity, 31.0 miles, from noon to 1 p.m. of 14th.

Most Windy day, 8th; Mean Velocity, 17.46 miles per hour.

Least Windy day, 31st; Mean Velocity, 1.23 miles per hour.

Most Windy hour, noon; Mean Velocity, 13.89 miles per hour.

Least Windy hour, 11 p.m.; Mean Velocity, 6.08 miles per hour.

Fog on 21st and 23rd.

Lightning on 22nd.

Solar haloes on 5th and 12th. Lunar haloes on 24th and 27th.

Rainbows 1st and 26th.

First snow of season, 7th; a few flakes on 1st.

COMPARATIVE TABLE FOR OCTOBER.

YEAR.	TEMPERATURE. Mean.	Excess above Average.	Maximum.	Minimum.	Range.	RAIN. No. of days.	Inches.	SNOW. No. of days.	Inches	WIND. Resultant. Direction.	Resultant. Velocity.	Mean Velocity.
1848	46.3°	+ 0.5°	61.8°	24.5°	37.3°	11	1.550	0	0.0	N 54° W	1.24	4.60
1849	45.3	— 0.5	58.9	24.2	34.7	13	5.965	1	Inap.	N 12 W	1.27	7.76
1850	45.4	— 0.4	66.7	22.4	44.3	10	2.085	0	0.0	N 66 W	1.10	5.30
1851	47.4	+ 1.6	66.2	25.2	41.0	10	1.680	2	0.3	S 72 W	1.06	4.39
1852	48.0	+ 2.2	70.7	23.8	46.9	12	5.280	0	0.0	N 5 E	1.19	4.47
1853	44.4	— 1.4	64.7	23.4	41.3	10	0.875	2	Inap.	S 88 W	1.74	4.77
1854	49.5	+ 3.7	75.4	26.4	49.0	15	1.495	3	Inap.	N 45 W	1.52	4.57
1855	45.4	— 0.4	68.0	22.6	45.4	14	2.485	5	0.8	N 82 W	4.91	9.88
1856	45.3	— 0.5	71.4	23.0	48.4	10	0.875	2	0.1	N 76 W	2.15	6.07
1857	45.4	— 0.4	64.0	26.5	37.5	10	1.040	2	0.2	N 19 W	2.93	6.24
1858	48.8	+ 3.0	76.3	31.5	44.8	17	1.797	1	Inap.	N 34 W	0.36	5.96
1859	43.0	— 2.8	69.8	22.3	47.5	11	0.940	4	Inap.	N 68 W	5.04	8.12
1860	47.3	+ 1.5	68.0	28.4	39.6	15	1.618	1	Inap.	N 9 W	2.06	6.93
1861	48.7	+ 2.9	71.0	29.0	42.0	15	1.993	1	Inap.	N 61 W	1.06	5.96
1862	48.7	+ 2.9	76.6	26.2	50.4	19	2.684	2	0.5	N 78 W	2.89	6.53
1863	45.9	+ 0.1	66.4	30.5	35.9	16	2.522	0	0.0	S 71 W	0.48	6.16
1864	45.2	— 0.6	67.0	28.0	39.0	22	3.321	1	Inap.	N 60 W	3.17	6.66
1865	44.5	— 1.3	71.4	21.6	49.8	17	2.705	3	4.5	N 36 W	3.15	7.26
1866	49.1	+ 3.3	71.0	31.8	39.2	11	2.470	1	Inap.	N 30 W	0.84	5.53
1867	49.9	+ 4.1	75.4	31.0	44.4	11	1.970	0	0.0	N 45 W	1.51	5.73
1868	42.4	— 3.4	67.6	24.0	43.6	10	1.365	2	2.0	N 89 W	1.27	7.10
1869	42.3	— 3.5	69.8	18.7	51.1	8	0.962	7	2.3	N 89 W	3.72	6.73
1870	50.0	+ 4.2	68.5	30.2	38.3	16	2.690	0	0.0	N 85 W	1.86	7.11
1871	48.3	+ 2.5	72.2	28.6	43.6	13	1.185	0	0.0	S 66 W	3.75	7.84
1872	45.6	— 0.2	70.0	25.2	44.8	14	3.288	1	Inap.	N 18 W	2.22	4.59
1873	45.7	— 0.1	69.2	24.2	45.0	13	2.155	3	0.2	West	1.77	7.81
1874	47.5	+ 0.7	67.0	24.8	42.2	11	1.418	2	Inap.	N 70 W	2.75	6.40
1875	43.2	— 2.6	63.0	27.6	35.4	15	2.415	2	3.8	N 88 W	2.72	9.31
1876	42.8	— 3.0	61.6	23.0	38.6	10	1.435	5	0.1	S 81 W	4.63	9.19
Res'lts to 1875.	45.82	......	68.80	25.91	42.95	12.58	2.381	1.83	0.89	N 64 W	1.85	6.31
Excess for 1876	— 3.06	......	— 7.26	— 2.91	— 4.35	— 0.58	— 0.916	+ 3.17	— 0.79	...	...	+ 2.88

MONTHLY METEOROLOGICAL REGISTER, AT THE MAGNETICAL OBSERVATORY, TORONTO, ONTARIO—NOVEMBER, 1876.

Latitude—43° 39'4 North. Longitude—5h. 17m. 33s. West. Elevation above Lake Ontario, 108 feet.

Day.	Barom. at temp. of 32°.				Temp. of the Air.				Excess of Mean above Av'rage.	Tension of Vapour.				Humidity of Air.				Direction of Wind.				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.	10 P.M.	MEAN		6 A.M.	2 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.	Resultant.	6 A.M.	2 P.M.	10 P.M.	Result't	MEAN		
1	29.636	29.541	29.475	29.5363	°51.7	°36.9	°53.7	°53.12	°+10.95	.384	.408	.403	.389	100	88	97	96	E	S	S E	S 63° E	3.0	4.0	2.8	0.98	2.75	.010	...
2	.293	.049	28.968	.1140	46.3	55.0	53.9	51.88	+ 9.47	.312	.341	.333	.328	99	78	80	86	E	S E	S W	S 18 W	3.2	3.8	23.0	4.40	7.66	...	...
3	.265	.452	29.611	.4687	43.0	47.0	43.4	44.23	+ 2.55	.229	.232	.224	.232	83	72	79	80	S W	W	W	S 73 W	14.5	12.2	7.5	14.04	14.16	.280	...
4	.780	.856	.931	.8607	37.3	45.9	40.5	40.40	— 1.02	.200	.173	.196	.190	89	56	78	76	W	W	W	S 87 W	4.5	11.0	1.0	6.27	6.34	.058	...
5	.960	.950	.920	.9400	38.5	44.0	39.0	40.55	— 0.59	—	—	—	—	—	—	—	—	W	S	N E	S 8 E	3.0	5.5	4.4	1.58	3.75	...	...
6	.730	.401	.307	.4740	42.3	42.3	44.1	42.50	+ 1.60	.202	.239	.251	.219	75	88	87	80	E	S E	S W	S 71 E	13.0	15.0	13.0	8.23	11.58	...	...
7	.363	.413	.510	.4310	40.0	43.4	40.7	40.70	+ 0.12	.218	.205	.223	.213	88	73	87	84	S W	S W	S W	S 40 W	10.8	9.8	2.4	7.02	7.12	.710	...
8	.521	.541	.581	.5455	38.4	43.2	39.4	40.43	+ 0.12	.206	.181	.198	.196	89	65	82	78	N	E	N	N 29 E	4.0	5.6	8.5	3.75	4.80	...	...
9	.591	.598	.654	.6210	37.3	41.6	37.6	38.30	+ 1.70	.179	.182	.200	.190	80	69	89	82	N W	W	N W	N 33 W	5.5	5.4	4.6	4.34	5.12	R	...
10	.672	.644	.629	.6458	35.8	39.8	35.8	36.43	— 3.23	.156	.196	.189	.179	81	80	90	83	N	E	N E	N 26 E	6.8	9.0	4.8	4.94	5.82	.010	...
11	.607	.581	.643	.6155	35.0	39.3	30.7	34.78	— 3.60	.194	.216	.171	.192	92	83	99	91	N E	S	S	S 51 E	1.2	3.8	3.2	1.14	2.77	...	...
12	.700	.660	.690	.6850	29.0	40.0	34.0	34.33	— 4.64	—	—	—	—	—	—	—	—	N	S	N E	N 51 E	3.8	1.8	0.2	0.45	2.45	...	...
13	.620	.548	.618	.5980	35.1	44.5	48.1	42.13	+ 3.53	.193	.232	.278	.227	97	79	83	84	N E	E	N W	N 33 E	4.2	4.0	15.2	2.76	5.32	...	...
14	.773	.818	.769	.7885	41.6	38.9	34.0	37.20	— 1.03	.165	.137	.147	.145	62	57	75	66	N	N E	N E	N 5 E	9.5	9.2	11.2	10.49	12.78	...	S
15	.738	.789	.865	.8098	30.8	37.6	34.4	33.83	— 4.00	.149	.149	.175	.152	86	66	88	79	N E	S E	W	N 42 E	7.0	5.6	2.2	2.44	5.22	...	...
16	.895	.853	.847	.8670	32.7	39.8	39.1	37.18	— 0.27	.156	.154	.193	.170	84	62	81	76	N W	S	S E	S 24 E	3.0	7.9	3.6	2.02	3.72	...	...
17	.797	.794	.810	.8057	34.2	40.5	41.2	38.92	+ 1.90	.177	.196	.190	.192	89	78	73	81	N	E	E	N 76 E	6.6	8.4	4.6	4.55	5.32	...	...
18	.790	.725	.699	.7357	40.9	44.9	44.9	43.75	+ 7.15	.220	.250	.272	.250	85	84	91	87	E	E	E	N 86 E	4.6	13.0	13.2	8.84	8.96	.020	...
19	.685	.650	.630	.6523	44.5	44.0	43.0	43.50	+ 7.33	—	—	—	—	—	—	—	—	E	E	E	N 82 E	10.5	14.5	15.0	12.89	12.95	.220	...
20	.606	.563	.601	.5913	40.7	42.7	40.2	41.32	+ 5.60	.246	.223	.229	.232	96	81	92	89	E	N E	N E	N 58 E	10.5	9.5	7.0	9.52	9.85	.050	...
21	.614	.557	.449	.5327	39.8	41.2	42.7	41.25	+ 5.07	.225	.225	.251	.235	92	87	92	91	N	E	E	N 83 E	4.4	7.5	16.0	6.51	7.40	.020	...
22	.325	.449	.542	.4540	43.6	37.3	35.5	38.03	+ 3.22	.272	.161	.162	.185	96	72	79	80	S W	S W	S W	S 41 W	14.5	16.5	13.5	12.24	14.21	.120	...
23	.595	.537	.572	.5713	33.8	35.1	32.0	33.65	— 0.72	.168	.149	.148	.152	86	72	82	79	S W	S W	W	S 61 W	15.0	12.2	4.8	10.96	11.79	...	...
24	.631	.624	.573	.6080	30.8	34.8	31.1	32.00	— 1.90	.134	.146	.138	.144	78	70	79	79	W	W	S W	S 80 W	10.0	14.5	0.6	9.20	9.27	...	...
25	.451	.315	.255	.3340	30.1	35.5	33.7	33.68	+ 0.28	.156	.193	.192	.184	93	93	99	75	N	W	E	S 58 E	5.4	1.0	6.0	2.74	4.12	.220	0.3
26	.200	.250	.290	.2567	33.0	34.0	25.0	29.42	— 3.52	—	—	—	—	—	—	—	—	N E	N	N W	N 17 W	15.0	9.0	3.2	6.91	7.94	.030	4.2
27	.214	.145	.251	.2102	20.3	32.6	28.3	27.67	— 4.78	.103	.172	.140	.141	94	92	90	92	N	E	N W	N 61 E	7.0	7.0	4.0	2.02	5.55	...	4.5
28	.301	.384	.548	.4237	29.7	34.4	31.3	31.05	— 0.92	.147	.150	.157	.148	89	76	89	85	W	W	S W	S 78 W	8.2	11.0	2.2	5.65	5.86	...	0.1
29	.620	.612	.635	.6228	25.4	32.6	24.6	26.50	— 5.00	.125	.112	.100	.110	92	61	75	77	W	W	N W	N 74 W	5.8	13.0	9.5	7.24	8.20	...	S
30	.615	.531	.512	.5462	10.2	15.3	7.0	10.38	—20.65	.062	.071	.054	.061	92	81	91	78	N W	N	N W	N 22 W	6.2	13.5	12.0	10.38	10.48	...	...
	29.5873	29.5610	29.5795	29.5782	35.66	40.14	36.96	37.29	+ 0.05	.192	.196	.201	.194	88	75	86	83	....	....	....	....	7.36	8.81	7.31	......	7.44	1.748	9.1

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR NOVEMBER, 1876.

NOTE.—The monthly means of the Barometer and Temperature include Sunday observations. The daily means, excepting those that relate to the wind, are derived from six observations daily, namely, at 6 A.M., 8 A.M., 2 P.M., 4 P.M., 10 P.M., and midnight. The means and resultants for the wind are from hourly observations.

Highest barometer ....29.970 at 8 a.m. on 5th } Monthly range=
Lowest barometer ....28.968 at 10 p.m. on 2nd } 1.002.

Self-registering Ther.
- Maximum temperature..............................58°8 on 1st } Monthly range=
- Minimum temperature.... .... 5°4 on 30th } 53°4.
- Mean maximum temperature ....42°30 } Mean daily range=
- Mean minimum temperature..............................31°97 } 10°33.
- Greatest daily range........................17°9 from a.m. to p.m. of 13th.
- Least daily range .... 3°3 from a.m. to p.m. of 21st.

Warmest day .... 1st; mean temperature................53°12 } Difference=42°74.
Coldest day................30th; mean temperature................10°38 }

Maximum Radiation { Solar ....102°5 on 5th } Monthly Range=
{ Terrestrial .... 0°8 on 30th } 101°7.

Aurora observed on 1 night, viz., 10th.

Possible to see Aurora on 6 nights; impossible on 24 nights.

Raining on 13 days; depth, 1.748 inches; duration of fall, 72.0 hours.

Snowing on 7 days; depth, 9.1 inches; duration of fall, 28.1 hours.

Mean of cloudiness, 0.89.

WIND.

Resultant direction, N. 20° W.; resultant velocity, 0.52 miles.

Mean velocity, 7.44 miles per hour.

Maximum velocity, 25.0 miles, from 11 p.m. to mid. of 2nd.

Most windy day, 22nd; mean velocity, 14.21 miles per hour.

Least windy day, 12th; mean velocity, 2.45 miles per hour.

Most windy hour, 11 a.m.; mean velocity, 9.58 miles per hour.

Least windy hour, 6 p.m.; mean velocity, 6.06 miles per hour.

Fog on 1st, 2nd, 11th, 12th and 13th.

Lightning on 1st.

Rainbow on 3rd.

Solar halo on 24th.

Lunar halo on 5th.

COMPARATIVE TABLE FOR NOVEMBER.

YEAR.	TEMPERATURE. Mean.	Excess above aver'ge	Maxi-mum.	Mini-mum.	Range.	RAIN. No. of days.	Inches	SNOW. No. of days.	Inches	WIND. Resultant. Direction.	Velo'y	Mean Velocity.
	°	°	°	°	°					°		
1848	34.5	— 1.5	49.0	15.9	33.1	9	2.020	3	1.4	N 81 W	1.81	4.81
1849	42.8	+ 6.8	56.4	26.5	29.9	10	2.815	2	1.0	N 39 W	1.55	4.78
1850	38.8	+ 2.8	62.8	11.0	51.8	7	2.955	1	Inap	N 42 W	1.43	5.27
1851	32.9	— 3.1	50.2	13.8	36.4	5	3.855	6	6.7	N 50 W	1.25	4.70
1852	36.0	0.0	50.4	18.2	32.2	7	1.775	3	2.0	N 59 W	1.53	6.50
1853	38.7	+ 2.7	55.6	12.8	42.8	15	2.425	6	2.7	N 9 W	0.55	5.52
1854	36.8	+ 0.8	55.4	13.8	41.6	13	1.115	4	1.3	West	3.44	7.54
1855	38.6	+ 2.6	59.2	15.5	43.7	8	4.590	6	3.0	N 66 W	3.18	10.81
1856	37.4	+ 0.8	56.4	18.8	37.6	10	1.375	9	9.5	S 85 W	2.95	8.75
1857	33.5	— 2.5	58.2	—3.5	61.7	14	3.235	9	6.9	S 61 W	5.45	9.25
1858	34.2	— 1.8	53.0	15.3	37.7	12	3.879	13	4.0	N 25 W	3.14	8.87
1859	38.9	+ 2.9	62.6	21.8	40.8	12	5.193	9	0.6	N 81 W	3.39	9.65
1860	37.9	+ 1.9	64.5	13.2	51.3	12	2.569	8	1.9	S 89 W	4.95	11.02
1861	37.1	+ 1.1	52.4	23.0	29.4	14	4.294	8	3.2	N 46 W	1.94	7.44
1862	35.6	— 0.4	58.0	16.2	41.8	11	2.205	11	5.3	N 46 W	3.00	6.60
1863	39.1	+ 3.1	67.0	17.8	49.2	13	3.656	6	0.1	N 88 W	3.50	7.86
1864	36.9	+ 0.9	60.2	21.0	39.2	11	3.765	8	4.5	S 72 W	3.82	7.64
1865	38.6	+ 2.6	63.2	23.6	39.6	5	0.975	7	1.1	N 79 W	2.98	7.90
1866	38.4	+ 2.4	54.2	21.8	32.4	13	2.963	4	2.2	N 88 W	3.06	6.96
1867	36.9	+ 0.9	60.4	9.6	50.8	8	1.835	9	0.9	N 87 W	4.02	7.76
1868	36.2	+ 0.2	50.5	20.1	30.4	14	5.150	10	4.3	N 35 W	2.10	8.16
1869	32.7	— 3.3	58.0	13.0	45.0	9	2.540	18	10.2	N 78 W	3.69	8.12
1870	36.6	+ 0.6	57.2	19.4	37.8	6	0.594	5	3.1	N 89 W	4.36	8.74
1871	30.6	— 5.4	47.1	0.0	47.1	10	2.655	12	4.5	N 45 W	4.08	10.35
1872	32.9	— 3.1	52.0	8.2	43.8	7	0.420	9	1.3	S 85 W	5.02	7.48
1873	27.6	— 8.4	51.4	0.8	50.6	5	0.510	18	19.6	N 50 W	3.08	6.67
1874	34.6	— 1.4	61.0	3.5	57.5	7	0.935	11	11.7	S 87 W	3.07	7.70
1875	31.7	— 4.3	51.0	—5.0	56.0	6	1.000	8	7.8	N 66 W	3.63	9.73
1876	37.3	+ 1.3	58.8	5.4	53.4	13	1.748	7	9.1	N 20 W	0.52	7.44
Resu'ts to 1875.	35.99	...	56.33	13.79	42.54	9.61	2.747	7.39	4.10	N 77 W	2.78	7.74
Excess for '76.	+ 1.30	...	+ 2.47	— 8.39	+ 10.86	+ 3.39	— 0.999	— 0.39	+ 5.00	...	...	— 0.30

MONTHLY METEOROLOGICAL REGISTER, AT THE MAGNETICAL OBSERVATORY, TORONTO, ONTARIO—DECEMBER, 1876.

Latitude—43° 39'4 North. Longitude—5h. 17m. 33s. West. Elevation above Lake Ontario, 108 feet.

Day.	Barom. at temp. of 32°. 6 A.M.	2 P.M.	10 P.M.	Mean.	Temp. of the Air. 6 A.M.	2 P.M.	10 P.M.	MEAN	Excess of Mean above Average	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N.	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Direction of Wind. 6 A.M.	2 P.M.	10 P.M.	Res'l-tant.	Velocity of the Wind. 6 A.M.	2 P.M.	10 P.M.	Res'l-tant.	MEAN	Rain in inches	Snow in inches
					°	°	°	°	°												°							
1	29.445	29.387	29.359	29.4002	0.9	9.1	13.1	8.63	—21.90	.044	.058	.071	.060	94	89	90	91	N W	N W	N W	N 44 W	6.5	9.5	8.7	9.82	10.00	...	0.7
2	.427	.552	.703	.5803	16.7	21.2	20.0	19.07	—10.98	.078	.087	.091	.085	85	75	84	82	N W	N W	N W	N 26 W	21.0	18.0	12.2	15.91	15.94	...	0.1
3	.790	.830	.900	.8483	19.0	24.0	24.6	22.60	— 6.96	—	—	—	—	—	—	—	—	N W	N	N	N 24 W	7.1	7.4	9.3	9.40	9.56	...	...
4	.935	.911	.903	.9160	17.1	23.6	19.4	19.23	— 9.87	.086	.098	.088	.086	92	77	83	83	N	N	W	N 33 W	2.2	10.0	6.4	6.82	7.33	...	...
5	.874	.796	.705	.7862	21.2	30.2	23.6	25.43	— 3.20	.099	.104	.098	.104	86	63	77	76	W	W	S W	S 81 W	5.6	10.5	13.0	7.74	8.23	...	...
6	.511	.336	.292	.3700	27.2	34.0	29.0	29.95	+ 1.78	.124	.161	.133	.136	84	82	83	82	S W	W	S W	S 63 W	10.5	16.2	8.0	12.93	13.15	...	...
7	.224	.168	.202	.1988	24.5	29.2	23.9	25.48	— 2.23	.121	.097	.109	.105	92	60	84	77	S W	S W	N W	S 68 W	12.0	11.5	7.8	10.63	11.29	...	0.1
8	.184	.023	28.893	.0258	22.1	24.7	16.4	20.42	— 6.87	.105	.092	.063	.086	89	69	70	77	S W	S W	W	S 67 W	13.0	13.2	12.5	10.03	10.87	...	...
9	28.902	.280	29.655	.3187	10.6	7.3	—1.3	4.90	—21.97	.057	.046	.032	.045	84	74	80	82	W	N W	N	N 78 W	20.9	37.0	3.6	22.10	23.90	...	...
10	29.860	.800	.670	.7717	—9.0	7.0	13.0	4.17	—22.27	—	—	—	—	—	—	—	—	N	N E	S E	N 71 E	7.0	11.2	18.3	5.28	9.87	...	3.0
11	.606	.483	.326	.4553	8.4	19.6	25.0	18.57	— 7.48	.061	.091	.129	.096	96	87	96	91	N E	S E	S E	S 86 E	10.3	16.3	7.8	6.81	10.35	...	2.1
12	.221	.355	.397	.3362	25.4	30.8	34.0	30.07	+ 4.42	.131	.163	.156	.144	95	95	78	86	N	S W	S W	S 66 W	2.0	7.4	10.0	4.94	6.96	...	1.4
13	.142	.280	.448	.2952	35.5	38.5	33.7	35.83	+10.57	.193	.167	.152	.168	93	71	79	80	S W	W	W	S 55 W	14.5	11.0	2.0	11.30	12.48	...	...
14	.427	.349	.354	.3957	33.3	35.5	27.0	30.78	+ 5.90	.142	.141	.113	.127	74	68	77	72	S W	S W	W	S 61 W	7.0	15.0	28.5	12.86	13.85	...	0.2
15	.614	.395	.011	.3005	14.9	21.4	28.2	21.33	— 3.22	.075	.084	.093	.089	87	74	60	77	W	S W	S W	S 56 W	7.5	30.0	33.0	19.99	20.96	...	0.1
16	.403	.798	.990	.7763	6.4	—0.6	—2.1	1.13	—23.10	.044	.035	.031	.034	76	85	80	76	N W	W	W	N 79 W	30.0	14.6	14.0	20.91	23.06	...	1.3
17	30.200	30.090	.900	30.0217	—3.0	4.0	13.0	4.83	—19.07	—	—	—	—	—	—	—	—	N	N E	E	N 52 E	4.0	12.0	21.0	7.73	11.15	...	6.5
18	29.481	29.651	.636	29.5893	4.0	6.2	16.0	9.37	—14.23	.050	.052	.074	.058	95	90	83	86	N	W	S W	N 23 W	15.0	6.2	20.0	6.37	12.73	...	4.0
19	.439	.690	30.012	.7457	11.3	15.5	7.9	10.48	—12.85	.057	.061	.048	.053	78	70	80	75	S W	W	W	S 75 W	23.5	13.0	2.0	13.46	15.10	...	0.2
20	30.106	30.036	29.813	.9758	—1.3	8.1	16.4	6.55	—16.52	.035	.033	.069	.045	85	53	76	75	N	N E	E	N 27 E	10.8	7.6	11.4	6.83	8.13	...	s
21	29.586	29.493	.453	.5088	18.1	16.0	16.0	15.68	— 7.17	.088	.074	.081	.075	89	83	89	85	N E	N E	N	N 43 E	7.5	9.0	8.6	6.61	7.84	...	1.5
22	.355	.280	.428	.3673	19.2	24.8	20.0	21.03	— 1.58	.098	.105	.087	.096	92	78	80	84	N	N	N W	N 7 W	4.6	6.4	8.6	5.62	5.79	...	0.6
23	.604	.686	.840	.7407	10.6	21.2	15.3	15.18	— 7.23	.061	.094	.071	.072	88	83	80	82	N	S W	W	N 64 W	5.0	9.5	13.0	6.19	7.71	...	0.2
24	30.080	30.130	30.120	30.1167	1.0	10.0	4.2	5.07	—17.14	—	—	—	—	—	—	—	—	N	N	N	N 3 W	2.4	7.6	6.4	7.22	7.42	...	...
25	30.000	29.820	29.760	29.8400	10.0	15.0	25.0	17.00	— 5.04	—	—	—	—	—	—	—	—	N	N E	S E	N 47 E	10.3	12.0	13.2	10.69	12.52	...	1.5
26	29.588	.585	.624	.6027	19.6	22.7	19.6	20.52	— 1.35	.098	.102	.085	.096	92	83	80	86	N E	S W	W	S 85 W	6.5	11.8	8.6	4.13	8.22	..	1.2
27	.614	.669	.758	.6957	20.0	20.3	20.0	19.73	— 2.00	.101	.078	.081	.085	92	70	75	79	S W	S W	S W	S 62 W	10.5	12.5	12.0	9.89	10.01	...	...
28	.774	.733	.709	.7415	12.7	24.6	22.8	20.23	— 1.38	.064	.107	.090	.087	84	81	72	79	W	W	N E	N 68 W	4.8	4.6	6.8	3.64	5.57	...	0.5
29	.554	.276	28.983	.2442	22.1	17.4	14.2	17.50	— 4.02	.102	.089	.080	.090	86	94	96	93	N E	N E	N	N 30 E	14.0	20.5	23.0	17.32	18.38	...	10.1
30	.074	.335	29.524	.3350	14.5	18.5	14.5	16.47	— 4.98	.079	.085	.073	.081	95	84	87	88	N W	W	S W	N 59 W	26.0	17.5	12.0	16.89	18.75	...	0.7
31	.660	.700	.790	.7250	14.5	21.0	16.0	17.08	— 4.31	—	—	—	—	—	—	—	—	N W	W	W	S 89 W	5.4	15.5	7.5	9.19	9.77	...	0.5
	29.5703	29.5780	29.5857	29.5814	14.11	19.38	18.34	17.24	— 7.62	.088	.092	.088	.088	88	78	81	82	...	...	...	...	10.56	13.05	11.91	...	11.83	...	36.5

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR DECEMBER, 1876.

NOTE.—The monthly means of the Barometer and Temperature include Sunday observations. The daily means, excepting those that relate to the wind, are derived from six observations daily, namely, at 6 A.M., 8 A.M., 2 P.M., 4 P.M., 10 P.M., and midnight. The means and resultants for the wind are from hourly observations.

Highest Barometer..........30.200 at 6 a.m. on 17th. } Monthly range
Lowest Barometer..........28.810 at 1 a.m. on 16th. } 1.390.

Self-registering Ther.:
- Maximum temperature .... 40°1 on 13th. } Monthly range
- Minimum temperature .... —9°5 on 10th. } 49°6.
- Mean maximum temperature ....24°15. } Mean daily range
- Mean minimum temperature .... 9°96. } 14°19.
- Greatest daily range..........33°1 from a.m. to p.m. of 16th.
- Least daily range.......... 6°5 from a.m. to p.m. of 2nd.

Warmest day ....13th; mean temperature ....35°83 } Difference=34°70.
Coldest day..........16th; mean temperature .... 1°13 }

Maximum Radiation { Solar .... 121°0 on 19th. } Monthly range
{ Terrestrial .... —15°0 on 10th. } 136.0.

No Aurora observed.

Possible to see Aurora on 9 nights; impossible on 22 nights.

No rain fell.

Snowing on 23 days; depth, 36.5 inches; duration of fall 158.8 hours.

Mean of cloudiness, 0.74.

WIND.

Resultant direction N. 68° W.; resultant velocity 5.68 miles.

Mean velocity 11.83 miles per hour.

Maximum velocity 40.0 miles, from 1 to 2 a.m. of 16th.

Most windy day 9th; mean velocity 23.90 miles per hour.

Least windy day 28th; mean velocity 5.59 miles per hour.

Most windy hour 3 p.m.; mean velocity 13.12 miles per hour.

Least windy hour 6 a.m.; mean velocity 10.56 miles per hour.

Solar halos on 10th, 15th, 19th, 24th and 28th.

Lunar halos on 1st, 2nd and 24th.

COMPARATIVE TABLE FOR DECEMBER.

YEAR.	TEMPERATURE. Mean.	Excess above aver'ge	Maximum.	Minimum.	Range.	RAIN. No. of days.	Inches	SNOW. No. of days.	Inches.	WIND. Resultant. Direction.	Vel'y	Mean Velocity. Miles.
1848	29.1°	+ 3.3°	48.8°	1.1°	47.7°	7	2.750	7	16.5	S 83° W	1.12	5.44
1849	26.5	+ 0.7	40.8	— 6.5	47.3	5	0.840	12	9.6	N 82 W	2.56	6.23
1850	21.7	— 4.1	48.8	— 9.0	57.8	2	0.190	18	29.5	N 44 W	2.93	7.40
1851	21.5	— 4.3	44.0	—14.8	58.8	6	1.075	15	10.7	N 82 W	4.00	7.37
1852	31.9	+ 6.1	51.0	13.2	37.8	7	3.995	10	20.1	S 69 W	1.03	6.54
1853	25.3	— 0.5	46.4	— 8.4	54.8	4	0.625	13	22.3	N 35 W	2.39	4.98
1854	21.9	— 3.9	44.8	— 7.0	51.8	5	0.590	12	17.2	N 44 W	4.30	8.56
1855	26.8	+ 1.0	47.0	— 5.2	52.2	6	1.845	10	29.5	S 88 W	5.29	11.38
1856	22.9	— 2.9	42.2	— 9.1	51.3	6	1.790	20	16.3	S 87 W	4.62	11.56
1857	31.9	+ 6.1	46.0	4.7	41.3	7	3.205	14	9.0	N 89 W	2.50	6.84
1858	27.4	+ 1.6	45.4	4.2	41.2	11	1.657	18	10.4	N 78 W	1.66	9.36
1859	17.9	— 7.9	54.8	— 6.0	60.8	3	1.035	23	37.4	N 53 W	4.29	10.77
1860	24.0	— 1.8	39.0	— 7.0	46.0	3	1.362	21	13.5	N 62 W	4.66	10.14
1861	31.1	+ 5.3	55.2	5.5	49.7	6	0.560	8	6.8	N 72 W	3.50	7.96
1862	28.8	+ 3.0	50.1	— 3.4	53.5	5	1.945	8	10.4	N 73 W	3.17	7.58
1863	27.0	+ 1.2	53.4	— 1.5	54.9	10	2.960	17	7.1	N 41 W	1.61	9.40
1864	24.7	— 1.1	50.4	—10.4	60.8	9	2.045	18	27.1	S 82 W	4.94	9.98
1865	27.7	+ 1.9	54.2	5.7	48.5	7	1.727	11	5.2	S 81 W	3.07	7.33
1866	25.1	— 0.7	51.0	— 5.0	56.0	7	2.790	13	15.5	S 88 W	4.98	9.91
1867	21.6	— 4.2	49.5	—12.8	62.3	7	1.408	21	13.6	S 81 W	4.82	10.32
1868	22.5	— 3.3	44.2	— 3.2	47.4	1	0.005	18	15.5	N 71 W	4.05	9.80
1869	28.7	— 2.9	45.0	6.0	39.0	10	2.590	9	7.1	S 80 W	2.31	8.44
1870	26.5	+ 0.7	45.2	— 5.8	51.0	6	2.430	16	15.9	N 89 W	5.06	11.46
1871	19.9	— 5.9	48.2	—21.0	69.2	4	0.940	20	14.2	S 70 W	6.91	11.52
1872	18.7	— 7.1	40.0	—13.8	53.8	3	0.390	4	38.0	N 87 W	5.51	9.06
1873	29.8	+ 4.0	48.2	6.4	41.8	10	0.995	12	19.2	WEST	2.95	5.93
1874	25.7	— 0.1	44.0	— 7.5	51.5	5	0.050	15	11.1	S 84 W	5.93	8.72
1875	27.2	+ 1.4	61.0	—13.2	74.2	9	1.620	13	18.7	N 54 W	1.75	10.42
1876	17.2	— 8.6	40.1	— 9.5	49.6	0	0.000	23	36.5	N 68 W	5.68	11.83
Res'lts to 1875.	25.79	...	47.81	—4.42	52.23	5.83	1.552	13.86	15.07	N 77 W	3.42	8.73
Excess for '76.	— 8.55	...	— 7.71	— 5.08	— 2.63	— 5.83	— 1.552	+ 9.14	+ 21.43	...	...	+ 3.10

GENERAL METEOROLOGICAL REGISTER

FOR THE YEAR 1876.

GENERAL METEOROLOGICAL

MAGNETICAL OBSERVATORY,

Latitude 43° 39′ 4″ North. Longitude 5h. 17m. 33s. West. Elevation above

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
Mean Temperature	29°.03	23°.76	26°.02	38°.24	51°.47	65°.53	68°.78
Difference from average (36 years)	+ 6.26	+ 1.21	− 3.12	− 2.48	− 0.22	+ 3.80	+ 1.39
Thermic anomaly (lat. 43° 40′)	− 3.77	−10.94	−14.08	−11.76	− 6.63	+ 0.93	+ 0.08
Highest temperature	57.5	44.1	50.5	57.2	81.9	87.2	92.9
Lowest temperature	5.1	− 3.9	− 2.9	17.0	30.4	44.2	46.2
Monthly and Annual Ranges	52.4	48.0	53.4	40.2	51.5	43.0	46.7
Mean maximum temperature	36.85	30.17	33.35	45.59	60.42	74.39	78.30
Mean minimum temperature	22.47	16.07	18.85	31.73	41.85	56.30	58.75
Mean daily range	14.38	14.10	14.50	13.86	18.57	18.09	19.55
Greatest daily range	37.0	42.1	41.9	24.5	35.5	29.2	31.4
Mean height of the Barometer	29.6316	29.6573	29.5994	29.5889	29.6377	29.5402	29.5975
Difference from average (35 years)	−.0158	+.0311	−.0025	−.0008	+.0677	−.0339	+.0048
Highest barometer	30.216	30.350	30.168	30.109	29.988	29.763	29.813
Lowest barometer	28.703	28.863	28.729	28.939	29.271	29.237	29.343
Monthly and Annual Ranges	1.513	1.487	1.439	1.170	0.717	0.526	0.470
Mean humidity of the air	81	81	79	69	70	76	76
Mean elasticity of aqueous vapour	0.134	0.111	0.116	0.165	0.261	0.478	0.536
Mean of cloudiness	0.78	0.73	0.70	0.61	0.53	0.58	0.50
Difference from average (23 years)	+ .04	+ .03	+ .08	+ .01	− .02	+ .06	.00
Resultant direction of the wind	S 79 W	N 63 W	N 29 W	N 69 W	N 22 W	S 7 W	N 78 W
" velocity of the wind	6.31	3.71	3.43	4.11	1.41	1.51	1.63
Mean velocity (miles per hour)	11.79	12.45	12.04	9.87	8.36	6.32	6.31
Difference from average (28 years)	+ 3.36	+ 3.72	+ 2.90	+ 1.56	+ 1.37	+ 0.99	+ 1.22
Total amount of rain	1.960	2.300	1.250	1.815	3.230	1.590	3.290
Difference from average (36 years)	+0.754	+1.452	−0.319	−0.623	+0.098	−1.264	+0.142
Number of days rain	12	7	6	13	13	8	15
Total amount of snow	3.2	20.1	44.1	0.3	...	...	...
Difference from average (33 years)	−14.29	+ 1.74	+31.12	− 2.23	− 0.15	...	...
Number of days snow	9	15	14	3	...	...	...
Number of fair days	11	10	13	15	18	23	16
Number of Auroras observed	0	2	1	3	0	0	3
Possible to see Aurora (No. of nights)	9	11	14	17	17	18	24
Number of Thunderstorms	0	2	0	2	5	3	6

REGISTER FOR THE YEAR 1876.

TORONTO, ONTARIO.

Lake Ontario 108 feet. Approximate elevation above the Sea, 350 feet.

AUG.	SEPT.	OCT.	NOV.	DEC.	1876.	1875.	1874.	1873.	1872.	1871.	1870.
70°.24	57°.46	42°.76	37°.29	17°.24	43°.98	40°.77	44°.30	42°.94	42°.92	43°.81	45°.93
+ 4.04	— 0.68	— 3.06	+ 1.50	— 8.55	— 0.01	— 3.22	+ 0.31	— 1.05	— 1.07	— 0.18	+ 1.94
+ 1.74	— 4.04	—11 04	— 5.91	—18.76	— 7.01	—10.23	— 6.70	— 8.06	— 8.08	— 7.19	— 5.07
88.8	77.8	61.6	58.8	40.1	92.9	88.0	95.0	89.5	96.0	89.5	88.4
45.0	38.5	23.0	5.4	— 9.5	— 9.5	— 16.0	— 7.5	— 18.4	— 13.8	— 21.0	— 6.6
43.8	39.3	38.6	53.4	49.6	102.4	104.0	102.5	107.9	109.8	110.5	95.0
80.39	64.75	50.24	42.30	24.15	...	...	...	...	...	...	...
59.66	50.39	34.74	31.97	9.96	...	...	...	...	...	...	...
20.73	14.36	15.50	10.33	14.19	15.68	17.38	17.43	16.93	17.59	16.46	15.71
32.2	24.2	24.4	17.9	33.1	42.1	46.0	46.5	37.9	37.8	34.6	36.2
29.6704	29.5999	29.5382	29.5782	29.5814	29.6017	29.6151	29.6452	29.5964	29.6079	29.6066	29.5956
+.0467	—.0656	—.1060	—.0341	-0.0676	—.0147	—.0013	+.0288	—.0200	—.0085	—.0098	—.0208
29.889	29.965	29.976	29.970	30.200	30.350	30.271	30.416	30.246	30.231	30.388	30.212
29.334	29.181	28.929	28.968	28.810	28.703	28.751	28.538	28.797	28.789	28.673	28.186
0.555	0.784	1.047	1.002	1.390	1.647	1.520	1.878	1.449	1.442	1.715	2.046
67	70	74	83	82	76	76	74	78	75	73	76
0.505	0.353	0.213	0.194	0.088	0.263	0.236	0.255	0.257	0.259	0.242	0.279
0.46	0.68	0 70	0.89	0.74	0.66	0.62	0.63	0.60	0.59	0.64	0.62
— .02	+ .18	+ .08	+ .15	— .02	+ .05	+ .01	+ .02	— .01	— .02	+ .03	+ .01
S 31 W	N 6 W	S 81 W	N 20 W	N 68 W	N 51 W	N 70 W	N 61 W	N 58 W	N 72 W	N 72 W	N 45 W
0.23	2.97	4.63	0.52	5.68	1.98	2.31	2.67	1.98	2.91	2.49	1.61
6.57	9.22	9.19	7.44	11.83	9.29	8.96	8.03	7.96	6.78	8.24	7.33
+ 1.25	+ 3.60	+ 2.88	— 0.30	+ 3.10	+ 2.14	+ 1.81	+ 0.88	+ 0.81	— 0.37	+ 1.09	+ 0.18
R	2.455	1.435	1.748	0.000	21.063	18.980	17.574	20.232	18.588	22.771	33.898
—2.864	—1.120	—0.946	—0.999	—1.552	—7.241	—9.324	-10.730	—8.072	—9.716	—5.533	+5.594
2	16	12	13	0	117	103	103	110	115	110	116
...	...	0.1	9.1	36.5	113.4	107.5	67.7	113.8	67.5	99.6	122.9
...	...	— 0.79	+ 5.0	+21.43	+41.83	+35.93	— 3.87	+42.23	— 4.07	+28.03	+51.33
...	...	5	7	23	76	70	75	79	77	84	77
31	14	15	12	8	186	201	197	170	185	187	185
2	0	1	1	0	13	17	28	60	67	55	77
24	12	10	6	9	171	212	197	203	236	209	206
1	0	0	0	0	19	26	23	22	28	22	34

TEMPERATURE.

	1876.	Average of 36 years.	Extremes.	
Mean temperature of the year	43.98	43.99	46.36 in '46.	40.77 in '75.
Warmest month	August.	July.	July, 1868.	Aug., 1860.
Mean temperature of the warmest month	70.24	67.39	75.80	64.46
Coldest month	December.	February.	Feb., 1875.	Feb., 1848.
Mean temperature of the coldest month	17.24	22.55	10.16	26.60
Difference between the temperature of the warmest and the coldest months	53.00	44.84	...	...
Mean of the deviation of monthly means from their respective averages of 35 years, signs of deviation being disregarded	3.01	2.47	3.50 in 1843.	...
Months of greatest deviation, without regard to sign	December.	January.	Feb., 1875.	...
Corresponding magnitude of deviation	8.55	3.96	12.4	...
Warmest day	July 9.	...	July 14, '68.	July 31, '44.
Mean temperature of the warmest day	82.67	77.63	84.50	72.75
Coldest day	Dec. 13.	...	Feb. 6, 1855. Jan. 22, 1857.	Dec. 22, '42.
Mean temperature of the coldest day	1.13	—1.59	—14.38	9.57
Date of the highest temperature	July 8.	...	Aug. 24, '54.	Aug. 19, '40.
Highest temperature	92.9	90.94	99.2	82.4
Date of the lowest temperature	Dec. 10.	...	Jan. 10, '59.	Jan. 2, '42.
Lowest temperature	—9.5	—12.34	—26.5	1.9
Range of the year	102.4	103.28	118.2	87.0

BAROMETER.

	1876.	Average of 35 years.	Extremes.	
Mean Pressure of the year	29.6017	29.6164	29.6770 in 1849.	29.5602 in 1864.
Month of the highest mean pressure	August.	Sept.	Jan. 1849.	Jan., 1864.
Highest mean monthly pressure	29.6704	29.6655	29.8046	29.6525
Month of the lowest mean pressure	October.	May.	March, 1859.	Nov., 1849.
Lowest mean monthly pressure	29.5382	29.5700	29.4143	29.5886
Date of the highest pressure in the year	Feb. 5.	...	Jan. 8, 1866.	Jan. 14, '70.
Highest pressure	30.350	30.365	30.940	30.212
Date of the lowest pressure in the year	Jan. 9.	...	Jan. 2, 1870.	Mar. 17, '45.
Lowest pressure	28.703	28.684	28.166	28.939
Range of the year	1.647	1.681	2.133 in 1866.	1.303 in 1845.

RELATIVE HUMIDITY.

	1876.	Average of 34 years.	Extremes.	
Mean humidity of the year	76	77	82 in 1851	73 in 1858
Month of greatest humidity	November.	January.	Jan., 1857.	Dec., 1858.
Greatest mean monthly humidity	83	83	89	81
Month of least humidity	August.	May.	Feb., 1843.	April, 1849.
Least mean monthly humidity	67	71	58	76

EXTENT OF SKY CLOUDED.

	1876.	Average of 23 years.	Extremes.	
Mean cloudiness of the year	0.66	0.61	0.66 in '69 '76	0.57 in 1856.
Most cloudy month	November.	December.	...	...
Greatest monthly mean of cloudiness	0 89	0.76	0 89	0.73
Least cloudy month	August.	August.	...	...
Least monthly mean of cloudiness	0.46	0.48	0.29	0 50

WIND.

	1876.	Result of 28 years.	Extremes.	
Resultant direction	N 51° W	N 61° W	...	...
Resultant velocity in miles	1.98	2.00	...	...
Mean velocity without regard to direction	9.29	7.15	9.29 in '76.	5.10 in '53.
Month of greatest mean velocity	Feb. 7.	March	March, 1874.	Jan., 1848.
Greatest monthly mean velocity	12.45	9.14	13.24	5.82
Month of least mean velocity	July.	July.	Aug., 1852.	Sept., 1860.
Least monthly mean velocity	6.31	5.09	3.30	5.79
Day of greatest mean velocity	Jan. 10.	...	Nov. 15, '71.	Dec. 2, 1848.
Greatest daily mean velocity	28.88	23 99	32.16	15.30
Day of least mean velocity	Oct. 31.	...	...	...
Least daily mean velocity	1.23	...	...	...
Hour of greatest absolute velocity	Dec. 16, 1 a m.	...	Dec. 27, '61. 9.10 a.m.	Mar. 14, '53. 11 am to Noon
Greatest velocity	40.0	40.0	46 0	25.6

RAIN.

	1876.	Average of 36 years.	Extremes.	
Total depth of rain in inches	21.063	28.304	43.555 in '43.	17.574 in '74.
Number of days in which rain fell	117	109	130 in 1861.	80 in 1841.
Month in which the greatest depth of rain fell	May.	September	Sept., 1843.	Sept., 1848.
Greatest depth of rain in one month	3.230	3.575	9.760	3.115
Month in which the days of rain were most frequent	September	October.	June, 1869, Oct. 1864.	May, 1841.
Greatest number of rainy days in one month	16	13	22	11
Day in which the greatest amount of rain fell	Sept. 18.	...	Sept. 14, '43	Sept. 14, '48.
Greatest amount of rain in one day	1.250	1.987	3 455	1.000

SNOW.

	1876.	Average of 33 years.	Extremes.	
Total depth of snow in inches	113.4	71.6	122.9 in '70.	38.4 in 1851.
Number of days in which snow fell	76	64	87 in 1859.	33 in 1848.
Month in which the greatest depth of snow fell	March.	February.	March, 1870.	Dec., 1851.
Greatest depth of snow in one month	44 1	18 4	62.4	10.7
Month in which the days of snow were most frequent	December.	January.	Dec., 1872.	Feb., 1848.
Greatest number of days of snow in one month	23	14	24	8
Day in which the greatest amount of snow fell.	March 28.	...	Mar. 28, '76.	Jan. 10, '57.
Greatest fall of snow in one day	16 2	9.9	16.2	5.5

DIFFERENCE OF CERTAIN METEOROLOGICAL ELEMENTS FROM THE NORMAL VALUES FOR EACH QUARTER, AND THE YEAR.

Quarter.	Barom.	Temper.	Rain.	Days Rain.	Snow.	Days Snow.	Velocity of Wind.	Clouded Sky.
	inches.	°	inches.		inches.		miles.	
Winter	+ .0043	+ 1.45	+ 1.887	+ 10.21	+ 18.57	+ 1.14	+ 3.33	+ 0.05
Spring	+ .0110	+ 0.37	— 1.789	+ 0.55	— 2.38	— 1.25	+ 1.31	+ 0.02
Summer	— .0048	+ 1.58	— 3.842	+ 0.09	...	...	+ 2.02	+ 0.05
Autumn	— .0692	— 3.44	— 3.497	— 3.02	+ 25.64	+ 11.92	+ 1.89	+ 0.07
Year	— .0147	— 0.01	— 7.241	+ 7.83	+ 41.83	+ 11.81	+ 2.14	+ 0.05

PERIODICAL OR OCCASIONAL EVENTS, 1876.

January 8. Bay frozen again.
February 9. Water in Bay very high Ft. 7.6 above zero. 10th. First thunderstorm.
" 20. Red woodpeckers.
March 4. Song sparrows. 5th Crows numerous.
" 12. First schooner arrived.
" 14. Robins seen.
April 5. First schooner left with cargo.
" 12. Bay clear of ice. 14th. Blue birds.
" 20. Swallows seen; numerous on 26th.
" 22. *City of Toronto* arrived. First trip to Niagara, 24th.
" 30. Last snow of spring.
May 2. Frogs noisy. 11th. Last ice of season.
" 8. Maples in flower. 15th. Plum trees in flower.
" 14. Humming birds seen. 18th. Baltimore bird and Virginia nightingale.
" 23. Last frost of season. 24th. Flowering currant in blossom.
" 30. Apple trees in blossom. Wild strawberries in flower.
June 1. Chestnut trees in flower. Lilacs in flower.
" 23. Night hawks. 24th. Fire flies.
July 25. Humming birds numerous.
August 29. Swallows appear to be all gone. The want of rain severely felt—grass scorched, wells dry.
October 1. First frost of season. 7th. First snow of season.
" 8. First ice of season.
" 28. Last trip *City of Toronto*.
Novem'r 26. First sleighing.
December 1. Bay frozen
" 15 and 28. Beautiful display of double halos and parhelia, followed on both occasions by furious snowstorms.

MONTHLY METEOROLOGICAL REGISTER, AT THE MAGNETICAL OBSERVATORY, TORONTO, ONTARIO—JANUARY, 1877.

Latitude—43° 39'4 *North.* *Longitude*—5*h.* 17*m.* 33*s. West.* *Elevation above Lake Ontario,* 108 *feet.*

Day.	Barom. at temp. of 32°.				Temp. of the Air.				Excess of Mean above aver'ge	Tension of Vapour.				Humidity of Air.				Direction of Wind.				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.	10 PM	MEAN		6 A. M	2 P. M.	10 P. M.	M'N.	6 A. M.	2 P. M.	10 P. M.	M'N.	6 A. M.	2 P. M.	10 P.M.	Res'l-tant.	6 A.M.	2 P.M.	10 P.M	Res'l-tant.	MEAN		
					°	°	°	°	°												°							
1	29.727	29.519	29.423	29.5433	16.4	20.3	14.4	16.60	— 4.73	.076	.096	.062	.078	83	88	76	84	W	N E	N E	N 33 E	5.0	7.8	12.0	2.96	7.44	...	1.0
2	.453	.533	.629	.5493	9.1	17.1	10.9	12.55	— 8.73	.064	.073	.061	.067	98	79	86	88	N	N W	N E	N 30 W	7.5	12.5	5.0	8.56	9.67	...	...
3	.653	.673	.754	.7028	2.7	6.8	4.4	4.07	—17.18	.042	.042	.045	.042	86	72	84	80	N	N W	W	N 37 W	6.0	6.0	11.0	6.32	6.46	...	...
4	.749	.753	.756	.7578	7.7	16.2	10.6	10.95	—10.28	.051	.058	.061	.057	85	69	87	81	W	W	W	S 79 W	7.8	13.0	5.2	6.79	6.88	...	...
5	.772	.752	.733	.7542	11.3	21.0	18.9	16.65	— 4.57	.067	.081	.087	.079	94	78	84	85	W	S	S	S 51 W	4.0	7.8	2.2	4.77	5.29	...	0.1
6	.673	.585	.371	.5353	22.1	30.8	31.1	28.42	+ 7.20	.108	.134	.167	.136	92	75	96	86	S W	S E	E	S 43 E	6.4	6.8	5.0	1.92	4.07	...	...
7	.020	.200	.340	.2033	30.0	33.0	27.0	29.17	+ 7.49	—	—	—	—	—	—	—	—	N	W	W	N 87 W	2.8	20.0	10.2	6.90	8.75	...	0.7
8	.396	.423	.637	.4988	18.1	10.6	1.1	9.23	—11.98	.083	.049	.044	.059	84	84	97	87	W	N W	N W	N 61 W	5.9	14.8	3.6	8.82	9.04	...	0.4
9	.736	.851	.790	.7905	5.0	10.9	14.6	10.30	—10.93	.048	.050	.055	.052	90	69	67	76	W	W	S	S 54 W	12.2	11.8	14.0	8.51	10.22	...	S
10	.662	.568	.665	.6322	19.2	23.0	20.7	20.78	— 0.48	.089	.097	.093	.093	86	80	82	83	S W	S W	S W	S 42 W	19.0	7.5	9.0	12.04	12.54	...	3.5
11	.684	.520	.834	.6992	24.3	27.2	12.7	20.02	— 1.30	.111	.118	.058	.095	84	84	74	83	S W	S W	N W	N 85 W	15.5	2.5	21.0	7.07	10.65	...	1.7
12	30.144	29.975	.686	.9297	-11.0	—4.0	—3.9	-6.12	—27.48	.021	.034	.036	.031	77	90	100	90	N	N E	N	N 15 E	9.5	14.0	14.8	12.36	12.94	...	S
13	29.744	.529	.311	.5112	1.3	13.5	14.9	10.72	—10.70	.041	.075	.069	.061	92	79	80	85	W	S W	W	S 65 W	9.2	20.5	27.0	14.43	15.88	...	0.3
14	.500	.700	.730	.6617	16.0	12.0	10.0	12.50	— 8.95	—	—	—	—	—	—	—	—	W	N	N E	N 61 W	14.0	6.0	8.7	6.36	11.46	...	4.0
15	.569	.496	.258	.4227	14.9	16.4	13.5	15.33	— 6.17	.075	.091	.079	.080	87	83	98	92	N E	N E	N E	N 40 E	12.0	14.5	17.0	12.88	12.92	...	1.5
16	.357	.681	.936	.6997	10.2	15.6	8.4	10.68	—10.90	.066	.066	.051	.059	96	76	82	83	N	N W	N W	N 26 W	10.0	9.0	4.6	6.88	7.74	...	...
17	30.077	30.126	30.091	30.0983	—1.0	20.0	13.8	11.23	—10.38	.040	.102	.068	.067	97	80	85	88	N W	S W	S W	S 84 W	1.0	5.2	8.0	3.11	3.94	...	0.1
18	30.033	29.949	29.911	29.9635	9.5	24.6	24.6	20.85	— 0.83	.059	.116	.127	.105	89	83	96	91	W	W	W	S 76 W	2.8	0.4	3.0	2.46	2.46	...	0.1
19	29.816	.623	.320	.5588	24.3	30.4	33.0	29.62	+ 7.87	.123	.105	.174	.154	95	90	92	93	W	S W	S W	S 41 W	0.8	9.0	17.5	7.13	7.48	...	...
20	28.964	.165	.555	.2468	35.8	22.1	16.0	23.80	+ 1.98	.198	.074	.074	.111	94	58	83	79	S W	W	S W	S 62 W	15.8	31.0	12.7	19.08	20.29	R	...
21	29.680	.750	.800	.7550	10.0	16.5	14.0	13.42	— 8.45	—	—	—	—	—	—	—	—	S W	S W	S W	S 58 W	13.0	12.0	6.0	11.40	11.54	...	...
22	.811	.831	.881	.8485	16.0	25.0	19.4	19.47	— 2.47	.074	.082	.084	.079	83	61	80	76	S W	W	W	S 84 W	4.0	21.5	4.0	8.58	8.83	...	...
23	.918	.857	.605	.7828	12.7	14.6	13.8	13.58	—13.57	.058	.060	.068	.061	75	64	84	75	W	S W	S W	S 65 W	10.5	17.0	18.8	14.63	15.33	...	S
24	.461	.700	.788	.6712	15.3	12.7	11.1	12.62	— 9.45	.071	.038	.059	.054	81	52	82	70	W	N W	W	N 86 W	17.0	30.5	16.5	18.14	19.27	...	S
25	.817	.800	.799	.8140	10.6	16.4	16.4	14.80	— 7.32	.057	.068	.069	.064	84	69	77	76	W	W	W	S 75 W	10.8	11.5	6.8	8.11	8.46	...	...
26	.749	.611	.496	.6068	16.7	29.7	31.1	26.68	+ 4.50	.085	.133	.138	.120	92	80	79	82	W	S W	S W	S 59 W	3.4	12.5	20.0	10.43	10.58	...	...
27	.496	.714	.911	.7317	23.9	31.5	18.9	24.07	— 1.83	.109	.120	.089	.104	84	75	86	79	W	N W	N W	N 79 W	7.0	10.6	10.0	8.67	10.22	...	...
28	.920	.700	.660	.7600	16.0	32.0	30.0	25.67	+ 3.36	—	—	—	—	—	—	—	—	N W	S W	W	S 52 W	4.6	21.8	5.4	6.46	8.72	...	...
29	.727	.775	.912	.8265	16.7	34.8	24.6	25.90	+ 3.52	.085	.156	.114	.119	92	70	85	83	W	S E	N E	S 74 W	2.4	5.0	3.6	0.47	3.08	...	...
30	30.056	30.102	30.046	30.0693	23.6	32.0	31.5	29.15	+ 6.72	.118	.164	.170	.150	94	91	95	93	N E	E	E	N 57 E	7.8	6.6	4.0	4.93	6.08	...	...
31	29.910	29.706	29.579	29.7165	30.1	32.9	29.7	31.48	+ 9.00	.164	.180	.162	.169	98	91	98	95	E	E	S	S 68 E	6.5	12.3	2.6	5.46	5.76	.030	...
	29.6863	29.6828	29.6841	29.6884	14.76	20.83	17.32	17.55	— 4.13	.081	.093	.088	.087	89	77	86	84	....	....	....	....	8.17	12.30	9.98	...	9.50	.030	13.4

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR JANUARY, 1877.

NOTE.—The monthly means of the Barometer and Temperature include Sunday observations. The daily means, excepting those that relate to the wind, are derived from six observations daily, namely, at 6 A.M., 8 A.M., 2 P.M., 4 P.M., 10 P.M., and midnight. The means and resultants for the wind are from hourly observations.

Highest Barometer .... 30.144 at 6 a.m. on 12th. } Monthly range
Lowest Barometer .... 29.020 at 6 a.m. on 7th. } 1.124.

Self-registering Ther.:
- Maximum temperature .... 40.8 on 20th. } Monthly range
- Minimum temperature .... —13.9 on 12th. } 54°7.
- Mean maximum temperature .... 24.32 } Mean Daily range
- Mean minimum temperature .... 9.99 } 15°33.
- Greatest daily range .... 26.9 from a.m. to p.m. on 20th.
- Least daily range .... 5.4 from a.m. to p.m. on 31st.

Warmest day .... 31st; mean temperature ...... 31.48 } Difference=37°60.
Coldest day .... 12th; mean temperature ... —6.12 }

Maximum Radiation { Solar .... 125.0 on 16th. } Monthly range
{ Terrestrial .... —19.0 on 12th. } 144.0

No Aurora observed.

Possible to see Aurora on 13 nights; impossible on 18 nights.

Raining on 2 days; depth, 0.030 inches; duration of fall, 4.5 hours.

Snowing on 15 days; depth, 13.4; duration of fall, 83.6 hours.

Mean of cloudiness, 0.69.

WIND.

Resultant direction, S. 87° W.; resultant velocity, 5.20 miles.

Mean velocity, 9.50 miles per hour.

Maximum velocity, 35.0 miles per hour, from 1 to 2 p.m. of 20th.

Most windy day, 20th; mean velocity, 20.29 miles per hour.

Least windy day, 29th; mean velocity, 3.08 miles per hour.

Most windy hour, 2 p.m.; mean velocity, 12.30 miles per hour.

Least windy hour, 1 a.m.; mean velocity, 7.79 miles per hour.

Solar halos on 2nd, 9th, 20th, 24th, 31st.

Lunar halos on 3rd, 21st, 23rd, 25th.

Fog on 29th and 31st.

COMPARATIVE TABLE FOR JANUARY.

YEAR.	TEMPERATURE. Mean.	Excess above Average.	Maximum.	Minimum.	Range.	RAIN. No. of days.	Inches.	SNOW. No. of days.	Inches.	WIND. Resultant. Direction.	V'locity.	Mean Velocity.
	°	°	°	°	°					°		
1849	18.5	— 4.4	39.5	—14.2	53.7	4	1.175	10	9.2	N 63 W	3.06	6.71
1850	29.7	+ 6.8	46.4	9.9	36.5	5	1.250	8	5.2	N 37 W	0.69	5.80
1851	25.5	+ 2.6	43.4	—12.8	56.2	4	1.275	10	7.8	S 77 W	3.26	7.69
1852	18.4	— 4.5	37.3	—10.6	47.9	0	0.000	19	30.9	N 68 W	3.14	7.67
1853	23.0	+ 0.1	40.9	— 9.7	50.6	1	0.290	6	7.5	N 27 W	2.52	6.34
1854	23.6	+ 0.7	46.4	— 5.4	51.8	7	1.270	11	7.5	N 77 W	2.44	6.91
1855	25.9	+ 3.0	49.0	— 5.4	54.4	5	0.525	13	23.3	N 73 W	1.91	7.26
1856	16.0	— 6.9	34.4	—12.0	46.4	0	0.000	14	13.6	N 75 W	5.24	10.69
1857	12.8	—10.1	37.2	—20.1	57.3	3	inap.	16	21.8	N 70 W	4.96	10.31
1858	30.0	+ 7.1	47.4	6.5	40.9	6	1.152	11	4.0	N 71 W	2.33	7.40
1859	26.4	+ 3.5	43.2	—26.5	69.7	6	1.449	19	16.4	S 81 W	3.17	8.76
1860	23.4	+ 0.5	46.4	— 6.8	53.2	6	0.740	16	8.7	N 89 W	6.09	9.37
1861	19.9	— 3.0	37.0	—11.2	48.2	4	0.685	23	20.6	N 86 W	2.92	9.30
1862	21.7	— 1.2	44.5	— 2.6	47.1	5	0.115	19	27.4	N 26 W	2.69	8.83
1863	28.1	+ 5.2	47.0	—14.0	61.0	10	1.122	17	20.6	N 61 W	1.13	7.23
1864	22.8	— 0.1	44.2	— 9.0	53.2	5	1.165	14	26.3	S 73 W	6.00	10.22
1865	17.7	— 5.2	37.2	— 9.0	46.2	1	0.440	18	14.8	N 85 W	4.80	9.39
1866	20.7	— 2.2	44.0	—14.0	58.0	4	0.522	19	10.3	N 75 W	2.98	9.34
1867	17.6	— 5.3	43.8	— 4.8	48.6	1	inap.	21	42.0	N 55 W	3.27	6.96
1868	19.0	— 3.9	39.0	— 7.0	46.0	2	inap.	21	14.6	S 83 W	3.97	8.91
1869	27.7	+ 4.8	45.0	— 1.0	46.0	4	0.887	12	9.8	N 72 W	3.40	9.21
1870	24.4	+ 1.5	45.0	— 3.2	48.2	8	3.412	18	21.3	S 89 W	2.63	8.98
1871	21.3	— 1.6	46.4	—13.2	59.6	8	0.864	23	43.6	S 49 W	2.56	9.84
1872	22.4	— 0.5	41.8	— 2.5	44.3	5	0.220	15	3.9	S 87 W	4.73	8.87
1873	17.7	— 5.2	46.0	—18.4	64.4	4	1.110	17	39.2	N 78 W	2.96	10.01
1874	24.8	+ 1.9	57.5	— 4.0	61.5	13	2.820	15	12.2	N 61 W	3.42	8.58
1875	16.1	— 6.8	39.0	— 8.8	47.8	1	inap.	17	32.3	N 88 W	4.06	9.54
1876	29.0	+ 6.1	57.5	5.1	52.4	12	1.960	9	3.2	S 79 W	6.31	11.79
1877	17.5	— 5.4	40.8	—13.9	54.7	2	0.030	15	13.4	S 87 W	5.20	9.50
Res'lts to 1876.	22.94	......	43.80	—8.02	51.82	4.92	1.227	14.05	17.07	N 80 W	3.23	8.54
Excess for 1877	— 5.39	......	— 3.00	— 5.88	+ 2.88	— 2.92	— 1.197	+ 0.95	— 3.67	...	...	+ 0.96

MONTHLY METEOROLOGICAL REGISTER, AT THE MAGNETICAL OBSERVATORY, TORONTO, ONTARIO—FEBRUARY, 1877.

Latitude—43° 39'4 *North.* *Longitude*—5*h.* 17*m.* 33*s.* *West.* *Elevation above Lake Ontario,* 108 *feet.*

Day.	Barom. at temp. of 32°.				Temp. of the Air.				Excess of Mean above Av'rage.	Tension of Vapour.				Humidity of Air.				Direction of Wind.				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.	10 PM	MEAN		6 A. M.	2 P. M.	10 P. M.	M'N.	6 A. M.	2 P. M.	10 P. M.	M'N.	6 A.M.	2 P.M.	10 P.M.	Resultant.	6 A. M	2 P. M.	10 P. M.	Result't	MEAN		
1	29.489	29.532	29.654	29.5705	36.5°	39.8°	35.8°	37.25°	+14.70°	.189	.171	.173	.177	87	70	82	80	S W	W	W	S 64° W	11.5	12.5	2.6	7.49	8.25	...	...
2	.644	.618	.711	.6722	33.7	38.0	34.4	35.37	+12.75	.176	.174	.174	.175	90	76	88	85	S W	E	E	N 86 E	0.8	4.5	4.2	1.25	2.68	...	...
3	.792	.872	.990	.8933	34.8	37.6	33.7	35.35	+12.68	.177	.175	.153	.167	88	77	79	81	N W	N W	N W	N 36 W	5.4	6.8	7.4	7.73	7.78	...	...
4	30.030	.960	.880	.9500	32.0	30.0	21.0	27.00	+ 4.28	—	—	—	—	—	—	—	—	W	S W	S W	S 79 W	2.6	5.4	1.8	3.11	4.06	...	...
5	29.710	.602	.656	.6547	25.4	25.9	30.1	27.15	+ 4.37	.125	.126	.150	.134	91	90	89	90	N W	W	S W	S 84 W	4.1	3.7	7.8	3.07	3.94	...	...
6	.664	.575	.490	.5688	32.6	34.6	34.4	33.73	+10.90	.165	.155	.158	.160	88	77	79	82	W	S W	S W	S 55 W	6.2	12.5	11.0	10.93	11.12	...	...
7	.455	.507	.732	.5772	34.4	38.0	29.0	32.70	+ 9.80	.175	.152	.133	.146	87	66	83	78	S W	W	N W	S 86 W	8.0	14.0	17.0	11.03	13.38	...	...
8	.825	.790	.752	.7925	14.6	25.4	24.8	21.52	— 1.43	.069	.071	.091	.079	82	51	68	68	N W	W	W	N 60 W	3.5	4.2	5.5	4.87	5.67	...	...
9	.808	.797	.739	.7793	15.6	31.9	27.9	24.95	+ 1.92	.073	.114	.117	.102	82	63	77	75	W	S W	S W	S 69 W	2.6	3.0	0.4	3.38	3.77	...	...
10	.689	.644	.741	.7005	28.6	38.3	29.0	32.45	+ 9.38	.131	.156	.133	.142	83	67	83	77	S W	S W	N W	S 44 W	9.2	7.6	4.2	4.60	5.90	...	...
11	.800	.740	.660	.7183	21.0	40.0	40.0	33.92	+10.76	—	—	—	—	—	—	—	—	N	S	S W	S 34 W	3.0	9.8	13.0	4.63	6.51	...	...
12	.547	.856	30.180	.8965	39.4	17.6	13.5	21.60	— 1.65	.192	.080	.049	.093	80	84	60	72	N W	N W	N W	N 56 W	22.0	30.0	24.5	20.06	23.23	...	0.3
13	30.309	30.329	30.316	30.3168	7.0	18.9	14.2	13.65	— 9.67	.054	.054	.070	.060	91	51	86	75	N W	N	N	N 23 W	7.4	10.6	11.0	11.14	11.43	...	...
14	30.218	30.101	30.014	30.0953	10.6	26.6	18.9	18.43	— 4.97	.057	.091	.087	.076	83	62	84	75	N W	S	N E	N 29 W	5.5	4.5	4.4	1.24	4.22	...	...
15	29.862	29.759	29.716	29.7658	18.5	29.7	32.0	27.70	— 4.20	.085	.147	.164	.136	86	89	90	88	N	S W	S W	S 66 W	5.0	6.0	5.4	2.50	6.18	...	S
16	.570	.512	.601	.5635	35.1	33.7	22.5	30.18	+ 6.60	.074	.129	.085	.119	85	67	70	69	S W	W	W	S 28 W	9.0	20.0	6.8	2.39	13.26	...	0.1
17	.528	.637	.729	.6375	21.8	18.9	16.4	18.35	— 5.35	.099	.060	.076	.076	84	58	83	75	W	N W	W	N 63 W	10.6	19.0	6.0	10.98	11.98	...	S
18	.700	.560	.490	.5733	14.0	25.5	24.0	20.75	— 3.06	—	—	—	—	—	—	—	—	W	S	N	S 84 W	3.7	4.0	4.6	2.45	3.25	...	2.4
19	.463	.520	.628	.5470	9.5	20.1	21.8	17.30	— 6.60	.059	.066	.093	.072	89	61	79	75	N	N W	N W	N 31 W	5.4	21.0	11.8	12.00	12.61	...	0.1
20	.709	.614	.369	.5500	14.7	31.1	31.9	25.88	+ 1.83	.070	.087	.122	.086	84	50	66	60	N W	S W	W	N 82 W	15.0	10.5	20.0	9.60	12.92	...	...
21	.310	.289	.282	.2973	30.8	42.7	34.9	35.57	+11.35	.126	.155	.160	.144	73	56	78	69	S W	S W	S W	S 61 W	5.6	8.2	5.6	8.19	8.73	...	...
22	.338	.377	.462	.3973	33.7	43.4	35.5	37.23	+12.92	.129	.159	.176	.150	67	56	85	68	W	S W	N E	S 48 W	8.7	7.0	5.6	4.21	6.19	...	...
23	.411	.357	.402	.3928	37.3	39.2	40.5	39.12	+14.63	.146	.145	.137	.138	64	59	54	57	N E	E	N E	N 60 E	12.0	18.0	17.0	14.42	14.63	...	...
24	.355	.358	.438	.3897	37.6	40.9	36.9	38.20	+13.58	.154	.166	.145	.154	68	64	66	66	N E	N E	N	N 80 E	9.0	5.8	11.2	4.32	9.46	...	...
25	.520	.650	.740	.6567	30.0	31.0	31.0	30.50	+ 5.69	—	—	—	—	—	—	—	—	N W	N W	N W	N 27 W	10.0	15.0	6.0	12.96	13.47	...	...
26	.807	.853	.898	.8633	29.7	31.9	30.1	30.40	+ 5.37	.154	.106	.114	.117	93	58	67	69	N W	N W	N	N 33 W	8.2	12.5	8.8	9.80	9.99	...	...
27	.952	.924	.860	.9078	25.0	36.4	29.5	29.75	+ 4.58	.089	.121	.120	.107	66	56	73	65	N	S E	W	N 3 E	9.0	6.0	4.2	2.33	5.92	...	...
28	.807	.795	.804	.8063	24.6	36.9	29.0	30.65	+ 5.25	.114	.122	.117	.112	86	52	74	67	N W	W	S W	N 70 W	9.8	14.0	6.6	8.13	9.02	...	...
	29.6897	29.6831	29.7118	29.6977	26.02	32.29	28.67	28.81	+ 5.17	.124	.124	.125	.122	82	65	77	74	....	....	....	....	7.60	10.57	8.37	......	8.91	...	2.9

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR FEBRUARY, 1877.

NOTE.—The monthly means of the Barometer and Temperature include Sunday observations. The daily means, excepting those that relate to the wind, are derived from six observations daily, namely, at 6 A.M., 8 A.M., 2 P.M., 4 P.M., 10 P.M., and midnight. The means and resultants for the wind are from hourly observations.

Highest barometer ....30.352 at 9 a.m. on 13th } Monthly range=
Lowest barometer ....29.282 at 4 p.m. on 21st } 1.070.

Self-registering Ther.:
- Maximum temperature..............44°9 on 22nd } Monthly range=
- Minimum temperature.............. 4°9 on 13th } 40°0.
- Mean maximum temperature ....36°01 } Mean daily range=
- Mean minimum temperature..............20°94 } 15°07.
- Greatest daily range..............28°9 from a.m. to p.m. of 12th.
- Least daily range .... 4°1 from a.m. to p.m. of 26th.

Warmest day ....23rd; mean temperature..............39°12 } Difference=25°47.
Coldest day..............13th; mean temperature..............13°65 }

Maximum Radiation { Solar ....111°0 on 21st } Monthly Range=
{ Terrestrial ....—22°0 on 14th } 113°0.

No Aurora observed.

Possible to see Aurora on 14 nights; impossible on 14 nights.

No Rain fell during month.

Snowing on 6 days; depth, 2.9 inches; duration of fall, 22.6.

Mean of cloudiness, 0.60.

WIND.

Resultant direction, N. 64° W.; resultant velocity, 4.62 miles.

Mean velocity, 8.91 miles per hour.

Maximum velocity, 35.5 miles from 11 a.m. to noon of 12th.

Most windy day, 12th; mean velocity, 23.23 miles per hour.

Least windy day, 2nd; mean velocity, 2.68 miles per hour.

Most windy hour, 3 p.m.; mean velocity, 11.01 miles per hour.

Least windy hour, 5 a.m.; mean velocity, 7.50 miles per hour.

Fog on morning of 5th.

Lightning on 6th.

Solar halos on 8th, 9th, 11th, 20th and 23rd.

Lunar halos on 22nd, 24th and 25th.

COMPARATIVE TABLE FOR FEBRUARY.

YEAR.	TEMPERATURE. Mean.	Excess above aver'ge	Maxi-mum.	Mini-mum.	Range.	RAIN. No. of days.	Inches	SNOW. No. of days.	Inches	WIND. Resultant. Direction.	Velo'y	Mean Velocity.
1849	19.5	— 3.1	40.6	— 9.8	50.4	2	0.240	13	19.2	N 41 W	1.48	6.58
1850	26.0	+ 3.4	49.6	2.2	47.4	7	1.235	9	23.1	N 80 W	3.48	7.61
1851	27.6	+ 5.0	50.2	2.0	48.2	7	2.600	4	2.4	N 64 W	1.99	6.94
1852	23.4	+ 0.8	41.2	— 6.2	47.4	3	0.650	11	13.0	S 75 W	3.34	6.42
1853	24.1	+ 1.5	43.4	— 1.4	44.8	4	1.030	15	12.6	N 49 W	2.51	7.30
1854	21.1	— 1.5	42.8	—10.8	53.6	5	1.460	15	18.0	N 7 E	1.73	6.91
1855	15.4	— 7.2	39.0	—25.4	64.4	2	1.770	14	21.8	N 40 W	4.34	8.17
1856	15.7	— 6.9	37.8	—18.7	56.5	0	0.000	8	9.7	N 81 W	7.70	10.17
1857	28.5	+ 5.9	52.4	— 5.9	58.3	11	3.050	11	11.7	S 78 W	3.68	9.82
1858	17.0	— 5.6	42.4	— 7.3	49.7	1	Inap.	16	26.7	N 72 W	3.22	9.12
1859	26.0	+ 3.4	46.2	2.1	44.1	6	0.455	14	8.3	N 54 W	2.72	8.50
1860	22.8	+ 0.2	50.2	— 8.5	58.7	7	1.330	13	18.8	N 61 W	3.28	8.73
1861	26.1	+ 3.5	46.0	—20.8	66.8	4	0.815	17	29.7	N 77 W	3.86	10.58
1862	22.5	— 0.1	37.8	— 5.2	43.0	3	0.180	17	23.1	N 55 W	3.93	8.52
1863	22.4	— 0.2	41.5	—19.8	61.3	7	1.450	12	22.0	N 23 W	2.27	10.13
1864	24.3	+ 1.7	45.0	—15.0	60.0	2	0.397	14	9.5	S 84 W	6.48	10.11
1865	22.4	— 0.2	42.2	—10.0	52.2	5	0.810	11	16.8	N 23 W	3.95	8.23
1866	22.5	— 0.1	45.0	— 8.0	53.0	3	0.830	12	16.9	S 80 W	5.14	9.40
1867	28.9	+ 6.3	44.0	0.2	43.8	8	1.328	13	13.4	N 57 W	1.58	8.85
1868	17.2	— 5.4	45.0	—11.5	56.5	1	0.040	16	32.8	N 69 W	3.23	10.84
1869	25.0	+ 2.4	46.0	— 1.0	47.0	2	0.165	19	39.7	N 34 W	4.18	10.04
1870	21.5	— 1.1	40.6	— 6.6	47.2	2	0.520	18	20.1	N 29 W	2.84	8.10
1871	24.3	+ 1.7	48.0	—15.8	63.8	3	0.040	15	23.0	N 70 W	4.26	9.87
1872	20.7	— 1.9	45.2	— 3.6	48.8	5	0.350	9	7.3	N 61 W	3.32	8.93
1873	21.5	— 1.1	43.0	—10.5	53.5	0	0.000	11	10.4	N 68 W	4.29	10.21
1874	22.8	+ 0.2	42.0	0.4	41.6	6	1.150	15	19.1	N 24 W	2.46	8.12
1875	10.2	—12.4	47.6	—16.0	63.6	5	0.470	9	9.1	S 88 W	6.67	9.91
1876	23.8	+ 1.2	44.1	— 3.9	48.0	7	2.300	15	20.1	N 63 W	3.71	12.45
1877	28.8	+ 6.2	44.9	4.9	40.0	0	0.000	6	2.9	N 64 W	4.62	8.91
Resu'ts to 1876.	22.58	...	44.24	—8.39	52.63	4.08	0.889	12.46	18.41	N 67 W	3.26	8.85
Excess for '77.	+ 6.23	...	+ 0.66	+ 13.29	— 12.63	— 4.08	— 0.889	— 6.46	— 15.51	...	...	+ 0.06

MONTHLY METEOROLOGICAL REGISTER, AT THE MAGNETICAL OBSERVATORY, TORONTO, ONTARIO—MARCH, 1877.

Latitude—43° 39'4 North. Longitude—5h. 17m. 33s. West. Elevation above Lake Ontario, 108 feet.

Day.	Barom. at temp. of 32°.				Temp. of the Air.				Excess of Mean above Normal.	Tension of Vapour.				Humidity of Air.				Direction of Wind.				Velocity of the Wind.					Rain in inches	Snow in inches
	6 A.M.	2 P.M.	10 P.M.	Mean.	6 A.M.	2 P.M.	10 P.M.	MEAN		6 A.M.	2 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.	Res'l-tant.	6 A.M.	2 P.M.	10 P.M.	Res'l-tant.	MEAN		
1	29.802	29.755	29.559	29.6927	24.5°	39.2°	34.4°	33.38°	+ 7.78°	.101	.128	.155	.126	76	54	79	66	W	S	E	S 10° E	5.0	5.2	8.7	1.95	4.69	...	...
2	.164	28.816	.043	.0042	34.2	42.7	36.6	37.62	+11.82	.185	.242	.154	.193	94	88	71	84	E	S	W	S 17 W	13.5	16.0	21.0	3.44	13.46	.460	0.3
3	.390	29.384	.330	.3637	30.1	38.0	33.3	33.73	+ 7.72	.114	.186	.170	.156	68	81	89	79	W	S W	S W	S 56 W	8.4	14.0	1.4	6.02	10.95	...	0.9
4	.380	.590	.710	.5817	20.0	26.0	24.0	22.67	— 3.59	—	—	—	—	—	—	—	—	N W	W	S W	S 88 W	14.0	22.0	16.0	10.49	13.47	...	0.7
5	.708	.639	.758	.7093	10.4	26.1	13.8	17.10	— 9.42	.063	.033	.072	.076	92	58	89	82	N	W	N W	S 89 W	2.0	23.0	7.0	9.23	10.93	...	0.3
6	.829	.668	.393	.6147	3.8	22.1	29.7	19.85	— 6.92	.046	.083	.162	.101	89	70	97	86	N W	S W	S W	S 41 W	2.8	17.0	23.0	10.16	12.32	...	1.5
7	.609	.849	.762	.7518	18.5	21.8	20.0	20.12	— 6.88	.064	.068	.081	.071	64	56	74	64	N W	W	N E	N 13 W	22.2	3.8	6.8	3.50	12.08	...	0.3
8	.415	.194	28.886	.1305	26.5	30.1	31.9	28.62	+ 1.32	.141	.157	.180	.153	98	93	100	97	E	N	N E	N 53 E	18.5	10.0	5.9	10.83	12.63	.510	3.5
9	28.728	.103	29.503	.1587	20.0	20.7	14.5	17.55	—10.00	.093	.086	.079	.080	87	76	94	83	N W	W	W	N 64 W	15.5	23.0	12.2	15.51	17.39	.160	0.5
10	29.709	.827	.884	.8190	8.8	18.2	14.9	14.22	—13.65	.050	.068	.069	.061	78	68	80	72	W	S W	W	S 68 W	10.0	14.6	6.0	10.74	11.01	...	...
11	.910	.880	.884	.8913	12.0	31.5	31.0	25.33	— 2.82	—	—	—	—	—	—	—	—	W	S W	S W	S 60 W	8.2	9.3	2.6	5.96	6.12	...	0.2
12	.886	.798	.740	.8017	23.6	30.1	27.2	26.58	— 1.88	.119	.150	.118	.125	93	89	79	86	N E	E	N E	N 48 E	7.6	7.2	8.0	6.79	7.11	...	2.9
13	.838	.906	.730	.8160	19.4	27.9	27.9	25.10	— 3.67	.088	.103	.103	.099	83	66	66	71	N	S E	S E	N 71 E	5.5	7.8	11.0	6.23	8.98	...	0.1
14	.409	.241	.558	.4097	32.2	33.8	19.6	27.35	— 1.73	.162	.190	.079	.126	89	98	74	80	S E	W	N W	S 85 W	11.5	19.0	20.0	7.18	15.27	...	1.0
15	.613	.541	.574	.5763	18.2	25.0	21.0	21.12	— 8.30	.088	.083	.076	.083	89	61	66	74	W	W	W	W	7.6	16.0	9.0	12.43	12.73	...	...
16	.615	.528	.669	.6137	8.4	23.6	10.6	14.45	—15.30	.049	.078	.042	.060	78	61	58	69	N W	W	N W	N 54 W	4.0	8.2	18.5	7.16	8.90	...	s
17	.867	.944	.904	.9097	0.7	10.9	6.3	6.47	—23.62	.041	.047	.045	.044	92	65	78	77	N	N W	N W	N 7 W	12.8	5.4	7.0	5.87	6.75	...	s
18	.840	.790	.830	.8117	6.0	20.0	10.0	12.50	—17.91	—	—	—	—	—	—	—	—	N	S W	W	N 61 W	2.0	5.0	4.4	3.73	4.50	...	0.2
19	.757	.613	.701	.6860	4.0	22.3	12.6	13.82	—16.95	.045	.073	.068	.065	87	59	89	80	N	S E	S E	N 10 E	3.8	3.0	4.0	1.61	4.10	...	0.1
20	.808	.761	.554	.6847	7.3	26.1	27.5	21.67	— 9.45	.051	.096	.112	.089	85	68	74	75	W	S W	N E	S 17 W	3.4	11.5	10.8	2.89	7.11	...	s
21	.265	.350	.458	.3603	27.5	31.9	30.4	30.42	— 1.05	.143	.158	.146	.152	96	87	86	89	N E	W	S W	N 43 W	8.0	9.0	6.0	2.17	9.29	...	7.0
22	.541	.544	.480	.5227	30.8	36.9	32.9	33.77	+ 1.93	.155	.184	.168	.172	90	84	90	89	S W	S	E	S 18 W	6.0	12.0	5.6	5.62	7.83	...	...
23	.411	.546	.684	.5635	33.7	32.6	23.2	29.70	— 2.48	.183	.129	.083	.127	95	68	66	75	N E	N W	N W	N 27 W	0.7	13.5	13.0	9.54	10.12	...	...
24	.790	.876	.839	.8453	23.6	32.2	31.1	28.62	— 3.95	.105	.126	.153	.127	83	68	87	80	N W	E	E	N 39 E	9.0	9.5	16.0	7.18	10.92	...	...
25	.750	.610	.530	.6200	31.0	39.5	39.0	36.58	+ 3.64	—	—	—	—	—	—	—	—	E	N E	E	N 61 E	13.0	13.5	9.0	10.70	11.25	.020	...
26	.439	.329	.215	.3160	37.1	36.2	35.5	36.50	+ 3.20	.198	.201	.193	.200	89	94	93	92	N E	N E	N W	N 38 E	11.0	13.5	13.0	10.13	12.15	1.220	...
27	.200	.259	.354	.2738	33.3	33.3	30.8	31.75	— 1.93	.170	.153	.127	.142	89	80	74	79	N W	N W	N W	N 42 W	14.0	26.5	26.0	21.09	21.23	.040	0.2
28	.335	.300	.449	.3663	23.2	24.6	28.2	24.83	— 9.22	.089	.107	.100	.096	72	81	65	71	N W	N W	N W	N 41 W	35.0	43.0	26.0	34.07	34.21	...	s
29	.528	.605	.771	.6505	19.4	31.9	34.9	29.27	— 5.18	.073	.074	.080	.074	69	42	39	47	N W	N W	N W	N 40 W	30.0	36.5	23.5	30.23	30.31	...	...
30	.950	.650	.950	.9500	29.0	45.0	34.0	36.33	+ 1.51	—	—	—	—	—	—	—	—	N W	N W	W	N 36 W	13.0	11.5	1.2	8.90	9.56	...	...
31	.886	.795	.697	.7828	34.0	37.1	37.1	36.25	+ 1.07	.167	.156	.198	.176	87	70	89	82	E	N E	E	N 76 E	6.4	8.5	10.0	7.79	8.17	.040	0.2
	29.5926	29.5804	29.5935	29.5896	21.01	29.59	25.93	25.59	— 4.38	.107	.123	.116	.114	85	73	79	78	...	...	...	...	10.46	14.13	13.37	...	11.79	2.450	19.9

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR MARCH, 1877.

NOTE.—The monthly means of the Barometer and Temperature include Sunday observations. The daily means, excepting those that relate to the wind, are derived from six observations daily, namely, at 6 A.M., 8 A.M., 2 P.M., 4 P.M., 10 P.M., and midnight. The means and resultants for the wind are from hourly observations.

Highest Barometer..............29.960 at 8 a.m. on 30th. } Monthly range
Lowest Barometer...............28.728 at 6 a.m. on 9th. } 1.232.

Self-registering Ther.
- Maximum temperature .... 45°.1 on 30th. } Monthly range
- Minimum temperature .... —0°.6 on 17th. } 45°.7.
- Mean maximum temperature ....32°.99. } Mean daily range
- Mean minimum temperature ....17°.91. } 15°.08.
- Greatest daily range..........29°.6 from a.m. to p.m. of 6th.
- Least daily range..........—0°.6 from a.m. to p.m. of 17th.

Warmest day ....2nd; mean temperature ....37°.62 } Difference=31°.15.
Coldest day..........17th; mean temperature .... 6°.47 }
Maximum Radiation { Solar .... 120°.0 on 13th. } Monthly range
{ Terrestrial .... —8°.0 on 6th. } 128°.0.

Aurora observed on 9th.
Possible to see Aurora on 15 nights; impossible on 16 nights.
Raining on 7 days; depth, 2.450 inches; duration of fall, 53.1 hours.
Snowing on 21 days; depth, 19.9 inches; duration of fall, 90.7 hours.
Mean of cloudiness, 0.72.

WIND.

Resultant direction N. 49° W.; resultant velocity 5.26 miles.
Mean velocity 11.79 miles per hour.
Maximum velocity 43.0 miles, from 2 to 3 p.m. of 28th.
Most windy day 28th; mean velocity 34.21 miles per hour.
Least windy day 19th; mean velocity 4.10 miles per hour.
Most windy hour 2 p.m.; mean velocity 14.13 miles per hour.
Least windy hour 6 a.m.; mean velocity 10.46 miles per hour.

Solar halos on 1st, 5th, 7th, 10th, 13th, 19th, 20th and 21st.
Lunar halos on 27th and 28th.
Thunder on 2nd.
Wild geese on 27th.
Robins on 31st.

COMPARATIVE TABLE FOR MARCH.

YEAR.	TEMPERATURE.					RAIN.		SNOW.		WIND.		
	Mean.	Excess above aver'ge	Maximum.	Minimum.	Range.	No. of days.	Inches.	No. of days.	Inches.	Resultant. Direction.	Resultant. Vel'y	Mean Velocity. Miles.
1849	° 33.5	° + 4.5	° 53.0	° 15.1	° 37.9	7	1.525	2	2.3	N 3 W	1.48	5.37
1850	29.8	+ 0.8	46.5	7.2	39.3	2	0.745	7	11.2	N 52 W	2.62	7.62
1851	32.4	+ 3.4	59.3	12.0	47.3	3	0.770	9	8.8	N 21 W	1.93	7.65
1852	27.7	— 1.3	44.8	— 7.4	52.2	8	3.080	12	19.5	N 8 W	0.71	5.81
1853	30.6	+ 1.6	56.3	0.0	56.3	6	1.080	8	7.1	N 58 W	2.60	5.96
1854	30.7	+ 1.7	55.1	7.4	47.7	9	2.425	3	2.8	N 53 W	3.39	8.03
1855	28.5	— 0.5	49.4	— 2.9	52.3	5	1.485	11	18.1	N 88 W	4.76	9.95
1856	23.1	— 5.9	41.4	14.0	55.4	0	0.000	12	16.2	N 71 W	7.68	11.39
1857	27.8	— 1.2	57.6	— 5.5	63.1	4	0.335	15	11.3	N 63 W	6.63	10.84
1858	28.4	— 0.6	55.4	— 5.5	60.9	10	0.917	6	0.2	N 58 W	5.45	8.56
1859	36.3	+ 7.3	54.2	9.8	44.4	15	4.054	8	1.0	N 64 W	1.96	10.39
1860	34.5	+ 5.5	67.0	12.8	54.2	5	0.882	11	2.4	N 64 W	7.61	12.41
1861	26.9	— 2.1	47.4	— 5.2	52.6	8	2.125	14	7.1	N 54 W	4.33	10.56
1862	28.8	— 0.2	43.2	8.0	35.2	8	2.560	11	18.5	N 12 W	2.50	9.38
1863	25.8	— 3.2	42.2	— 4.0	46.2	4	0.687	17	11.4	N 27 W	2.62	9.27
1864	29.1	+ 0.1	50.2	3.0	47.2	9	1.620	12	3.7	N 53 W	2.29	8.41
1865	33.6	+ 4.6	55.6	— 3.5	59.1	10	3.050	12	18.9	N 61 W	2.16	8.80
1866	27.6	— 1.4	45.8	7.5	38.3	8	1.915	18	7.2	N 73 W	6.84	11.51
1867	26.6	— 2.4	46.8	3.0	43.8	6	0.617	14	33.4	N 34 W	2.12	8.52
1868	31.3	+ 2.3	59.0	—15.6	74.6	7	2.660	5	4.2	N 21 W	2.12	8.58
1869	23.1	— 5.9	46.8	— 5.4	52.2	3	0.985	9	15.0	N 53 W	2.86	8.02
1870	26.3	— 2.7	44.0	5.2	38.8	2	0.755	18	62.4	N 18 E	4.73	10.13
1871	34.7	+ 5.7	58.5	17.0	41.5	8	2.782	12	13.0	N 31 W	2.59	8.31
1872	19.9	— 9.1	46.4	—10.8	57.2	2	0.700	14	16.3	N 66 W	5.36	10.48
1873	26.6	— 2.4	45.0	— 6.0	51.0	5	1.756	15	25.2	N 61 W	5.91	11.47
1874	28.7	— 0.3	57.0	5.5	51.5	10	1.390	10	2.6	N 65 W	7.47	13.24
1875	24.1	— 4.9	51.5	— 1.5	55.0	3	0.930	11	30.0	N 23 W	2.80	9.40
1876	26.0	— 3.0	50.5	— 2.9	53.4	6	1.250	14	44.1	N 29 W	3.43	12.04
1877	25.6	— 3.4	45.1	— 0.6	45.7	7	2.450	21	19.9	N 49 W	5.26	11.79
Res'lts to 1876.	29.05	...	51.07	0.83	50.24	6.05	1.560	10.38	13.90	N 51 W	3.43	9.24
Excess for '77.	— 3.46	...	— 5.97	— 1.43	— 4.54	+ 0.95	+ 0.890	+ 10.62	+ 6.00	...	...	+ 2.55

MONTHLY METEOROLOGICAL REGISTER, AT THE MAGNETICAL OBSERVATORY, TORONTO, ONTARIO—APRIL, 1877.

Latitude—43° 39′ 4″ *North.* *Longitude*—5*h.* 17*m.* 33*s.* *West.* *Elevation above Lake Ontario,* 108 *feet.*

Day.	Barometer cor. to 32°. 6 A. M.	2 P. M.	10 P. M.	Mean.	Temp. of the Air. 6 A.M.	2 P.M.	10 PM	MEAN	Excess of Mean above Normal.	Tension of Vapour. 6 A. M.	2 P. M.	10 P. M.	M'N.	Humidity of Air. 6 A. M.	2 P. M.	10 P.M.	M'N.	Direction of Wind. 6 A. M.	2 P. M.	10 P. M.	Res'l-tant.	Velocity of Wind. 6 A. M.	2 P. M.	10 P. M.	Res'l-tant.	MEAN.	Rain in inches.	Snow in inches.
1	29.620	29.440	29.480	29.5117	° 36.0	° 51.0	° 48.0	° 45.33	+ ° 9.75	—	—	—	—	—	—	—	—	E	E	S W	N ° 85 E	6.5	9.8	10.0	5.55	9.12	.020	...
2	.731	.899	30.007	.8980	32.9	30.4	22.5	27.70	— 8.28	.132	.102	.097	.108	70	60	81	71	N W	N W	N W	N 37 W	16.0	16.0	14.0	13.87	14.79	...	...
3	30.033	.954	29.802	.9183	18.9	29.3	27.5	26.43	— 9.93	.079	.066	.108	.086	76	39	71	60	N E	E	E	N 65 E	8.5	10.7	10.2	7.41	10.07	...	...
4	29.650	.512	.394	.5007	30.8	41.6	39.8	37.67	+ 0.93	.149	.148	.188	.161	86	55	76	72	E	E	E	N 83 E	12.0	12.0	11.0	10.91	11.14	R	...
5	.291	.329	.430	.3557	36.6	39.8	34.4	37.23	+ 0.10	.196	.179	.166	.181	90	73	83	81	E	W	W	S 35 W	8.0	9.5	17.2	2.49	8.41	.250	...
6	.505	.537	.649	.5693	32.0	47.7	34.4	38.30	+ 0.80	.156	.132	.114	.135	86	39	58	60	W	N W	N W	N 64 W	12.5	17.0	4.9	13.40	13.53	...	...
7	.735	.752	.716	.7405	28.6	42.0	35.1	36.37	— 1.53	.102	.076	.107	.110	65	28	62	52	N	N	N	N 16 W	9.5	12.5	10.5	7.56	8.55	...	...
8	.710	.620	.620	.6467	30.0	40.0	39.0	36.33	— 1.95	—	—	—	—	—	—	—	—	N E	E	N E	N 66 E	8.0	12.0	12.0	8.65	9.15	...	...
9	.585	.654	.671	.6360	36.9	47.7	43.4	42.65	+ 3.98	.158	.186	.150	.160	72	56	54	59	E	E	N E	N 68 E	17.0	15.5	8.0	14.64	15.04	...	...
10	.724	.752	.700	.7288	39.1	51.9	45.2	46.37	+ 7.33	.138	.140	.147	.141	57	36	48	45	N E	S E	N	N 40 E	10.0	9.0	12.5	6.48	10.83	...	...
11	.722	.671	.679	.6918	41.6	55.3	42.0	47.07	+ 7.65	.139	.213	.197	.177	53	49	74	54	N	N	N W	N 16 W	12.0	15.0	10.5	13.41	13.75	...	...
12	.708	.750	.858	.7727	37.1	42.7	34.4	38.75	— 1.05	.143	.125	.135	.136	64	45	69	58	N	S E	N E	N 35 E	12.0	14.0	6.6	6.27	10.63	...	...
13	.859	.823	.742	.8025	35.1	44.5	38.0	40.15	— 0.03	.099	.085	.109	.100	48	28	47	40	N E	N E	N E	N 65 E	10.0	15.5	6.0	10.11	10.96	...	...
14	.740	.726	.694	.7270	35.8	52.1	43.4	44.72	+ 4.15	.138	.186	.159	.157	66	48	56	53	N	S	N W	N 10 E	6.8	9.0	7.4	0.61	7.21	...	...
15	.730	.690	.670	.6917	37.0	59.0	42.0	47.00	+ 6.06	—	—	—	—	—	—	—	—	N W	S	S E	S 45 W	7.0	11.0	1.6	0.79	5.79	...	...
16	.626	.560	.523	.5640	36.2	44.1	43.8	42.98	+ 1.67	.151	.205	.191	.186	71	71	67	67	N E	E	N E	N 78 E	4.4	6.5	7.0	3.64	4.75	.030	...
17	.589	.611	.607	.6068	42.7	57.5	47.7	50.43	+ 8.73	.188	.236	.233	.223	68	50	70	61	N	S	N E	N 51 E	8.0	9.2	4.2	2.01	6.29	...	...
18	.567	.519	.417	.4933	44.5	45.9	44.5	44.68	+ 2.63	.209	.209	.286	.236	71	67	98	80	N E	E	E	N 70 E	11.0	13.5	17.0	13.59	13.83	.335	...
19	.324	.155	.181	.2142	42.0	42.5	40.9	41.40	— 1.03	.243	.254	.220	.239	90	93	86	91	N E	N E	N	N 53 E	23.0	22.0	11.5	17.39	18.10	.800	...
20	.195	.315	.450	.3320	39.1	46.3	42.3	43.53	+ 0.72	.181	.195	.202	.189	75	62	75	67	N	N W	N W	N 1 W	14.0	15.0	11.3	13.03	14.02	...	...
21	.580	.704	.810	.7138	44.5	57.8	50.3	50.50	+ 7.32	.173	.151	.160	.150	58	32	44	42	N W	N W	N W	N 29 W	17.5	21.5	2.6	14.94	15.32	...	...
22	30.000	.960	.960	.9733	46.0	64.0	46.0	52.83	+ 9.27	—	—	—	—	—	—	—	—	N	S	N	N 55 W	10.0	6.5	3.0	1.78	5.93	...	...
23	29.958	.878	.749	.8572	40.5	66.5	45.9	52.73	+ 8.78	.208	.250	.209	.217	82	38	67	57	S	S	S E	S 5 W	0.5	8.2	2.2	3.16	4.08	...	...
24	.620	.633	.718	.6563	42.0	58.7	44.5	50.77	+ 6.47	.224	.263	.190	.209	84	53	65	56	S E	N W	N W	N 32 W	0.2	12.0	16.0	8.02	8.79	.020	...
25	.795	.750	.772	.7752	37.3	54.6	43.2	44.78	+ 0.12	.137	.213	.128	.157	61	50	45	52	N W	S W	N	N 50 W	13.5	11.0	10.0	5.32	8.06	...	...
26	.799	.742	.702	.7408	36.2	55.7	49.5	49.23	+ 4.22	.159	.178	.190	.192	74	40	53	56	N	S	N	S 66 W	4.5	8.0	6.5	0.42	5.55	...	...
27	.704	.649	.589	.6412	44.5	52.8	49.2	49.40	+ 3.98	.144	.177	.194	.166	49	44	54	46	N	E	N E	N 56 E	12.4	12.0	15.0	9.60	11.26	...	...
28	.469	.349	.205	.3268	42.7	42.7	43.0	42.40	— 3.37	.197	.234	.265	.232	71	85	96	85	E	E	N E	N 70 E	16.0	19.0	11.0	17.88	17.90	.796	...
29	.260	.370	.410	.3567	42.0	56.0	46.0	48.13	+ 2.01	—	—	—	—	—	—	—	—	S	S W	S W	S 35 W	3.8	14.0	7.5	6.05	6.90	.020	...
30	.469	.469	.513	.4807	43.0	43.0	40.3	41.93	— 4.55	.219	.201	.190	.198	79	72	75	74	S W	S W	S W	S 42 W	7.0	9.0	9.0	7.31	7.71	R	...
	29.6433	29.6258	29.6239	29.6308	37.72	48.77	41.54	43.26	+ 2.17	.162	.176	.173	.170	71	52	66	62	....	....	....	....	10.05	12.53	9.21	......	10.25	2.271	...

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR APRIL, 1877.

NOTE.—The monthly means of the Barometer and Temperature include Sunday observations. The daily means, excepting those that relate to the wind, are derived from six observations daily, namely, at 6 A.M., 8 A.M., 2 P.M., 4 P.M., 10 P.M. and midnight. The means and resultants for the wind are from hourly observations.

Highest Barometer........................30.058 at 8 a.m. on 3rd } Monthly range=
Lowest Barometer ....29.155 at 2 p.m. on 19th } 0.903.

Self-registering Ther.
- Maximum temperature ....67°2 on 23rd } Monthly range=
- Minimum temperature ....18°7 on 3rd } 48°5
- Mean maximum temperature ....51°83 } Mean daily range=
- Mean minimum temperature ....35°15 } 16°68
- Greatest daily range..........................28°2 from a.m. to p.m. of 23rd.
- Least daily range ....4°7 from a.m. to p.m. of 18th.

Warmest day .... 22nd; mean temperature 52°83 } Difference=26°40.
Coldest day .... 3rd; mean temperature 26°43 }

Maximum Radiation { Solar ....123°0 on 23rd } Monthly range=
{ Terrestrial.......................... 11°5 on 3rd } 111°5.

Aurora observed on 2 nights, viz., 7th and 14th

Possible to see Aurora on 19 nights; impossible on 11 nights.

Raining on 9 days; depth, 2.271 inches; duration of fall, 54.3 hours.

Mean of Cloudiness, 0.45.

WIND.

Resultant direction, N. 28° E.; Resultant Velocity, 4.37 miles.

Mean Velocity, 10.25 miles per hour.

Maximum Velocity, 26.0 miles, from 9 to 10 a.m. of 21st.

Most Windy day, 19th; Mean Velocity, 18.10 miles per hour.

Least Windy day, 26th; Mean Velocity, 5.55 miles per hour.

Most Windy hour, 11 a.m.; Mean Velocity, 12.85 miles per hour.

Least Windy hour, 9 p.m.; Mean Velocity, 8.13 miles per hour.

Solar halos on 3rd, 4th, and 27th.

Fog on 16th and 29th.

Thunder on 24th and 28th. Lightning on 28th.

Butterflies seen on 12th.

Frogs croaking, 21st.

Swallows seen on 30th.

COMPARATIVE TABLE FOR APRIL.

YEAR.	TEMPERATURE.					RAIN.		SNOW.		WIND.		
	Mean.	Excess above Average.	Maximum.	Minimum.	Range.	No. of days.	Inches.	No. of days.	Inches	Resultant. Direction.	Resultant. V'locity.	Mean Velocity.
1849	39.0°	− 1.6°	72.0°	15.5°	56.5°	10	2.655	2	1.7	N 43° W	3.14	7.50
1850	37.9	− 2.7	65.7	18.0	47.7	7	4.720	2	1.1	N 50 E	1.12	7.64
1851	41.3	+ 0.7	59.3	25.8	33.5	11	2.295	3	1.2	N 14 E	2.52	8.07
1852	38.2	− 2.4	53.8	20.0	33.8	6	1.990	4	9.4	N 23 E	2.44	6.68
1853	41.9	+ 1.3	65.7	25.0	40.7	10	2.625	1	1.0	N 12 W	1.95	5.20
1854	41.0	+ 0.4	64.5	20.2	44.3	12	2.685	4	2.7	N 50 E	2.57	6.81
1855	42.4	+ 1.8	69.4	10.7	58.7	8	2.030	3	1.6	N 36 W	3.99	7.57
1856	42.3	+ 1.7	72.2	14.2	58.0	13	2.780	3	0.1	N 29 E	1.64	6.05
1857	35.3	− 5.3	52.0	5.9	46.1	10	1.755	4	12.9	N 60 W	4.15	10.24
1858	41.5	+ 0.9	65.2	21.8	43.4	13	1.642	2	0.1	N 14 W	1.64	9.57
1859	39.5	− 1.1	64.8	22.6	42.2	9	2.527	8	1.2	N 36 W	2.33	10.79
1860	39.5	− 1.1	61.8	19.5	42.3	11	1.282	5	0.3	N 37 W	4.10	10.39
1861	42.0	+ 1.4	67.0	23.8	43.2	12	1.619	4	6.9	N 37 E	2.31	8.90
1862	39.6	− 1.0	68.0	14.5	53.5	10	2.235	4	0.2	N 50 E	2.48	9.77
1863	42.0	+ 1.4	69.0	8.6	60.4	8	2.210	4	1.6	N 14 E	3.75	9.20
1864	40.9	+ 0.3	59.4	28.1	31.3	16	3.633	3	3.5	N 41 E	3.39	7.77
1865	43.1	+ 2.5	62.5	23.0	39.5	17	3.972	6	2.0	N 84 W	2.11	8.39
1866	43.9	+ 3.3	71.0	28.5	42.5	7	1.675	2	Inap.	N 42 W	3.34	7.95
1867	39.5	− 1.1	65.5	25.4	40.1	12	2.147	5	7.2	N 51 W	2.68	7.89
1868	38.0	− 2.6	64.0	9.2	54.8	7	0.990	10	5.3	N 63 W	2.43	9.24
1869	40.1	− 0.5	72.2	16.6	55.6	9	2.965	6	0.5	N 59 W	4.03	8.91
1870	44.6	+ 4.0	67.0	29.6	37.4	9	2.145	2	0.1	N 40 E	3.55	7.03
1871	43.0	+ 2.4	72.8	26.4	46.4	17	3.318	2	1.3	N 48 W	1.86	8.85
1872	40.5	− 0.1	70.0	22.7	47.3	9	0.910	5	0.7	N 68 W	3.84	9.12
1873	38.6	− 2.0	61.2	24.4	36.8	13	3.975	3	Inap.	N 18 E	2.89	9.05
1874	34.2	− 6.4	60.8	9.5	51.3	4	1.240	7	11.0	N 39 W	4.09	9.64
1875	36.4	− 4.2	62.2	10.0	52.2	10	1.230	8	2.7	N 37 W	3.71	10.16
1876	38.2	− 2.4	57.2	17.0	40.2	3	1.805	3	0.3	N 69 W	4.11	9.89
1877	43.3	+ 2.7	67.2	18.7	48.5	19	2.271	0	0.0	N 28 E	4.37	10.25
Res'lts to 1876.	40.63	......	64.86	19.16	45.70	9.97	2.411	3.84	2.44	N 24 W	2.21	8.38
Excess for 1877	+ 2.63	......	+ 2.34	− 0.46	+ 2.80	− 0.97	− 0.140	− 3.84	− 2.44	...	...	+ 1.87

MONTHLY METEOROLOGICAL REGISTER, AT THE MAGNETICAL OBSERVATORY, TORONTO, ONTARIO—MAY, 1877.

Latitude—43° 39′4 *North*. *Longitude*—5*h*. 17*m*. 33*s*. *West*. *Elevation above Lake Ontario*, 108 *feet*.

Day.	Barom. at temp. of 32°. 6 A.M.	2 P.M.	10 P.M.	MEAN.	Temp. of the Air. 6 A.M.	2 P.M.	10 PM	MEAN	Excess of Mean above aver'ge	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N.	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Direction of Wind. 6 A.M.	2 P.M.	10 P.M.	Res'l-tant.	Velocity of Wind. 6 A.M.	2 P.M.	10 P.M	Res'l-tant.	MEAN	Rain in inches.	Snow in inches.
1	29.502	29.483	29.580	29.5227	38.0°	42.9°	35.1°	38.58°	− 8.27°	.186	.199	.142	.168	81	71	68	71	W	S W	N W	N 73° W	3.5	5.6	5.2	5.33	6.92	R	...
2	.610	.599	.616	.6102	33.7	45.6	35.8	39.43	− 7.75	.153	.142	.148	.136	78	44	70	57	N W	N W	N W	N 48 W	13.2	20.0	5.0	12.38	12.61	...	...
3	.558	.382	.355	.4232	36.9	56.4	47.2	46.80	− 0.75	.134	.111	.165	.149	60	24	50	49	W	W	N W	N 78 W	3.0	20.0	13.0	8.54	10.43	R	...
4	.433	.447	.549	.4865	36.2	53.1	37.1	42.72	− 5.18	.176	.115	.139	.141	82	29	62	55	W	N W	N	N 52 W	9.5	13.8	2.0	7.80	9.07	.005	...
5	.631	.675	.631	.6497	36.5	49.2	44.1	45.18	− 3.08	.127	.160	.141	.156	55	47	49	51	N E	E	N E	N 71 E	5.8	13.0	7.5	7.10	8.78	...	...
6	.660	.650	.645	.6550	42.0	57.0	40.0	47.50	− 1.12	—	—	—	—	—	—	—	—	N E	S E	W	N 83 E	8.0	10.5	1.5	4.21	7.44	...	...
7	.647	.556	.533	.5710	43.0	54.4	43.4	48.17	− 0.82	.130	.143	.150	.143	46	32	54	43	N E	S E	N E	N 88 E	4.8	11.0	8.0	6.67	8.08	...	...
8	.531	.506	.503	.5122	42.0	53.9	48.1	49.18	− 0.15	.197	.222	.228	.212	73	53	67	61	N E	S E	N W	N 60 E	7.8	12.0	12.0	4.90	8.87	...	...
9	.545	.537	.597	.5623	43.0	47.7	46.3	46.93	− 2.75	.201	.204	.263	.228	72	61	83	71	N	S	N W	N 65 E	8.0	6.4	3.8	2.50	6.25	.005	...
10	.645	.700	.788	.7195	44.5	46.3	44.1	46.00	− 4.05	.218	.218	.224	.220	74	69	77	71	N	S E	S E	N 36 E	13.0	4.8	2.6	2.28	6.67	...	...
11	.873	.893	.946	.9102	43.0	52.4	47.0	49.22	− 1.18	.229	.247	.232	.238	82	62	72	68	S E	S	S W	S 2 E	0.5	6.0	3.0	2.69	3.13	...	...
12	.990	.964	.945	.9668	44.1	61.6	46.6	52.28	+ 1.57	.242	.263	.205	.230	84	48	64	60	N W	S	W	S 39 W	2.2	9.0	3.0	3.22	4.75	...	...
13	.990	.940	.920	.9467	42.0	64.0	53.0	55.17	+ 4.09	—	—	—	—	—	—	—	—	N	S	N W	S 22 W	1.6	6.0	6.4	1.14	4.62	...	...
14	.980	.914	.867	.9102	44.5	68.6	57.1	58.48	+ 7.05	.200	.233	.231	.224	68	33	49	47	N	S	N	S 48 W	0.8	8.0	5.6	2.25	5.54	...	...
15	.855	.776	.666	.7602	49.9	65.4	52.1	57.62	+ 5.83	.209	.325	.373	.317	57	52	96	67	N W	N W	S	S 86 W	2.0	9.0	3.0	2.07	4.14	.080	...
16	.621	.490	.518	.5302	51.0	69.7	61.1	60.53	+ 8.40	.366	.544	.491	.460	98	75	91	87	N W	S	W	S 47 W	1.0	8.0	1.5	4.04	5.90	R	...
17	.563	.562	.546	.5540	57.8	62.2	57.5	59.72	+ 7.22	.426	.544	.441	.471	89	97	93	91	S W	S	S E	S 41 W	2.0	2.7	1.6	1.99	2.42	.488	...
18	.544	.553	.651	.5857	57.8	81.5	66.1	69.65	+16.83	.437	.489	.412	.433	91	45	64	63	S	N W	N W	N 82 W	3.8	28.0	7.5	10.09	11.21	...	...
19	.694	.641	.587	.6330	63.2	72.3	62.7	67.13	+13.97	.413	.475	.470	.461	70	59	83	70	N W	S W	N W	N 81 W	5.8	5.5	2.6	2.30	4.72	...	...
20	.550	.480	.420	.4750	59.0	71.0	62.0	64.00	+10.49	—	—	—	—	—	—	—	—	N E	E	N E	N 82 E	0.8	7.5	5.6	4.31	5.40	...	...
21	.344	.263	.268	.2798	57.1	69.5	55.9	59.45	+ 5.58	.435	.526	.432	.444	93	73	96	87	N E	S E	N E	N 77 E	3.6	7.0	3.6	4.23	5.09	.050	...
22	.199	.309	.462	.3340	53.0	56.8	54.6	54.25	+ 0.05	.383	.356	.233	.324	95	77	54	76	S	N	N W	N 2 E	3.4	10.2	12.0	5.02	7.38	.610	...
23	.591	.532	.603	.5757	44.1	49.9	39.8	43.58	−10.97	.141	.139	.179	.161	48	39	73	58	N	N W	N W	N 32 W	13.0	26.0	11.0	16.32	16.60	...	...
24	.619	.641	.663	.6457	40.5	49.9	41.8	44.85	−10.05	.187	.205	.214	.206	74	56	81	69	N W	N W	W	N 35 W	21.0	20.0	2.4	15.63	15.90	...	...
25	.668	.648	.694	.6723	46.5	54.4	54.0	52.82	− 2.42	.255	.267	.241	.254	81	63	57	64	N W	N W	N W	N 28 W	8.5	6.5	14.5	11.09	11.17	.110	...
26	.709	.698	.731	.7168	52.1	65.8	59.6	60.00	+ 4.43	.256	.285	.252	.249	66	45	49	49	N	N W	N	N 24 W	10.0	10.5	11.5	10.01	10.06	...	...
27	.760	.800	.820	.8067	58.0	68.0	54.0	59.83	+ 3.94	—	—	—	—	—	—	—	—	N	S E	S	S 71 E	2.3	5.5	3.0	0.50	5.45	...	...
28	.895	.860	.826	.8605	51.7	69.7	60.7	62.08	+ 5.87	.328	.315	.310	.302	85	44	58	56	S	S	W	S 20 W	0.5	10.0	4.0	3.93	5.27	...	...
29	.867	.805	.710	.7895	54.2	72.3	54.2	61.42	+ 4.87	.335	.342	.357	.347	80	43	84	66	W	S E	S E	S 1 E	1.2	7.8	1.8	2.68	4.22	...	...
30	.719	.636	.592	.6405	54.4	72.6	62.2	63.63	+ 6.77	.339	.442	.379	.376	79	55	67	64	E	S	W	S 8 E	1.6	7.3	3.5	3.25	4.17	...	...
31	.643	.648	.654	.6537	58.2	78.0	59.6	66.08	+ 8.92	.360	.468	.401	.398	74	48	78	64	W	S E	S W	S 2 W	2.2	8.5	2.0	2.91	3.87	...	...
	29.6592	29.6319	29.6415	29.6438	47.67	60.71	51.06	53.94	+ 1.85	.262	.296	.276	.276	75	53	70	64	....	....	....	....	5.31	10.52	5.47	...	7.29	1.348	...

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR MAY, 1877.

NOTE.—The monthly means of the Barometer and Temperature include Sunday observations. The daily means, excepting those that relate to the wind, are derived from six observations daily, namely, at 6 A.M., 8 A.M., 2 P.M., 4 P.M., 10 P.M., and midnight. The means and resultants for the wind are from hourly observations.

Highest Barometer ....30.010 at 8 a.m. on 12th. } Monthly range
Lowest Barometer ....29.196 at 8 a.m. on 22nd. } 0.814.

Self-registering Ther.
- Maximum temperature ....83.9 on 18th. } Monthly range
- Minimum temperature ....29.7 on 5th. } 54°2.
- Mean maximum temperature ....63.55 } Mean Daily range
- Mean minimum temperature ....43.21 } 20°34.
- Greatest daily range ....31.4 from a.m. to p.m. on 18th.
- Least daily range ....12.0 from a.m. to p.m. on 10th.

Warmest day ....18th; mean temperature......69.65 } Difference=31°07.
Coldest day .... 1st; mean temperature......38.58 }

Maximum Radiation { Solar ....134.5 on 18th. } Monthly range
{ Terrestrial ....—18.0 on 2nd. } 116·5

Aurora observed on 3 nights, viz., 2nd, 4th, and 28th.
Possible to see Aurora on 21 nights; impossible on 10 nights.
Raining on 10 days; depth, 1.348 inches; duration of fall, 24.5 hours.
Mean of cloudiness, 0.50.

WIND.

Resultant direction, N. 40° W.; resultant velocity, 2.26 miles.
Mean velocity, 7.29 miles per hour.
Maximum velocity, 28.0 miles per hour, from 2 to 3 p.m. of 18th.
Most windy day, 23rd; mean velocity, 16.60 miles per hour.
Least windy day, 17th; mean velocity, 2.42 miles per hour.
Most windy hour, noon; mean velocity, 10.95 miles per hour.
Least windy hour, 9 p.m.; mean velocity, 4.71 miles per hour.

Hoar frost on 2nd, 3rd, 4th, 5th, and 7th. Thin ice on 23rd and 24th.
Solar halos on 8th, 11th, 15th, 18th, 19th, and 28th. Lunar halo on 19th.
Dew on 12th, 13th, 15th, 16th, and 18th. Fog on 16th and 17th.
Lightning on 17th. Thunder on 17th and 21st. Rainbow on 22nd.
1st May, first trip City of Toronto; 5th, maples in flower; 15th, plum trees in flower; 16th, Baltimore birds and humming birds.

COMPARATIVE TABLE FOR MAY.

YEAR.	TEMPERATURE. Mean.	Excess above Average.	Maximum.	Minimum.	Range.	RAIN. No. of days.	Inches.	SNOW. No. of days.	Inches.	WIND. Resultant. Direction.	V'locity.	Mean Velocity.
1849	48.0°	— 3.7°	72.2°	27.9°	44.3°	16	5.115	0	0.0	N 51° E	1.97	5.33
1850	47.6	— 4.1	77.8	27.5	50.3	7	0.545	1	s	N 64 W	2.05	6.32
1851	51.3	— 0.4	73.3	28.0	45.3	12	2.950	1	0.5	N 32 W	1.59	6.34
1852	51.4	— 0.3	73.3	32.0	41.3	7	1.125	1	s	N 2 W	0.99	4.00
1853	50.9	— 0.8	78.4	32.2	46.2	17	4.420	1	s	E	0.83	5.16
1854	52.2	+ 0.5	71.4	25.2	46.2	11	4.630	0	0.0	N 1 W	0.40	5.38
1855	53.1	+ 1.4	77.5	33.0	44.5	6	2.565	2	0.9	N 4 E	2.76	5.93
1856	50.5	— 1.2	82.2	31.2	51.0	14	4.580	1	s	N 23 W	3.99	9.81
1857	48.9	— 2.8	74.8	26.0	48.8	15	4.145	1	s	N 42 E	1.14	8.13
1858	48.9	— 2.8	69.8	31.0	38.8	17	6.367	0	0	N 72 E	3.33	9.30
1859	55.2	+ 3.5	79.6	39.5	40.1	11	3.410	0	0	N 26 E	1.59	5.70
1860	55.5	+ 3.8	74.5	32.5	42.0	16	1.815	0	0	N 47 W	2.66	7.17
1861	47.5	— 4.2	73.0	28.0	45.0	12	3.380	1	0.5	N 52 W	3.60	9.17
1862	52.2	+ 0.5	78.5	32.4	46.1	8	1.427	0	0.0	N 56 W	2.80	7.87
1863	54.3	+ 2.6	79.0	36.4	42.6	14	3.363	1	0.1	N 56 E	0.41	5.89
1864	54.8	+ 3.1	79.0	32.2	46.8	18	4.070	0	0.0	N 7 W	1.86	5.64
1865	52.3	+ 0.6	79.0	30.0	49.0	11	4.005	0	0.0	N 3 W	1.65	5.48
1866	48.3	— 3.4	73.4	33.4	40.0	13	2.820	0	0.0	N 46 W	4.49	9.26
1867	46.5	— 5.2	65.0	24.6	40.4	18	3.220	1	s	N 51 W	3.55	8.40
1868	51.8	+ 0.1	73.0	33.2	39.8	16	7.670	0	0.0	N 38 E	3.16	6.87
1869	50.8	— 0.9	74.2	31.4	42.8	16	2.805	1	s	N 20 W	2.38	6.55
1870	56.3	+ 4.6	81.2	38.8	42.4	10	1.150	0	0.0	N 23 E	1.09	5.48
1871	54.2	+ 2.5	85.0	32.4	52.6	7	2.302	0	0.0	N 23 W	2.53	7.70
1872	51.9	+ 0.2	78.8	32.0	46.8	14	1.934	0	0.0	N 52 W	2.25	6.49
1873	51.9	+ 0.2	76.4	30.0	46.4	13	2.205	0	0.0	N 26 E	2.69	8.88
1874	52.5	+ 0.8	86.0	25.3	60.7	8	1.492	0	0.0	N 49 W	2.64	8.45
1875	52.3	+ 0.6	79.2	27.0	52.2	14	2.980	2	3.1	N 46 W	3.34	10.07
1876	51.5	— 0.2	81.9	30.4	51.5	13	3.230	0	0.0	N 22 W	1.41	8.36
1877	53.9	— 2.2	83.9	29.7	54.2	10	1.348	0	0.0	N 40 W	2.26	7.29
Res'lts to 1876.	51.68	......	76.69	30.84	45.85	11.95	3.134	0.37	0.15	N 17 W	1.60	7.04
Excess for 1877	+ 2.26	......	+ 7.21	— 1.14	+ 8.35	— 1.95	— 1.786	— 0.37	— 0.15	...	...	+ 0.25

MONTHLY METEOROLOGICAL REGISTER, AT THE MAGNETICAL OBSERVATORY, TORONTO, ONTARIO—JUNE, 1877.

Latitude—43° 39′4 *North.* *Longitude*—5*h.* 17*m.* 33*s. West.* *Elevation above Lake Ontario*, 108 *feet.*

Day.	Barom. at temp. of 32°. 6 A.M.	2 P.M.	10 P.M.	Mean.	Temp. of the Air. 6 A.M.	2 P.M.	10 PM	MEAN	Excess of Mean above Av'rage.	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N.	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Direction of Wind. 6 A.M.	2 P.M.	10 P.M.	Resultant.	Velocity of Wind. 6 A.M.	2 P.M.	10 P.M.	Result't	MEAN	Rain in inches.	Snow in inches.
1	29.723	29.713	29.673	29.7073	59.6°	73.0°	64.7°	65.03°	+ 7.53°	.401	.426	.345	.387	78	52	56	63	N E	E	E	S 78° E	1.0	8.0	5.0	4.65	5.24	...	...
2	.666	.629	.607	.6263	58.6	67.6	58.6	63.12	+ 5.32	.403	.585	.480	.490	82	87	97	84	E	S	E	S 76 E	1.2	4.5	0.5	1.66	2.70	...	...
3	.560	.420	.480	.4817	59.0	72.0	59.0	63.67	+ 5.53	—	—	—	—	—	—	—	—	E	S E	N W	S 61 W	1.0	4.6	12.5	1.28	5.11	.080	...
4	.503	.506	.544	.5193	53.5	67.9	52.1	58.55	+ 0.08	.322	.302	.288	.311	78	44	73	65	W	W	N W	N 77 W	2.4	20.0	2.0	9.26	9.67	.080	...
5	.509	.468	.418	.4578	50.6	59.3	50.6	54.32	— 4.45	.285	.321	.307	.311	77	64	83	74	N	E	N E	N 64 E	2.6	6.0	5.0	3.80	4.92	...	...
6	.405	.428	.514	.4548	54.2	69.0	55.3	60.42	+ 1.33	.346	.361	.364	.354	82	51	83	68	N	E	N	N 48 E	7.7	11.5	3.0	5.90	7.87	...	...
7	.516	.499	.515	.5118	59.3	65.8	59.3	62.17	+ 2.77	.322	.428	.441	.419	64	67	87	75	N	S E	E	N 66 E	11.5	10.5	5.0	5.37	8.22	...	...
8	.560	.518	.456	.4997	53.5	69.4	62.7	62.67	+ 2.93	.399	.481	.419	.445	97	67	74	79	E	E	E	S 82 E	0.3	7.7	6.5	4.06	4.46	...	...
9	.359	.274	.106	.2422	60.4	67.6	65.6	65.05	+ 5.02	.501	.629	.525	.549	95	93	83	88	S E	S	S	S 3 E	5.6	5.2	20.0	7.26	8.33	.050	...
10	.250	.440	.580	.4533	53.0	61.0	52.0	55.33	— 5.03	—	—	—	—	—	—	—	—	W	W	W	S 72 W	20.0	22.0	7.0	13.19	13.40	.020	...
11	.701	.688	.658	.6795	48.6	57.6	49.9	52.87	— 7.83	.252	.279	.242	.262	74	58	69	66	N	E	N E	N 81 E	4.0	11.5	7.5	5.73	7.02	...	...
12	.689	.711	.704	.6978	52.1	56.8	53.5	54.90	— 6.10	.307	.367	.376	.369	79	79	92	86	E	E	S W	S 40 E	2.7	5.0	4.5	3.59	5.27	.080	...
13	.738	.620	.636	.6675	52.8	70.8	62.2	62.70	+ 1.37	.364	.387	.426	.400	91	52	76	72	N E	S	N	S 14 W	3.4	18.0	3.0	4.29	7.56	...	...
14	.731	.694	.709	.7133	58.9	68.3	62.2	63.78	+ 2.12	.384	.495	.488	.467	77	71	87	79	N	S E	E	S 57 E	1.5	8.0	4.0	2.25	4.75	.030	...
15	.703	.571	.523	.5905	62.2	71.2	64.1	65.72	+ 3.73	.503	.558	.544	.531	89	73	91	84	E	S E	S W	S 10 E	3.0	10.5	9.2	4.43	7.15	.050	...
16	.450	.506	.619	.5342	63.6	74.8	57.8	65.47	+ 3.17	.565	.442	.414	.472	96	51	86	76	S W	N W	N W	N 76 W	5.0	21.0	2.0	7.40	9.56	...	...
17	.690	.740	.720	.7217	56.0	73.0	60.0	64.00	+ 1.39	—	—	—	—	—	—	—	—	N	S	S	S 74 W	8.0	10.5	1.0	1.23	5.88	...	...
18	.680	.506	.440	.5267	57.8	66.7	65.4	64.33	+ 1.42	.388	.417	.514	.451	81	64	82	75	N E	E	S W	S 39 E	2.0	11.0	3.0	3.27	5.18	...	...
19	.513	.668	.794	.6717	69.0	70.5	56.0	65.10	+ 1.88	.374	.329	.269	.307	52	44	60	50	N W	N W	N	N 36 W	18.5	21.0	8.0	12.29	13.06	...	...
20	.840	.759	.526	.7020	56.0	62.2	55.3	57.70	— 5.82	.184	.179	.173	.201	40	32	39	43	N E	E	N E	N 73 E	10.5	13.0	4.6	8.87	10.13	R	...
21	.418	.327	.425	.3912	55.0	66.1	54.6	59.18	— 4.62	.335	.599	.362	.438	77	93	85	85	N W	S	W	N 53 W	0.8	3.8	5.5	3.60	5.28	.230	...
22	.582	.675	.741	.6762	52.8	61.4	53.5	56.27	+ 7.83	.267	.239	.248	.241	66	44	60	54	N W	N W	N	N 36 W	21.0	16.0	5.5	13.79	14.00	...	...
23	.774	.620	.508	.6227	51.0	68.3	56.0	59.18	— 5.20	.245	.340	.225	.283	65	49	49	57	N W	S E	W	S 15 W	2.0	10.0	3.0	3.89	6.49	...	...
24	.460	.380	.310	.3717	56.0	75.0	71.0	68.00	+ 3.37	—	—	—	—	—	—	—	—	N	S	W	S 17 W	0.6	15.0	3.2	4.65	6.36	R	...
25	.426	.432	.491	.4438	65.0	85.6	66.5	73.47	+ 8.57	.559	.284	.407	.413	91	23	62	55	S W	W	E	N 76 W	5.6	20.0	3.0	5.81	9.00	...	...
26	.515	.527	.553	.5357	64.0	59.4	58.9	61.88	— 3.25	.427	.464	.440	.442	71	91	88	80	W	N E	S E	S 88 E	0.2	4.5	3.4	2.17	3.37	.190	...
27	.606	.621	.630	.6270	61.4	70.5	62.5	66.37	+ 0.98	.462	.404	.363	.424	85	54	64	66	N	S E	E	S 84 E	3.6	8.0	3.2	2.39	6.08	...	...
28	.645	.650	.627	.6375	60.0	69.4	61.8	65.35	— 0.30	.370	.422	.457	.416	71	58	83	67	N	N E	S	S 83 E	2.5	5.8	2.6	1.97	3.61	.050	...
29	.649	.521	.538	.5530	57.8	71.7	63.2	65.22	— 0.65	.437	.570	.524	.510	91	73	90	82	N E	S W	S W	S 15 W	1.4	20.0	3.8	6.40	7.46	R	...
30	.551	.380	.281	.3947	64.0	75.2	68.3	69.93	+ 3.82	.539	.655	.631	.604	90	75	91	83	S E	S	S W	S 10 E	6.6	12.8	3.6	4.83	6.03	.040	...
	29.5804	29.5497	29.5442	29.5571	57.52	68.24	59.42	62.36	+ 0.25	.382	.422	.395	.404	78	62	77	71	....	....	....	....	5.21	11.51	5.00	....	7.11	.900	...

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR JUNE, 1877.

NOTE.—The monthly means of the Barometer and Temperature include Sunday observations. The daily means, excepting those that relate to the wind, are derived from six observations daily, namely, at 6 A.M., 8 A.M., 2 P.M., 4 P.M., 10 P.M., and midnight. The means and resultants for the wind are from hourly observations.

Highest barometer .. ..29.867 at 8 a.m. on 20th } Monthly range = 0.761.
Lowest barometer ....29.106 at 10 p.m. on 9th }

Self-registering Ther.
- Maximum temperature..............................85°9 on 25th } Monthly range = 44°8.
- Minimum temperature..............................41°1 on 11th }
- Mean maximum temperature ....71°73 } Mean daily range= 19°50.
- Mean minimum temperature..............................52°23 }
- Greatest daily range..............................28°6 from a.m. to p.m. of 23rd.
- Least daily range ....10°4 from a.m. to p.m. of 26th.

Warmest day ....25th; mean temperature..............73°47 } Difference=20°60.
Coldest day..............11th; mean temperature..............52°87 }

Maximum Radiation { Solar ....134°0 on 1st and 25th } Monthly Range = 102°1.
{ Terrestrial..............................31°9 on 11th }

Aurora observed on 3 nights, viz., 6th, 7th, and 11th.

Possible to see Aurora on 17 nights; impossible on 13 nights.

Raining on 14 days; depth, 0.900 inches; duration of fall, 25.9 hours.

Mean of cloudiness, 0.51.

WIND.

Resultant direction, S. 38° W.; resultant velocity, 0.37 miles.

Mean velocity, 7.11 miles per hour.

Maximum velocity, 24.0 miles from 1 p.m. to 2 p.m. of 4th.

Most windy day, 22nd; mean velocity, 14.00 miles per hour.

Least windy day, 2nd; mean velocity, 2.70 miles per hour.

Most windy hour, 2 p.m.; mean velocity, 11.51 miles per hour.

Least windy hour, 4 a.m.; mean velocity, 3.56 miles per hour.

Fog on 2nd, 8th, 9th, 21st and 26th.

Thunder on 2nd, 3rd, 11th, 20th, 21st, 28th, 29th and 30th.

Lightning on 2nd, 11th, 13th, 14th, 20th, 21st, 29th and 30th.

Solar halos on 5th and 6th.

Dew on 13 days. Fireflies on 1st.

COMPARATIVE TABLE FOR JUNE.

YEAR.	TEMPERATURE.					RAIN.		SNOW.		WIND.		
	Mean.	Excess above aver'ge	Maximum.	Minimum.	Range.	No. of days.	Inches.	No. of days.	Inches	Resultant. Direction.	Resultant. Velo'y	Mean Velocity.
1849	63.2°	+ 1.4°	84.4°	35.2°	49.2°	7	2.020	...	...	S 71° E	0.49°	3.32
1850	64.3	+ 2.5	85.6	34.2	51.4	10	3.345	...	...	S 60 W	0.38	4.54
1851	59.2	— 2.6	79.2	37.0	42.2	11	2.695	...	...	S 2 W	1.26	4.42
1852	60.8	— 1.0	86.1	37.2	48.9	10	3.160	...	...	S 76 W	1.49	4.09
1853	65.5	+ 3.7	89.5	39.2	50.3	9	1.550	...	...	N 1 W	0.10	3.73
1854	64.1	+ 2.3	92.5	35.2	57.3	9	1.460	...	...	N 24 E	0.71	4.15
1855	59.9	— 1.9	91.5	36.2	55.3	17	4.070	...	...	N 69 W	1.33	5.70
1856	62.1	+ 0.3	89.2	42.0	47.2	13	3.200	...	...	S 21 W	0.90	5.30
1857	56.9	— 4.9	76.0	35.0	41.0	21	5.060	...	...	N 49 W	1.15	7.60
1858	66.2	+ 4.4	90.2	42.5	47.7	12	2.943	...	...	S 20 E	0.25	5.53
1859	58.3	— 3.5	86.4	32.2	54.2	16	4.085	2	Inap.	N 77 E	1.95	7.19
1860	63.2	+ 1.4	81.6	49.2	32.4	14	2.136	...	...	N 44 W	3.13	7.61
1861	61.3	— 0.5	87.8	41.6	46.2	13	2.329	...	...	N 39 W	2.29	6.11
1862	60.5	— 1.3	85.8	39.4	46.4	10	1.007	...	...	N 26 W	1.77	5.98
1863	60.1	— 1.7	84.8	37.4	47.4	13	1.662	...	...	N 50 W	2.26	5.24
1864	63.0	+ 1.2	93.4	34.8	58.6	5	0.570	...	...	N 55 W	1.72	4.53
1865	64.5	+ 2.7	90.2	43.0	47.2	7	2.005	...	...	S 30 W	0.60	4.06
1866	60.2	— 1.6	90.5	40.0	50.5	15	2.720	...	...	S 15 W	0.71	5.09
1867	64.3	+ 2.5	88.6	44.0	44.6	8	0.885	...	...	S 84 E	0.48	4.13
1868	62.0	+ 0.2	84.2	38.0	46.2	11	2.217	...	...	N 16 E	0.85	5.26
1869	58.4	— 3.6	81.4	36.4	45.0	22	4.373	...	...	N 80 W	1.70	5.23
1870	67.3	+ 5.5	88.4	50.0	38.4	16	8.090	...	...	N 17 E	0.40	5.14
1871	61.4	— 0.4	83.0	41.8	41.2	13	3.340	...	...	N 80 W	2.04	6.57
1872	63.7	+ 1.9	88.0	41.8	46.2	8	3.148	...	...	N 69 W	0.76	3.80
1873	63.7	+ 1.9	89.5	40.0	49.5	10	0.680	...	...	N 18 E	1.00	6.43
1874	62.5	+ 0.7	88.0	44.2	43.8	13	1.795	...	...	N 44 W	0.68	6.52
1875	61.0	— 0.8	86.8	37.4	49.4	7	1.825	...	...	N 69 W	1.05	7.35
1876	65.5	+ 3.7	87.2	44.2	43.0	8	1.590	...	...	S 7 W	1.51	6.32
1877	62.4	+ 0.6	85.9	41.1	44.8	14	0.900	...	...	S 38 W	0.37	7.11
Resu'ts to 1876.	61.84	...	86.78	39.61	47.17	11.54	2.820	...	...	N 64 W	0.79	5.36
Excess for '77.	+ 0.52	...	— 0.88	+ 1.49	— 2.37	+ 2.46	— 1.920	...	...	...	...	+ 1.75

MONTHLY METEOROLOGICAL REGISTER, AT THE MAGNETICAL OBSERVATORY, TORONTO, ONTARIO—JULY, 1877.

Latitude—43° 39'4 North. Longitude—5h. 17m. 33s. West. Elevation above Lake Ontario, 108 feet.

Day.	Barom. at temp. of 32°.				Temp. of the Air.				Excess of Mean above Normal.	Tension of Vapour.				Humidity of Air.				Direction of Wind.				Velocity of the Wind.					Rain in inches	Snow in inches
	6 A.M.	2 P.M.	10 P.M.	Mean.	6 A.M.	2 P.M.	10 P.M.	MEAN		6 A.M.	2 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.	Res'l-tant.	6 A.M.	2 P.M.	10 P.M.	Res'l-tant.	MEAN		
1	29.250	29.270	29.380	29.3133	71.0°	79.0°	66.0°	71.58°	+ 5.26°	—	—	—	—	—	—	—	—	S	W	W	S 72° W	10.0	31.0	21.0	15.36	16.89	...	...
2	.549	.578	.538	.5548	59.6	71.2	57.5	63.97	— 2.53	.364	.357	.374	.361	71	46	79	62	W	S W	S W	S 84 W	4.0	5.0	1.0	6.18	7.49	...	...
3	.479	.383	.554	.4778	59.6	74.6	64.3	65.40	— 1.30	.401	.626	.503	.500	79	73	83	79	E	W	N	N 47 E	7.2	5.6	5.2	3.05	5.59	.150	...
4	.691	.719	.667	.6963	58.9	77.0	62.2	68.53	+ 1.65	.434	.412	.440	.414	87	44	78	62	N	S	S W	S 73 W	11.0	11.0	6.5	1.21	7.98	...	...
5	.623	.519	.559	.5612	60.4	79.3	66.5	70.05	+ 2.98	.451	.525	.486	.480	86	52	74	67	S W	E	N	N 25 W	3.4	6.5	7.8	3.51	7.17	...	...
6	.651	.668	.690	.6733	60.9	74.6	63.8	66.12	— 1.15	.373	.424	.334	.378	70	50	56	59	N	S	N W	N 6 W	10.0	6.6	4.6	1.54	6.72	...	...
7	.727	.690	.591	.6663	57.8	79.1	66.8	69.30	+ 1.93	.298	.384	.390	.361	62	39	59	51	N W	S	S W	S 18 W	1.2	10.0	5.0	4.75	6.58	...	...
8	.560	.440	.380	.4467	63.5	84.5	69.0	72.83	+ 5.30	—	—	—	—	—	—	—	—	S W	S W	S W	S 33 W	5.0	10.5	6.2	7.42	7.70	.050	...
9	.390	.267	.282	.3007	67.6	80.4	71.5	73.12	+ 5.45	.607	.617	.466	.550	90	60	60	68	W	S W	N W	S 71 W	4.6	12.0	8.0	4.79	7.41	.110	...
10	.395	.440	.515	.4538	61.4	73.0	63.6	65.95	— 1.83	.378	.399	.299	.348	69	49	51	54	N W	S	N W	N 59 W	10.0	8.0	7.0	5.66	7.77	...	...
11	.580	.597	.626	.6053	57.8	72.3	58.2	64.17	— 3.73	.309	.354	.409	.336	64	45	84	58	N W	S	W	N 67 W	12.0	12.7	2.0	6.34	8.73	...	...
12	.667	.611	.669	.6522	59.3	84.2	67.2	71.27	+ 3.27	.345	.330	.360	.356	68	28	54	49	W	W	N	N 66 W	4.5	15.0	7.5	8.53	9.71	...	...
13	.743	.709	.652	.7012	60.0	70.1	58.5	62.82	— 5.27	.347	.322	.379	.349	67	44	77	63	N E	S E	N E	S 76 E	4.8	10.0	2.2	3.80	6.27	...	...
14	.658	.604	.594	.6173	58.9	73.7	64.7	66.20	— 1.98	.373	.430	.430	.419	75	52	70	66	N E	E	N E	S 85 E	3.5	10.0	4.5	4.44	5.31	...	...
15	.580	.520	.520	.5367	59.0	84.0	72.0	72.33	+ 4.08	—	—	—	—	—	—	—	—	C	S	S W	S 5 W	0.0	11.0	2.0	4.60	5.96	...	...
16	.485	.428	.380	.4312	64.7	87.4	74.4	76.23	+ 7.95	.471	.589	.549	.532	77	45	64	60	N W	S E	W	S 11 W	2.0	10.3	2.2	3.79	5.49	...	...
17	.426	.416	.424	.4192	67.2	78.2	67.0	71.32	+ 2.97	.631	.585	.505	.536	95	61	76	73	N W	S	S W	S 51 W	1.6	8.0	9.0	6.40	7.38	.430	...
18	.436	.397	.226	.3368	66.5	75.5	67.6	70.02	+ 1.63	.539	.547	.594	.580	83	62	88	80	S W	S	N E	S 6 W	4.5	8.4	3.0	4.35	5.18	.080	...
19	.126	.232	.309	.2312	65.0	74.4	61.4	68.02	— 0.40	.586	.394	.500	.500	95	46	92	75	S W	W	S W	S 52 W	5.8	14.0	3.0	6.50	7.83	.260	...
20	.352	.435	.525	.4450	60.4	68.6	58.9	63.67	— 4.77	.469	.430	.399	.438	89	61	80	75	S W	S W	W	S 64 W	2.5	7.5	7.0	5.73	6.98	...	...
21	.622	.674	.711	.6752	55.5	71.0	61.4	63.57	— 4.90	.378	.397	.462	.408	86	53	85	72	W	S	N E	S 3 E	4.2	10.7	3.8	2.78	5.92	.040	...
22	.800	.815	.830	.8192	61.0	76.0	69.0	68.33	— 0.14	—	—	—	—	—	—	—	—	N W	S	N	S 45 W	2.0	10.0	8.1	1.44	4.99	.165	...
23	.893	.869	.878	.8733	62.3	75.5	70.8	70.47	+ 2.02	.517	.515	.442	.493	92	58	58	67	N	S	N	S 38 W	2.4	5.8	5.2	0.44	4.27	...	...
24	.881	.792	.696	.7832	65.4	78.8	67.2	71.55	+ 3.10	.439	.443	.490	.465	71	45	74	62	N	S	N W	S 38 W	5.6	8.0	3.0	2.28	5.11	...	...
25	.682	.578	.544	.5927	69.0	86.0	74.1	76.90	+ 8.48	.440	.451	.534	.489	62	36	63	54	N W	S	W	S 59 W	9.5	9.0	2.2	3.22	5.28	...	...
26	.556	.552	.539	.5453	72.3	73.3	73.5	73.67	+ 5.30	.531	.697	.740	.686	67	85	90	82	N	N	S W	N 19 E	1.0	2.3	0.8	0.57	2.53	.240	...
27	.601	.584	.595	.5928	69.7	80.2	69.4	72.62	+ 4.25	.699	.802	.673	.726	96	78	94	96	S E	S	S E	S 15 E	2.0	9.0	5.0	2.26	3.69	.900	...
28	.589	.546	.482	.5287	69.4	82.7	71.9	75.20	+ 6.92	.673	.804	.716	.733	93	72	91	80	S W	S	S W	S 10 W	2.2	11.6	0.8	4.84	5.10	...	...
29	.460	.440	.480	.4600	69.0	82.0	73.0	74.67	+ 6.44	—	—	—	—	—	—	—	—	E	S E	N W	N 14 W	3.2	5.4	5.0	1.46	4.20	.295	...
30	.562	.592	.645	.6047	71.0	82.7	74.1	76.80	+ 8.60	.561	.637	.479	.528	74	57	57	58	N	N W	N	N 13 W	13.0	7.0	10.5	6.33	8.16	...	...
31	.745	.757	.754	.7578	67.9	75.9	66.8	70.62	+ 2.50	.413	.529	.452	.460	60	59	69	61	N E	S E	N E	N 77 E	4.8	10.0	4.4	5.42	7.02	...	...
	29.5725	29.5523	29.5560	29.5598	63.61	77.59	66.85	69.91	+ 2.00	.463	.500	.477	.478	78	54	73	67	...	...	...	...	5.08	9.74	5.27	...	6.66	2.720	...

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR JULY, 1877.

NOTE.—The monthly means of the Barometer and Temperature include Sunday observations. The daily means, excepting those that relate to the wind, are derived from six observations daily, namely, at 6 A.M., 8 A.M., 2 P.M., 4 P.M., 10 P.M., and midnight. The means and resultants for the wind are from hourly observations.

Highest Barometer....................29.907 at 8 a.m. on 23rd. } Monthly range =
Lowest Barometer....................29.126 at 6 a.m. on 19th. } 0.781.

Self-registering Ther.
- Maximum temperature....................88°7 on 16th. } Monthly range =
- Minimum temperature....................50°3 on 7th. } 38°4.
- Mean maximum temperature....................80°15. } Mean daily range=
- Mean minimum temperature....................59°56. } 20°59.
- Greatest daily range..........33°2 from a.m. to p.m. of 15th.
- Least daily range..........13°4 from a.m. to p.m. of 31st.

Warmest day.........25th; mean temperature....................76°90 } Difference=14°08.
Coldest day..........13th; mean temperature....................62°82 }
Maximum { Solar....................145°5 on 26th. } Monthly range =
Radiation { Terrestrial....................43°6 on 21st. } 101°9.

No Aurora observed.
Possible to see Aurora on 24 nights; impossible on 7 nights.
Raining on 11 days; depth, 2.720 inches; duration of fall, 18.5 hours.
Mean of cloudiness, 0.43.

WIND.

Resultant direction S. 62° W.; resultant velocity 2.42 miles.
Mean velocity 6.66 miles per hour.
Maximum velocity 31.0 miles, from 2 to 3 p.m. of 1st.
Most windy day 1st; mean velocity 16.89 miles per hour.
Least windy day 26th; mean velocity 2.53 miles per hour.
Most windy hour 1 p.m.; mean velocity 10.45 miles per hour.
Least windy hour 5 a.m.; mean velocity 4.02 miles per hour.

Fog on 19th and 29th.
Dew on 20th, 21st and 23rd.
Rainbows on 21st and 22nd.
Solar halos on 2nd and 6th.
Thunder on 3rd, 9th, 12th, 19th, 22nd, 26th and 27th.
Lightning on 2nd, 5th, 8th, 9th, 12th, 16th, 17th, 18th, 26th and 27th.

COMPARATIVE TABLE FOR JULY.

YEAR.	TEMPERATURE.					RAIN.		SNOW.		WIND.		
	Mean.	Excess above aver'ge	Maximum.	Minimum.	Range.	No. of days.	Inches	No. of days.	Inches.	Resultant. Direction.	Resultant. Vel'y	Mean Velocity. Miles.
1849	68.4°	+1.0°	88.6°	45.2°	43.4°	4	3.415	...	...	S 5° W	0.75	3.52
1850	68.9	+ 1.5	86.2	51.6	34.6	12	5.270	...	...	N 81 E	0.59	4.36
1851	65.0	— 2.4	82.7	46.5	36.2	12	3.625	...	...	N 60 W	0.88	4.13
1852	66.8	— 0.6	90.1	48.5	41.6	8	4.025	...	...	N 43 W	0.93	3.33
1853	65.6	— 1.8	91.3	41.6	49.7	10	0.915	...	...	S 58 E	0.24	3.69
1854	72.5	+ 5.1	98.0	42.5	55.5	9	4.805	...	...	S 49 W	0.37	4.03
1855	67.9	+ 0.5	92.8	49.2	43.6	13	3.245	...	...	S 19 W	0.73	6.47
1856	69.9	+ 2.5	96.6	49.5	47.1	8	1.120	...	...	N 79 W	1.57	5.84
1857	67.8	+ 0.4	86.6	47.0	39.6	15	3.475	...	...	S 68 E	0.81	4.74
1858	67.9	+ 0.5	85.0	52.0	33.0	13	3.072	...	...	N 15 E	1.13	5.76
1859	66.9	— 0.5	88.0	44.7	43.3	12	2.611	...	...	N 56 W	1.48	5.81
1860	63.9	— 3.5	88.0	43.8	44.2	13	4.356	...	...	N 60 W	2.15	7.29
1861	65.4	— 2.0	84.5	47.0	37.5	16	2.635	...	...	N 74 W	1.43	4.66
1862	66.7	— 0.7	95.5	48.2	47.3	15	5.344	...	...	S 89 W	1.42	5.80
1863	67.6	+ 0.2	85.5	48.0	35.5	15	3.408	...	...	N 18 W	0.40	3.89
1864	69.7	+ 2.3	90.2	49.0	41.2	8	1.332	...	...	N 61 W	2.23	6.00
1865	65.0	— 2.4	85.0	45.8	37.2	11	2.470	...	...	N 86 W	2.28	5.34
1866	70.4	+ 3.0	94.0	47.8	46.2	16	5.390	...	...	S 79 W	0.94	4.17
1867	68.2	+ 0.8	94.0	48.2	45.8	12	1.965	...	...	N 48 W	1.40	5.45
1868	75.8	+ 8.4	93.4	59.0	34.4	5	0.510	...	...	S 87 E	0.72	4.66
1869	64.5	— 2.9	84.9	49.8	35.1	13	4.610	...	...	S 67 W	2.01	5.07
1870	68.8	+ 1.4	87.4	48.0	39.4	16	1.896	...	...	S 78 W	1.59	4.82
1871	66.0	— 1.4	88.4	47.8	40.6	11	1.255	...	...	N 88 W	1.55	5.67
1872	70.2	+ 2.8	96.0	52.2	43.8	13	2.297	...	...	N 67 W	1.19	3.56
1873	68.4	+ 1.0	87.5	47.5	40.0	11	1.913	...	...	S 75 W	1.71	6.11
1874	67.9	+ 0.5	83.5	44.4	39.1	11	3.350	...	...	N 58 W	1.26	6.55
1875	66.6	— 0.8	88.0	46.4	41.6	6	1.810	...	...	S 88 W	1.69	6.78
1876	68.8	+ 1.4	92.9	46.2	46.7	15	3.290	...	...	N 78 W	1.63	6.31
1877	69.9	+ 2.5	88.7	50.3	38.4	11	2.720	...	...	S 62 W	2.42	6.16
Res'lts to 1876.	67.43	...	89.31	47.76	41.56	10.73	3.152	...	...	N 78 W	0.89	5.14
Excess for '77.	+ 2.48	...	— 0.61	+ 2.54	— 3.16	+ 0.27	— 0.432	...	...	...	...	+ 1.52

MONTHLY METEOROLOGICAL REGISTER, AT THE MAGNETICAL OBSERVATORY, TORONTO, ONTARIO—AUGUST, 1877.

Latitude—43° 39′ 4″ *North.* *Longitude*—*5h.* 15*m.* 33*s. West.* *Elevation above Lake Ontario,* 108 *feet.*

Day.	Barom. at temp. of 32°. 6 A.M.	2 p.m.	10 P.M.	Mean.	Temp. of the Air. 6 A.M.	2 P.M.	10 PM	MEAN	Excess of Mean above Normal.	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N.	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Direction of Wind. 6 A.M.	2 P.M.	10 P.M.	Res'l-tant.	Velocity of Wind. 6 A.M.	2 P.M.	10 P.M.	Res'l-tant.	MEAN.	Rain in inches.	Snow in inches
1	29.757	29.729	29.692	29.7220	65.0°	78.2°	71.9°	72.67°	+ 4.60°	.481	.622	.661	.612	77	64	84	76	N E	E	N E	N 69° E	4.0	11.5	6.5	7.71	8.33	...	...
2	.692	.578	.547	.6057	70.8	79.8	70.5	73.08	+ 5.07	.685	.724	.644	.661	90	71	86	80	S E	W	N W	S 57 E	2.8	9.5	8.2	2.85	5.71	.420	...
3	.601	.548	.603	.5837	62.5	75.5	61.4	66.47	— 1.45	.526	.366	.438	.414	93	41	80	66	N W	N W	N W	N 46 W	7.0	11.0	5.0	9.27	9.54	...	...
4	.664	.660	.657	.6625	58.2	74.8	60.2	65.20	— 2.65	.402	.277	.311	.332	84	32	59	57	N W	N W	N W	N 33 W	9.0	13.0	3.2	7.90	8.22	...	...
5	.650	.580	.540	.5817	54.0	74.0	67.9	66.00	— 1.76	—	—	—	—	—	—	—	—	N W	N W	N W	N 63 W	10.7	6.6	7.0	6.49	7.58	...	...
6	.520	.426	.400	.3377	59.6	78.4	68.6	69.88	+ 2.22	.412	.449	.580	.507	81	46	83	70	W	S	S W	S 47 W	2.6	11.5	5.8	4.77	6.67	...	...
7	.366	.318	.326	.3360	63.6	74.3	67.2	70.30	+ 2.75	.489	.637	.612	.583	83	75	92	79	S W	S W	N W	S 42 W	2.2	6.0	4.0	3.13	4.71	R	...
8	.335	.333	.314	.3260	65.4	77.0	66.5	70.45	+ 3.02	.581	.586	.580	.592	93	63	89	80	N	S E	N E	S 65 E	1.6	7.8	3.1	1.93	3.58	.510	...
9	.300	.298	.343	.3177	65.0	77.7	66.1	69.78	+ 2.47	.546	.562	.504	.518	88	59	79	72	N W	S	N	N 53 W	2.0	9.4	6.6	0.46	3.99	R	...
10	.370	.398	.501	.4283	61.1	74.1	64.7	67.55	+ 0.38	.491	.520	.443	.468	91	61	72	71	N W	S W	N W	N 88 W	1.8	8.4	4.5	5.67	6.86	...	...
11	.576	.579	.598	.5838	62.5	77.3	67.6	68.60	+ 1.55	.472	.491	.392	.458	83	53	58	67	W	S	N	S 53 W	7.0	8.0	3.0	2.81	5.82	...	...
12	.590	.560	.510	.5433	58.0	65.0	63.0	62.17	— 4.72	—	—	—	—	—	—	—	—	N W	N E	N	N 25 E	6.2	8.0	5.0	3.83	5.04	.395	...
13	.521	.506	.459	.4978	60.0	67.6	55.0	64.65	— 2.10	.480	.551	.532	.525	93	82	86	86	N	E	N E	N 45 E	6.0	5.8	4.6	1.79	3.74	R	...
14	.405	.373	.422	.4002	64.0	72.6	65.1	66.82	+ 0.23	.566	.601	.585	.582	95	75	94	89	E	E	N	S 89 E	7.6	9.0	5.0	3.63	5.88	.390	...
15	.433	.433	.443	.4328	62.2	74.8	67.6	68.53	+ 2.10	.557	.511	.594	.561	99	59	88	82	N E	N E	N W	N 61 E	3.6	5.4	5.2	3.09	4.68	...	...
16	.431	.411	.446	.4297	64.7	69.0	63.0	66.17	— 0.08	.536	.621	.520	.554	88	88	90	86	N	S W	N	N 12 W	4.6	5.5	5.2	3.99	5.69	.260	...
17	.489	.501	.552	.5152	63.2	75.2	68.1	68.73	+ 2.67	.543	.625	.559	.566	94	72	81	81	N W	S	N W	N 62 W	5.0	7.0	3.5	2.03	4.71	.020	...
18	.588	.579	.601	.5878	63.2	73.0	69.4	68.42	+ 2.50	.413	.581	.474	.487	71	72	66	70	N W	S W	W	W	6.8	7.2	3.4	2.69	4.89	R	...
19	.620	.610	.640	.6233	61.0	82.0	72.0	72.50	+ 6.80	—	—	—	—	—	—	—	—	N W	S	N	S 73 W	4.4	6.5	10.0	2.12	5.44	...	...
20	.682	.664	.656	.6650	60.0	77.5	66.1	68.92	+ 3.42	.468	.521	.571	.516	90	55	89	75	N	S E	E	S 75 W	1.0	8.5	3.8	1.69	5.08	...	...
21	.681	.640	.614	.6410	62.9	77.0	68.3	70.58	+ 5.30	.548	.527	.616	.571	96	57	89	78	N E	E	E	N 88 E	3.6	10.0	3.2	5.78	6.25	...	...
22	.579	.542	.536	.5527	65.4	79.5	69.7	72.43	+ 7.38	.608	.636	.626	.632	97	63	86	80	N E	E	N E	N 84 E	3.8	8.0	3.6	5.02	5.79	...	...
23	.579	.574	.571	.5675	66.1	77.0	73.3	73.32	+ 8.47	.545	.693	.531	.610	85	75	64	74	N E	E	S	S 81 E	2.0	7.0	11.0	3.48	6.57	.080	...
24	.568	.530	.544	.5452	69.4	77.7	70.1	72.33	+ 7.73	.570	.684	.588	.625	79	72	80	79	S E	S E	S W	S 38 E	7.2	11.5	7.0	7.01	8.72	...	...
25	.580	.553	.590	.5715	65.1	77.1	63.2	69.18	+ 4.83	.571	.600	.475	.539	92	64	82	76	S W	S	S W	S 31 W	6.5	10.0	1.5	5.83	6.33	...	...
26	.600	.630	.710	.6517	64.0	82.0	66.0	70.67	+ 6.57	—	—	—	—	—	—	—	—	S W	W	N	S 85 W	5.0	12.0	1.0	6.61	6.93	...	...
27	.771	.760	.788	.7697	63.2	82.4	71.5	72.80	+ 8.97	.504	.620	.555	.565	87	56	72	71	S W	S	S W	S 32 W	0.6	11.5	3.3	5.09	6.29	...	...
28	.830	.745	.702	.7488	65.9	79.1	69.0	71.20	+ 7.63	.560	.665	.694	.659	88	67	98	87	N	S E	S	S 19 E	1.2	2.2	1.4	0.89	3.00	.770	...
29	.649	.592	.651	.6212	67.9	76.6	67.6	71.68	+ 8.38	.679	.792	.524	.624	99	87	77	81	W	S	N W	N 81 W	2.4	8.0	6.6	6.30	7.48	.030	...
30	.703	.682	.632	.6678	59.6	73.0	66.1	66.53	+ 3.47	.425	.466	.518	.474	83	57	81	73	N W	S	S W	S 86 W	11.5	7.5	2.8	1.94	6.73	...	...
31	.554	.418	.383	.4552	61.8	67.9	67.6	66.40	+ 3.60	.445	.562	.601	.544	80	82	89	84	N E	S W	W	S 59 W	2.2	10.0	7.5	4.73	5.75	.290	
	29.5705	29.5403	29.5475	29.5507	63.07	75.71	67.21	69.16	+ 3.20	.522	.574	.545	.547	88	65	81	77	....	....	....	... .	4.58	8.49	4.89	....	6.00	3.165	...

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR AUGUST, 1877.

NOTE.—The monthly means of the Barometer and Temperature include Sunday observations. The daily means, excepting those that relate to the wind, are derived from six observations daily, namely, at 6 A.M., 8 A.M., 2 P.M., 4 P.M., 10 P.M. and midnight. The means and resultants for the wind are from hourly observations.

Highest Barometer.........................29.837 at 8 a.m. on 28th } Monthly range =
Lowest Barometer ....29.298 at 2 p.m. on 9th } 0.539.

Self-registering Ther.
- Maximum temperature......................83°1 on 19th, 27th } Monthly range =
- Minimum temperature ....53°5 on 5th } 29°6
- Mean maximum temperature ....77°92 } Mean daily range =
- Mean minimum temperature ....61°04 } 16°88
- Greatest daily range..............................23°6 from a.m. to p.m. of 6th.
- Least daily range .... 9°5 from a.m. to p.m. of 12th.

Warmest day .... 23rd; mean temperature 73°32 } Difference=11°15.
Coldest day .... 12th; mean temperature 62°17 }

Maximum Radiation { Solar .... 139°0 on 4th } Monthly range =
{ Terrestrial.. 45°4 on 5th } 93°6.

Aurora observed on 1 night, viz., 18th.

Possible to see Aurora on 24 nights; impossible on 7 nights.

Raining on 14 days; depth, 3.165 inches; duration of fall, 27.5 hours.

Mean of Cloudiness, 0.56.

WIND.

Resultant direction, N. 85° W.; Resultant Velocity, 0.69 miles.

Mean Velocity, 6.00 miles per hour.

Maximum Velocity, 20.0 miles, from 4 to 5 p.m. of 10th.

Most Windy day, 3rd; Mean Velocity, 9.54 miles per hour.

Least Windy day, 28th; Mean Velocity, 3.00 miles per hour.

Most Windy hour, noon; Mean Velocity, 9.10 miles per hour.

Least Windy hour, 7 p.m.; Mean Velocity, 4.02 miles per hour.

Fog on 14th and 15th.

Dew on 15 mornings.

Solar halos on 13th and 22nd.

Lightning on 5th, 7th, 8th, 9th, 13th, 14th, 15th, 16th, 18th, 22nd, 24th, 29th and 31st.

Thunder on 2nd, 7th, 8th, 9th, 12th, 14th, 16th, 18th, 28th and 29th.

COMPARATIVE TABLE FOR AUGUST.

YEAR.	TEMPERATURE.					RAIN.		SNOW.		WIND.		
	Mean.	Excess above Average.	Maximum.	Minimum.	Range.	No. of days.	Inches.	No. of days.	Inches.	Resultant. Direction.	Resultant. V'locity.	Mean Velocity.
1849	66°3	0°0	79°0	49°0	30°0	10	4.970	...	...	N 71° W	0.60	3.76
1850	66.8	+ 0.5	85.0	41.0	44.0	13	4.355	...	...	N 15 W	0.35	4.46
1851	63.6	— 2.7	79.8	42.0	37.8	10	1.360	...	...	N 63 W	0.40	4.63
1852	65.9	— 0.4	81.2	45.8	35.4	9	2.695	...	...	N 70 E	0.56	3.30
1853	68.6	+ 2.3	94.9	42.5	52.4	11	2.575	...	...	S 36 E	0.30	4.26
1854	68.0	+ 1.7	99.2	45.6	53.6	5	0.455	...	...	N 64 W	1.76	4.60
1855	64.1	— 2.2	83.5	40.0	43.5	7	1.455	...	...	N 63 W	1.04	6.97
1856	63.6	— 2.7	82.7	41.5	41.2	12	1.680	...	...	N 50 W	2.88	7.03
1857	65.3	— 1.0	88.2	46.0	42.2	13	5.265	...	...	N 77 W	1.51	6.36
1858	67.6	+ 1.3	84.0	44.0	40.0	11	3.890	...	...	N 69 W	1.57	6.50
1859	66.6	+ 0.3	82.2	45.8	36.4	11	3.900	...	...	N 36 W	1.62	5.96
1860	64.5	— 1.8	87.0	46.8	40.2	14	3.405	...	...	N 70 W	1.83	5.80
1861	65.5	— 0.8	85.2	47.0	38.2	15	2.953	...	...	N 8 E	0.46	4.21
1862	67.6	+ 1.3	89.5	42.8	46.7	15	3.483	...	...	N 78 W	1.67	5.96
1863	66.6	+ 0.3	88.0	42.4	45.6	12	2.208	...	...	S 61 W	1.80	4.89
1864	68.6	+ 2.3	94.0	47.0	47.0	16	5.060	...	...	N 70 W	1.38	4.75
1865	65.2	— 1.1	87.8	44.4	43.4	8	1.990	...	...	N 60 W	1.55	5.07
1866	60.8	— 5.5	77.0	42.4	34.6	14	4.457	...	...	N 59 W	2.58	5.16
1867	68.1	+ 1.8	95.2	42.2	53.0	10	2.440	...	...	N 76 W	1.25	4.52
1868	67.2	+ 0.9	84.4	46.8	37.6	13	1.562	...	...	S 58 W	1.01	6.15
1869	63.6	— 2.7	89.0	43.5	45.5	11	4.273	...	...	N 42 W	1.98	5.15
1870	67.1	+ 0.8	84.0	40.0	44.0	14	3.422	...	...	N 75 W	1.80	5.92
1871	67.4	+ 1.1	89.5	46.0	43.5	8	2.800	...	...	N 52 W	1.09	6.86
1872	69.6	+ 3.3	91.8	51.0	40.8	19	2.405	...	...	N 51 W	1.43	3.73
1873	66.6	+ 0.3	85.0	46.4	38.6	12	1.913	...	...	N 84 E	1.35	5.56
1874	67.1	+ 0.8	95.0	48.0	47.0	4	0.380	...	...	N 23 E	0.70	6.16
1875	65.2	— 1.1	81.9	48.0	33.9	14	1.880	...	...	S 56 E	1.58	6.70
1876	70.2	+ 3.9	88.8	45.0	43.8	2	R	...	...	S 31 W	0.23	6.57
1877	69.2	+ 2.9	83.1	53.5	29.6	14	3.165	...	...	N 85 W	0.69	6.00
Res'lts to 1876.	66.32	......	86.89	44.75	42.14	10.73	2.784	...	...	N 62 W	0.87	5.36
Excess for 1877	+ 2.84	......	— 3.79	+ 8.75	— 12.54	+ 3.27	+ 0.381	...	...	...	...	+ 0.64

MONTHLY METEOROLOGICAL REGISTER, AT THE MAGNETICAL OBSERVATORY, TORONTO, ONTARIO—SEPTEMBER, 1877.

Latitude—43° 39'4 *North.* *Longitude*—5*h.* 17*m.* 33*s. West.* *Elevation above Lake Ontario,* 108 *feet.*

Day.	Barom. at temp. of 32°.				Temp. of the Air.				Excess of Mean above aver'ge	Tension of Vapour.				Humidity of Air.				Direction of Wind.				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.	10 PM	MEAN		6 A.M.	2 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.	Res'l-tant.	6 A.M.	2 P.M.	10 P.M.	Res'l-tant.	MEAN		
1	29.469	29.476	29.464	29.4727	° 57.3	° 65.4	° 55.0	° 59.02	° — 3.53	.396	.276	.303	.319	84	44	70	65	N W	N W	N W	N 48° W	7.5	11.0	4.4	8.59	9.25	...	...
2	.440	.410	.450	.4333	50.0	61.0	51.0	54.58	— 7.67	—	—	—	—	—	—	—	—	W	N W	N W	N 72 W	4.2	14.0	9.0	6.35	7.29	.010	...
3	.469	.468	.496	.4800	46.1	61.8	56.0	55.53	— 6.45	.265	.289	.407	.323	85	53	89	74	N W	W	S W	N 88 W	9.4	21.0	3.5	9.59	10.10	R	...
4	.530	.528	.575	.5458	52.4	71.0	60.4	62.08	+ 0.40	.348	.391	.414	.393	88	51	79	72	W	S	S W	S 33 W	6.0	9.1	4.0	6.04	6.36	.020	...
5	.621	.737	.855	.7505	57.8	58.5	55.3	58.05	— 3.33	.402	.356	.398	.386	84	72	91	80	S W	N	C	N 15 W	3.4	14.0	3.2	3.31	5.40	.195	...
6	.917	.899	.868	.8915	53.5	61.8	59.3	58.60	— 2.45	.248	.323	.267	.273	60	58	53	55	N E	E	N E	N 58 E	8.5	11.0	7.5	7.77	8.29	...	...
7	.834	.845	.817	.8333	55.7	60.7	57.6	58.22	— 2.50	.325	.452	.428	.399	73	85	91	82	N E	N E	N E	N 40 E	5.4	9.0	4.2	6.45	6.65	.030	...
8	.814	.782	.757	.7853	53.5	65.0	52.4	57.30	— 3.05	.344	.414	.369	.370	84	67	93	79	N	S E	N E	N 72 E	6.0	9.0	4.4	4.28	6.29	...	...
9	.765	.700	.680	.7108	49.0	66.0	59.0	59.00	— 0.99	—	—	—	—	—	—	—	—	N	E	E	N 79 E	4.0	8.5	4.4	4.40	5.55	...	...
10	.605	.545	.526	.5532	58.2	69.4	64.0	63.83	+ 4.23	.444	.406	.512	.473	91	51	86	80	N E	E	N E	N 69 E	5.0	8.5	2.8	5.84	6.10	...	...
11	.562	.607	.649	.6153	62.9	71.5	66.5	66.85	+ 7.65	.521	.555	.566	.537	91	71	87	82	E	E	E	N 89 E	4.1	8.0	4.0	4.94	5.31	...	...
12	.712	.686	.671	.6880	60.7	73.0	65.4	66.83	+ 8.01	.509	.596	.581	.564	96	73	93	86	N E	E	N E	S 84 E	3.5	8.5	3.0	4.60	5.04	...	...
13	.711	.699	.721	.7055	58.9	78.0	66.7	69.50	+11.08	.470	.534	.543	.570	94	66	82	79	C	S	S	S 11 W	0.0	8.2	5.0	1.36	3.42	...	...
14	.729	.670	.614	.6675	60.0	79.1	67.6	70.28	+12.27	.480	.543	.551	.537	93	55	82	75	N	S E	E	S 83 E	4.8	5.8	2.0	2.53	3.87	...	...
15	.571	.504	.498	.5175	63.2	80.2	66.5	70.90	+13.28	.550	.603	.601	.599	95	58	92	81	N E	S E	E	S 63 E	2.6	10.5	1.6	3.90	5.31	...	...
16	.540	.550	.560	.5517	65.0	80.0	68.0	71.33	+14.13	—	—	—	—	—	—	—	—	S	S W	S W	S 42 W	2.2	9.6	4.2	3.88	4.83	.010	...
17	.528	.433	.582	.5205	59.3	65.0	51.3	58.17	+ 1.38	.465	.389	.332	.398	92	63	87	82	N W	N W	W	N 51 W	5.8	19.0	2.5	6.30	6.55	.050	...
18	.637	.642	.684	.6587	46.3	60.2	47.7	52.45	+ 3.92	.247	.185	.264	.233	78	35	80	62	W	W	W	N 75 W	6.5	18.0	3.0	7.58	7.65	...	...
19	.689	.618	.613	.6390	39.8	70.1	57.6	57.17	+ 1.23	.225	.236	.279	.268	92	32	58	60	W	S	S W	S 37 W	0.2	14.0	4.2	6.77	7.71	...	...
20	.620	.576	.611	.6000	48.8	65.8	55.0	57.25	+ 1.70	.269	.391	.313	.303	78	61	72	66	N W	S	N	N 47 W	0.8	2.4	5.5	2.58	5.58	R	...
21	.733	.802	.863	.8038	47.0	60.4	50.3	53.18	— 1.93	.282	.167	.269	.223	88	31	74	58	N	N W	N	N 14 W	7.0	10.5	5.0	7.52	7.63	...	...
22	.911	.869	.828	.8682	38.9	64.0	49.5	52.67	— 2.02	.213	.305	.341	.301	90	52	96	77	S W	S E	S E	S 24 E	2.5	7.4	0.8	2.70	4.57	...	...
23	.830	.750	.750	.7783	46.0	71.0	56.0	58.00	+ 6.17	—	—	—	—	—	—	—	—	N W	S	W	S 16 W	2.0	7.0	1.5	3.70	4.96	...	...
24	.776	.697	.714	.7247	49.5	78.0	62.5	64.62	+10.78	.341	.559	.511	.479	96	58	90	79	W	S	S W	S 17 W	0.4	10.6	1.5	4.54	5.02	...	...
25	.715	.650	.654	.6737	58.6	78.4	62.7	67.18	+13.77	.486	.574	.550	.542	99	59	96	83	S W	S	S W	S 27 W	0.7	11.0	1.0	5.11	5.29	...	...
26	.660	.681	.751	.7027	60.4	74.4	60.4	66.13	+13.15	.488	.516	.319	.436	93	60	61	69	N W	N W	N W	N 29 W	1.8	9.5	10.0	2.51	4.73	...	...
27	.831	.748	.709	.7535	51.3	60.7	61.6	58.08	+ 5.48	.286	.376	.465	.373	75	70	85	76	N E	E	N E	N 57 E	7.5	9.0	6.0	7.73	7.85	...	...
28	.675	.702	.786	.7268	56.0	74.6	57.8	63.08	+10.90	.413	.596	.309	.405	92	70	64	71	N W	S W	N	N 21 W	0.8	5.0	14.0	4.04	6.69	...	...
29	.803	.726	.682	.7283	54.2	66.8	60.4	60.82	+ 9.07	.357	.415	.426	.418	84	64	81	79	N E	E	N E	N 69 E	3.4	10.5	2.0	5.36	6.50	...	...
30	.710	.660	.620	.6600	55.0	78.0	63.0	65.17	+13.79	—	—	—	—	—	—	—	—	N E	S	S W	S 5 W	3.0	10.0	2.4	3.10	5.33	...	...
	29.6802	29.6553	29.6683	29.6682	53.84	68.99	58.88	61.20	+ 3.95	.376	.422	.412	.405	87	59	81	74	....	....	....	....	3.97	10.32	4.22	...	6.17	...	...

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR SEPTEMBER, 1877.

NOTE.—The monthly means of the Barometer and Temperature include Sunday observations. The daily means, excepting those that relate to the wind, are derived from six observations daily, namely, at 6 A.M., 8 A.M., 2 P.M., 4 P.M., 10 P.M., and midnight. The means and resultants for the wind are from hourly observations.

Highest Barometer.......29.932 at 8 a.m. on 22nd. } Monthly range = 0.522.
Lowest Barometer.......29.410 at 2 p.m. on 2nd. }

Self-registering Ther.:
- Maximum temperature.......81.7 on 15th. } Monthly range = 43°4.
- Minimum temperature.......38.3 on 22nd. }
- Mean maximum temperature.......71.19 } Mean Daily range = 19°01.
- Mean minimum temperature.......52.18 }
- Greatest daily range.......31.2 from 6 a.m. to 1 p.m. of 19th.
- Least daily range....... 7.9 from a.m. to p.m. of 7th.

Warmest day.......16th; mean temperature......71.33 } Difference=18°.88
Coldest day.......18th; mean temperature......52.45 }

Maximum Radiation { Solar.......136.0 on 15th. } Monthly range = 104·6
Maximum Radiation { Terrestrial.......—31.4 on 22nd. }

Aurora observed on 1 night, viz., 18th.
Possible to see Aurora on 21 nights; impossible on 9 nights.
Raining on 8 days; depth, 0.415 inches; duration of fall, 8.4 hours.
Mean of cloudiness, 0.47.

WIND.

Resultant direction, N. 13° W.; resultant velocity, 0.56 miles.
Mean velocity, 6.17 miles per hour.
Maximum velocity, 21.0 miles per hour, from 2 to 3 p.m. on 3rd.
Most windy day, 3rd; mean velocity, 10.10 miles per hour.
Least windy day, 13th; mean velocity, 3.42 miles per hour.
Most windy hour, 1 p.m.; mean velocity, 10.60 miles per hour.
Least windy hour, 6 a.m.; mean velocity, 3.97 miles per hour.

Fog on 12th, 13th, 15th, 22nd, 24th and 25th.
Dew on 10 mornings.
First frost of season on 18th.
Lightning on 1st, 4th, 12th, 25th and 27th.
Solar halo on 9th.

COMPARATIVE TABLE FOR SEPTEMBER.

YEAR.	TEMPERATURE. Mean.	Excess above Average.	Maximum.	Minimum.	Range.	RAIN. No. of days.	Inches.	SNOW. No. of days.	Inches.	WIND. Resultant. Direction.	V'locity.	Mean Velocity.
1849	58.2°	+ 0.1°	80.1°	32.7°	47.4°	9	1.480	...	...	N 75° W	0.69	4.23
1850	56.5	— 1.6	76.0	29.5	46.5	11	1.735	...	...	S 65 W	1.02	4.78
1851	60.0	+ 1.9	86.3	32.0	54.3	17	2.665	...	...	N 14 E	1.03	5.45
1852	57.5	— 0.6	81.8	35.8	46.0	10	3.630	...	...	N 77 W	0.53	4.60
1853	58.0	— 0.1	85.5	33.9	51.6	12	5.140	...	...	N	1.06	4.33
1854	61.0	+ 2.9	93.6	35.8	57.8	14	5.375	...	...	N 22 W	1.33	4.04
1855	59.5	+ 1.4	82.6	33.0	49.6	12	5.585	...	...	N 20 E	1.29	7.61
1856	57.1	— 1.0	78.4	35.0	43.4	13	4.105	...	...	S 79 W	1.98	6.53
1857	58.6	+ 0.5	82.0	34.1	47.9	11	2.640	...	...	N 68 W	1.61	6.55
1858	59.1	+ 1.0	81.4	35.6	45.8	8	0.735	...	...	S 74 W	1.53	5.69
1859	55.2	— 2.9	75.4	35.7	39.7	15	3.525	...	...	N 44 W	1.60	6.36
1860	55.3	— 2.8	75.8	28.7	47.1	14	1.959	...	...	N 71 W	2.63	5.79
1861	59.1	+ 1.0	78.8	37.1	41.7	17	3.607	...	...	N 71 W	1.39	4.81
1862	59.6	+ 1.5	79.4	39.0	40.4	9	2.344	...	...	N 59 W	1.07	5.11
1863	55.9	— 2.2	80.0	31.4	48.6	8	1.235	...	...	N 16 W	0.92	6.46
1864	56.4	— 1.7	73.0	37.8	35.2	11	2.508	...	...	N 38 W	1.89	7.06
1865	64.5	+ 6.4	90.5	42.0	48.5	12	2.450	...	...	S 56 E	0.47	4.12
1866	55.2	— 2.9	80.0	34.4	45.6	15	5.657	...	...	N 33 W	1.45	4.63
1867	57.9	— 0.2	87.0	31.8	55.2	9	1.226	...	...	N 37 W	1.48	5.43
1868	56.6	— 1.5	75.5	36.0	39.5	16	4.239	...	...	N 74 W	0.88	4.68
1869	60.7	+ 2.6	81.0	34.4	46.6	8	4.027	...	...	N 53 W	1.16	4.89
1870	61.8	+ 3.7	78.0	45.8	32.2	11	6.794	...	...	N 29 E	2.26	5.04
1871	54.8	— 3.3	81.8	34.0	47.8	8	1.290	...	...	N 74 W	1.72	5.50
1872	59.1	+ 1.0	84.4	38.2	46.2	16	2.526	...	...	N 79 W	1.47	5.24
1873	57.3	— 0.8	79.0	33.5	45.5	14	3.020	...	...	N 81 W	2.92	7.39
1874	63.3	+ 5.2	88.6	39.5	49.1	11	1.554	...	...	S 14 E	0.09	6.30
1875	55.5	— 2.6	84.5	32.0	52.5	13	2.820	...	...	S 88 W	1.89	8.09
1876	57.5	— 0.6	77.8	38.5	39.3	16	2.455	...	...	N 6 W	2.97	9.22
1877	61.2	+ 3.1	81.7	38.3	43.4	8	0.415	...	...	N 13 W	0.56	6.17
Res'lts to 1876.	58.10	......	81.36	35.26	46.10	11.46	3.544	...	...	N 55 W	1.17	5.75
Excess for 1877	+ 3.10	......	+ 0.34	+ 3.04	— 2.70	— 3.46	— 3.129	...	...	...	...	+ 0.42

MONTHLY METEOROLOGICAL REGISTER, AT THE MAGNETICAL OBSERVATORY, TORONTO, ONTARIO—OCTOBER, 1877.

Latitude—43° 39′4 *North*. *Longitude*—5*h*. 17*m*. 33*s*. *West*. *Elevation above Lake Ontario*, 108 *feet*.

Day.	Barom. at temp. of 32°. 6 A.M.	2 P.M.	10 P.M.	Mean.	Temp. of the Air. 6 A.M.	2 P.M.	10 PM	MEAN	Excess of Mean above Av'rage.	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N.	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Direction of Wind. 6 A.M.	2 P.M.	10 P.M.	Resultant.	Velocity of Wind. 6 A.M.	2 P.M.	10 P.M.	Result't	MEAN	Rain in inches.	Snow in inches.
1	29.657	29.615	29.663	29.6503	° 62.9	° 78.0	° 66.7	° 69.40	° +18.42	.511	.559	.550	.541	89	58	84	76	S W	S	N	S 45° W	4.5	10.5	9.0	3.33	6.76	...	...
2	.706	.653	.631	.6623	60.0	60.0	57.1	59.17	+ 8.58	.444	.456	.435	.435	86	88	93	87	N E	E	N	N 53 E	5.8	8.0	5.0	5.50	6.12	...	...
3	.634	.524	.342	.4830	54.9	60.2	60.7	58.15	+ 7.92	.380	.459	.509	.440	88	88	96	90	N E	E	S E	N 61 E	5.8	8.2	5.4	5.76	6.21	...	...
4	.133	.229	.478	.2892	64.3	60.0	46.5	55.80	+ 5.95	.555	.269	.211	.342	92	52	66	72	S	W	W	N 81 W	15.0	20.0	12.6	10.38	14.50	.230	...
5	.610	.604	.690	.6462	38.8	52.8	43.8	45.45	— 4.07	.199	.206	.218	.198	86	51	75	66	N W	S W	W	S 86 W	5.0	14.0	9.5	6.66	8.44	...	...
6	.848	.909	.998	.9255	42.0	54.6	44.7	46.95	— 2.18	.206	.203	.188	.193	77	47	63	61	W	W	W	S 88 W	8.5	15.0	3.0	8.14	8.23	...	...
7	30.040	.980	.840	.9350	36.0	56.0	56.0	50.00	+ 1.20	—	—	—	—	—	—	—	—	N	E	S E	S 57 E	3.0	9.5	11.0	5.71	6.50	...	...
8	29.693	.489	.494	.5512	51.7	56.0	55.7	54.83	+ 6.38	.357	.378	.381	.360	93	84	86	83	S E	S E	S	S 30 E	10.7	20.5	17.0	14.26	15.67	1.010	...
9	.641	.705	.737	.6995	49.3	57.8	49.9	52.80	+ 4.67	.323	.331	.326	.333	92	69	91	84	S W	N W	S E	S 50 W	5.0	5.6	5.0	2.97	6.17	R	...
10	.641	.463	.412	.4918	53.0	58.9	52.4	54.37	+ 6.55	.383	.385	.316	.351	95	77	80	82	E	S E	S	S 39 E	5.0	10.0	20.0	5.76	9.25	.190	...
11	.385	.451	.603	.4927	47.0	51.9	47.0	48.83	+ 1.32	.303	.309	.264	.289	94	80	81	84	S W	N	N W	N 71 W	4.6	9.0	12.5	6.67	10.00	.089	...
12	.722	.752	.832	.7792	43.8	50.8	46.3	46.83	— 0.35	.241	.252	.241	.243	84	68	77	76	N W	N W	N W	N 46 W	11.0	13.5	0.2	10.43	10.48	...	...
13	.847	.777	.725	.7882	38.4	53.7	55.3	50.05	+ 3.15	.219	.296	.353	.301	95	71	81	82	N W	E	S E	S 66 E	1.4	9.0	3.0	2.65	4.39	.100	...
14	.770	.760	.810	.7833	55.0	68.0	57.0	59.17	+12.56	—	—	—	—	—	—	—	—	S	S	S W	S 24 W	1.6	10.0	2.0	4.27	4.65	.162	...
15	.862	.781	.723	.7788	50.1	62.7	58.9	57.55	+11.20	.343	.432	.446	.422	95	76	90	89	S E	S E	S W	S 41 E	3.5	3.0	4.0	1.67	2.85	...	...
16	.713	.781	.843	.7928	56.6	58.2	52.1	54.98	+ 8.92	.358	.293	.297	.309	78	60	76	72	N W	N	N	N 42 W	12.8	16.0	8.0	9.46	10.92	...	...
17	.855	.787	.687	.7795	47.7	52.8	52.1	50.92	+ 5.13	.273	.298	.256	.277	83	75	66	75	N E	E	E	N 65 E	8.0	8.0	7.5	6.66	7.29	R	...
18	.639	.609	.637	.6253	48.8	54.2	50.1	50.93	+ 5.40	.330	.340	.303	.323	96	81	83	86	E	N E	N	N 66 E	7.0	7.0	0.4	6.30	6.79	.290	...
19	.637	.655	.698	.6693	47.7	48.1	45.9	46.92	+ 1.65	.303	.293	.259	.278	92	87	83	86	N	N E	N E	N 27 E	4.0	7.4	11.4	6.55	6.63	.320	...
20	.707	.700	.668	.6962	39.4	44.5	36.2	39.78	— 5.27	.176	.191	.167	.176	73	65	78	71	N E	N E	N	N 30 E	10.5	7.0	6.0	7.44	7.84	...	...
21	.620	.510	.470	.5250	34.0	42.0	39.0	38.83	— 5.95	—	—	—	—	—	—	—	—	N E	N	N	N 35 E	12.0	10.0	9.0	9.32	9.46	...	...
22	.514	.511	.500	.5113	31.9	48.8	44.5	42.57	— 2.00	.136	.135	.209	.166	75	38	71	61	N W	W	S W	N 60 W	9.0	9.5	11.0	5.42	9.29	...	...
23	.470	.471	.513	.4902	38.7	59.6	54.2	51.75	+ 7.43	.211	.307	.303	.280	90	60	72	73	S W	S W	S W	S 36 W	3.0	12.5	10.0	7.61	8.21	...	...
24	.539	.488	.497	.5068	51.9	63.4	54.8	56.17	+12.12	.279	.280	.311	.298	72	47	72	67	S W	S W	W	S 60 W	10.5	14.0	4.0	9.64	10.12	.050	...
25	.459	.573	.655	.5712	48.8	39.3	36.4	40.77	— 3.03	.325	.224	.173	.239	94	93	80	91	N E	N E	N E	N 42 E	6.5	11.0	12.0	8.20	8.75	.160	...
26	.644	.618	.629	.6317	35.1	40.5	36.2	37.10	— 6.48	.136	.162	.131	.141	66	64	59	63	N E	N E	N E	N 45 E	12.5	11.5	10.0	11.04	11.25	...	...
27	.641	.651	.671	.6515	34.0	43.4	42.3	40.28	— 3.08	.129	.205	.239	.193	66	73	87	75	N E	E	E	N 63 E	6.4	5.2	6.0	5.54	6.48	.025	...
28	.660	.620	.490	.5817	41.0	49.0	50.0	47.33	+ 4.24	—	—	—	—	—	—	—	—	N E	E	E	N 87 E	3.7	7.0	4.5	4.58	5.00	...	...
29	.403	.627	.685	.5797	55.7	54.6	43.0	51.05	+ 8.18	.370	.203	.229	.268	83	48	83	71	S W	N W	S W	S 80 W	8.4	17.0	4.0	9.96	12.77	...	...
30	.694	.655	.567	.6328	35.5	49.2	38.1	41.53	— 1.10	.191	.194	.194	.195	93	54	84	75	W	S	S W	S 64 W	4.8	9.5	1.2	4.50	6.13	...	...
31	.393	.376	.545	.4422	41.8	45.9	36.7	42.10	— 0.32	.217	.219	.186	.201	82	70	85	76	S W	W	W	S 78 W	1.0	12.0	6.0	7.16	7.85	.010	
	29.6380	29.6234	29.6365	29.6337	46.23	54.03	48.70	49.76	+ 2.47	.292	.292	.285	.288	86	68	79	77	....	....	....	....	6.79	10.66	7.43	....	8.23	2.636	...

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR OCTOBER, 1877.

NOTE.—The monthly means of the Barometer and Temperature include Sunday observations. The daily means, excepting those that relate to the wind, are derived from six observations daily, namely, at 6 A.M., 8 A.M., 2 P.M., 4 P.M., 10 P.M., and midnight. The means and resultants for the wind are from hourly observations.

Highest barometer ....30.040 at 6 a.m. on 7th } Monthly range =
Lowest barometer ....29.091 at 8 a.m. on 4th } 0.949.

Self-registering Ther.
- Maximum temperature ....79°6 at 0.50 p.m. on 1st } Monthly range =
- Minimum temperature ....31°3 a.m. on 22nd } 48°3.
- Mean maximum temperature ....56°73 } Mean daily range=
- Mean minimum temperature ....42°65 } 14°08.
- Greatest daily range....................25°7 from a.m. to p.m. of 23rd.
- Least daily range ....5°6 from a.m. to p.m. of 19th.

Warmest day .... 1st; mean temperature...............69°40 } Difference=32°30.
Coldest day................26th; mean temperature...............37°10 }

Maximum Radiation { Solar ....135°5 on 1st } Monthly Range =
{ Terrestrial ....25°8 on 22nd } 109°7.

Aurora observed on 1 night, viz., 11th.

Possible to see Aurora on 14 nights; impossible on 17 nights.

Raining on 14 days; depth, 2.636 inches; duration of fall, 75.6 hours.

Mean of cloudiness, 0.76.

WIND.

Resultant direction, N. 70° W.; resultant velocity, 0.95 miles.

Mean velocity, 8.23 miles per hour.

Maximum velocity, 31.0 miles from 10 to 11 a.m. of 29th.

Most windy day, 8th; mean velocity, 15.67 miles per hour.

Least windy day, 15th; mean velocity, 2.85 miles per hour.

Most windy hour, 1 p.m.; mean velocity, 10.91 miles per hour.

Least windy hour, 1 a.m.; mean velocity, 6.56 miles per hour.

Fog on 15th and 25th.

Solar halo on 24th. Lunar halo on 20th.

Lightning on 1st, 5th, and 13th.

Thunder on 13th.

Hail on 25th.

COMPARATIVE TABLE FOR OCTOBER.

YEAR.	TEMPERATURE.					RAIN.		SNOW.		WIND.		
	Mean.	Excess above aver'ge	Maximum.	Minimum.	Range.	No. of days.	Inches.	No. of days.	Inches	Resultant. Direction.	Resultant. Velo'y	Mean Velocity.
1849	45.3°	— 0.4°	58.9°	24.2°	34.7°	13	5.965	1	Inap	N 12° W	1.27	7.76
1850	45.4	— 0.3	66.7	22.4	44.3	10	2.085	0	0.0	N 66 W	1.10	5.30
1851	47.4	+ 1.7	66.2	25.2	41.0	10	1.680	2	0.3	S 72 W	1.06	4.39
1852	48.0	+ 2.3	70.7	23.8	46.9	12	5.280	0	0.0	N 5 E	1.19	4.47
1853	44.4	— 1.3	64.7	23.4	41.3	10	0.875	2	Inap.	S 88 W	1.74	4.77
1854	49.5	+ 3.8	75.4	26.4	49.0	15	1.495	3	Inap.	N 45 W	1.52	4.57
1855	45.4	— 0.3	68.0	22.6	45.4	14	2.485	5	0.8	N 82 W	4.91	9.88
1856	45.3	— 0.4	71.4	23.0	48.4	10	0.875	2	0.1	N 76 W	2.15	6.07
1857	45.4	— 0.3	64.0	26.5	37.5	10	1.040	2	0.2	N 19 W	2.93	6.24
1858	48.8	+ 3.1	76.3	31.5	44.8	17	1.797	1	Inap.	N 34 W	0.36	5.96
1859	43.0	— 2.7	69.8	22.3	47.5	11	0.940	4	Inap.	N 68 W	5.04	8.12
1860	47.3	— 1.6	68.0	28.4	39.6	15	1.618	1	Inap.	N 9 W	2.00	6.93
1861	48.7	+ 3.0	71.0	29.0	42.0	15	1.993	1	Inap.	N 61 W	1.06	5.96
1862	48.7	+ 3.0	76.6	26.2	50.4	19	2.684	2	0.5	N 78 W	2.89	6.53
1863	45.9	+ 0.2	66.4	30.5	35.9	16	2.522	0	0.0	S 71 W	0.48	6.16
1864	45.2	— 0.5	67.0	28.0	39.0	22	3.321	1	Inap.	N 60 W	3.17	6.66
1865	44.5	— 1.2	71.4	21.6	49.8	17	2.705	3	4.5	N 36 W	3.15	7.26
1866	49.1	+ 3.4	71.0	31.8	39.2	11	2.470	1	Inap.	N 30 W	0.84	5.53
1867	49.9	+ 4.2	75.4	31.0	44.4	11	1.970	0	0.0	N 45 W	1.51	5.73
1868	42.4	— 3.3	67.6	24.0	43.6	10	1.365	2	2.0	N 89 W	1.27	7.10
1869	42.3	— 3.4	69.8	18.7	51.1	8	0.962	7	2.3	N 89 W	3.72	6.73
1870	50.0	+ 4.3	68.5	30.2	38.3	16	2.690	0	0.0	N 85 W	1.86	7.11
1871	48.3	+ 2.6	72.2	28.6	43.6	13	1.185	0	0.0	S 66 W	3.75	7.84
1872	45.6	— 0.1	70.0	25.2	44.8	14	3.288	1	Inap.	N 18 W	2.22	4.59
1873	45.7	0.0	69.2	24.2	45.0	13	2.155	3	0.2	W	1.77	7.81
1874	47.5	+ 1.8	67.0	24.8	42.2	11	1.418	2	Inap.	N 70 W	2.75	6.40
1875	43.2	— 2.5	63.0	27.6	35.4	15	2.415	2	3.8	N 88 W	2.72	9.31
1876	42.8	— 2.9	61.6	23.0	38.6	12	1.435	5	0.1	S 81 W	4.63	9.19
1877	49.8	+ 4.0	79.6	31.3	48.3	14	2.636	0	0.0	N 70 W	0.95	8.23
Resu'ts to 1876.	45.74	...	68.85	25.86	42.99	12.57	2.355	1.92	0.86	N 60 W	1.92	6.41
Excess for '77.	+ 4.02	...	+ 10.75	+ 5.44	+ 5.31	+ 1.43	+ 0.281	— 1.92	— 0.86	...	...	+ 1.82

MONTHLY METEOROLOGICAL REGISTER, AT THE MAGNETICAL OBSERVATORY, TORONTO, ONTARIO—NOVEMBER, 1877.

Latitude—43° 39′ 4″ *North*. *Longitude*—5*h*. 17*m*. 33*s*. *West*. *Elevation above Lake Ontario*, 108 *feet*.

Day.	Barom. at temp. of 32°.				Temp. of the Air.				Excess of Mean above Average	Tension of Vapour.				Humidity of Air.				Direction of Wind.				Velocity of the Wind.					Rain in inches.	Snow in inches
	6 A.M.	2 p.m.	10 P.M.	Mean.	6 A.M.	2 P.M.	10 PM	MEAN		6 A.M.	2 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.	Res'l-tant.	6 A.M.	2 P.M.	10 P.M.	Res'l-tant.	MEAN.		
1	29.596	29.620	29.483	29.5550	34.7°	46.3°	45.6°	42.92°	+ 0.75°	.187	.195	.195	.194	93	62	63	71	W	S	E	S 11° E	8.5	4.0	19.0	1.72	6.83	...	...
2	28.890	28.844	.097	28.9452	44.5	47.0	41.8	44.18	+ 2.27	.286	.223	.180	.230	98	68	67	78	E	S W	S W	S 33 W	10.5	21.0	20.5	10.31	18.77	.835	...
3	29.278	29.488	.699	29.5162	39.3	41.2	34.0	37.63	— 4.05	.186	.154	.141	.156	77	58	72	69	W	S W	W	S 72 W	24.5	22.0	10.5	18.25	18.46	.080	...
4	.840	.800	.730	.7817	30.0	42.0	39.0	36.50	— 4.93	—	—	—	—	—	—	—	—	W	S	C	...	...	...	...	...	...	.090	...
5	.520	.433	.674	.5573	38.0	33.3	25.4	31.17	— 8.98	.220	.180	.111	.174	96	95	81	91	N	N	N	...	2.0	15.0	17.0	...	...	.340	1.5
6	.903	.927	30.000	.9538	21.4	37.1	29.7	29.33	—11.57	.104	.135	.136	.127	90	61	83	79	N W	W	W	N 74 W	3.5	18.5	5.0	7.62	9.12	...	...
7	30.043	.964	29.811	.9273	25.4	39.8	36.9	34.93	— 5.65	.118	.179	.200	.171	86	73	91	83	S W	S E	E	S 22 E	3.0	6.5	5.5	1.30	5.08	...	...
8	29.670	.389	.141	.3758	42.3	43.4	45.4	44.05	+ 3.73	.211	.275	.298	.266	78	98	98	92	S E	E	E	S 73 E	8.0	9.4	6.0	5.49	7.86	1.360	...
9	.276	.563	.845	.5958	40.2	32.0	25.4	31.58	— 8.42	.212	.138	.094	.141	85	76	69	75	N	N	N	N 10 W	15.0	15.5	20.0	14.84	15.44	.010	0.1
10	.986	.988	.986	.9915	18.9	28.6	26.1	24.17	—15.50	.093	.138	.116	.112	90	87	83	85	N	S	S W	N 15 E	5.0	4.0	4.0	2.97	5.60	...	...
11	.940	.890	.860	.8850	21.0	39.0	30.0	29.83	— 9.49	—	—	—	—	—	—	—	—	W	S E	N W	S 88 W	3.0	3.0	2.1	1.68	3.17	...	...
12	.800	.782	.822	.8063	32.0	42.9	36.2	36.70	— 2.27	.172	.212	.176	.185	95	77	82	85	W	S W	N W	S 77 W	3.5	7.8	5.5	4.53	5.08	...	...
13	.868	.877	.811	.8513	33.3	38.7	36.9	36.30	— 2.30	.170	.203	.200	.191	89	86	91	89	N E	E	E	N 68 E	7.0	8.0	3.4	5.91	6.85	...	...
14	.764	.722	.716	.7300	30.6	52.8	45.2	43.20	+ 4.97	.157	.257	.287	.239	92	64	95	85	E	S	S W	S 11 W	2.7	11.0	2.5	3.84	5.36	.125	...
15	.653	.530	.557	.5782	47.4	49.6	48.3	48.55	+10.72	.302	.331	.306	.317	92	93	90	92	S	S W	S W	S 22 W	8.0	10.5	8.0	8.38	8.56	.020	...
16	.603	.694	.716	.6803	48.8	50.6	43.4	46.33	+ 8.88	.300	.255	.251	.253	87	69	89	81	W	S W	C	S 50 W	7.0	5.0	0.0	5.84	6.65	R	...
17	.627	.479	.469	.5273	43.2	49.7	42.3	44.33	+ 7.32	.267	.317	.197	.252	96	89	73	85	S E	S E	W	S 39 W	2.5	6.6	18.0	3.35	6.48	.040	...
18	.700	.900	30.000	.8900	32.0	36.0	32.0	32.83	— 3.77	—	—	—	—	—	—	—	—	W	W	N W	N 72 W	24.5	19.0	10.0	19.36	20.00	...	S
19	30.042	30.079	30.136	30.0980	27.9	30.4	23.6	27.30	— 8.87	.138	.102	.105	.110	90	60	82	75	N W	N W	N	N 26 W	8.0	7.0	3.5	7.99	8.12	...	...
20	30.175	30.163	30.156	30.1570	21.0	31.9	33.3	29.00	— 6.72	.101	.121	.156	.126	89	67	82	78	N	N E	E	N 48 E	8.0	8.5	9.2	6.28	7.42	...	...
21	30.030	29.898	29.803	29.8990	34.8	40.2	40.7	38.95	+ 3.67	.153	.162	.168	.163	75	65	66	68	E	E	S E	S 88 E	12.0	9.0	8.5	10.11	10.50	...	...
22	29.753	.798	.874	.8150	41.2	44.8	44.5	43.62	+ 8.80	.253	.261	.291	.265	97	88	99	93	S E	S	C	S 32 E	11.0	3.4	0.0	4.97	5.29	.250	...
23	.867	.799	.766	.8072	43.0	43.4	43.9	43.35	+ 8.98	.266	.282	.275	.276	95	100	96	98	E	N E	N E	N 61 E	4.0	7.6	12.3	6.18	6.21	.140	...
24	.710	.585	.557	.6055	43.0	43.0	42.3	42.67	+ 8.77	.265	.256	.252	.255	96	92	93	93	N E	N E	N E	N 61 E	17.0	17.5	14.0	16.10	16.13	1.110	...
25	.490	.410	.370	.4100	43.0	44.0	45.0	44.17	+11.23	—	—	—	—	—	—	—	—	E	N E	N E	N 66 E	11.0	11.5	9.0	12.64	12.71	.560	...
26	.271	.131	.135	.1660	45.7	46.5	42.5	44.98	+12.05	.292	.336	.254	.287	94	95	93	93	N E	N E	S	N 75 E	11.0	10.5	7.5	7.98	10.62	.480	...
27	.228	.306	.382	.3170	43.8	45.0	41.6	42.87	+10.42	.255	.230	.211	.229	89	77	80	83	S	S W	S W	S 13 W	13.5	13.5	5.5	10.43	10.77	.010	...
28	.415	.495	.558	.4977	38.3	38.4	34.0	36.25	+ 4.28	.199	.164	.141	.162	86	70	72	75	S W	S W	W	S 53 W	10.0	12.0	5.0	10.80	11.25	...	S
29	.487	.388	.367	.4075	30.8	30.1	26.4	28.80	— 2.70	.149	.127	.108	.123	86	76	76	78	S W	W	W	S 68 W	7.5	11.0	13.0	9.42	9.60	...	S
30	.382	.446	.541	.4727	26.5	26.8	26.8	26.50	— 4.53	.119	.102	.116	.111	83	70	80	77	W	W	W	S 76 W	13.0	18.5	9.5	14.96	15.00	...	S
	29.6602	29.6463	29.6687	29.6600	35.40	40.48	36.94	37.47	+ 0.23	.199	.205	.191	.197	89	78	83	83	....	....	....	....	9.36	10.78	8.46	......	9.75	5.450	1.6

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR NOVEMBER, 1877.

NOTE.—The monthly means of the Barometer and Temperature include Sunday observations. The daily means, excepting those that relate to the wind, are derived from six observations daily, namely, at 6 A.M., 8 A.M., 2 P.M., 4 P.M., 10 P.M. and midnight. The means and resultants for the wind are from hourly observations.

Highest Barometer......................30.175 at 6 a.m. on 20th } Monthly range=
Lowest Barometer ....28.712 at 10 a.m. on 2nd } 1.463.

Self-registering Ther.
- Maximum temperature ....55°0 on 2nd } Monthly range=
- Minimum temperature ....17°2 on 10th } 37°8
- Mean maximum temperature ....43°12 } Mean daily range=
- Mean minimum temperature ....31°45 } 11°67
- Greatest daily range..........................23°9 from a.m. to p.m. of 14th.
- Least daily range .... 2°7 from a.m. to p.m. of 24th and 31st.

Warmest day .... 15th; mean temperature 48°55 } Difference=24°38.
Coldest day .... 10th; mean temperature 24°17 }

Maximum Radiation { Solar ....112°0 on 16th } Monthly range=
{ Terrestrial.......................... 4°0 on 10th } 108°0.

Aurora observed on 1 night, viz., 2nd.

Possible to see Aurora on 11 nights; impossible on 19 nights.

Raining on 16 days; depth, 5.450 inches; duration of fall, 112.9 hours.

Snowing on 5 days; depth, 1.6 inches; duration of fall, 13.5 hours.

Mean of Cloudiness, 0.75.

WIND.

Resultant direction, S. 77° W.; Resultant Velocity, 1.37 miles.

Mean Velocity, 9.75 miles per hour.

Maximum Velocity, 30.0 miles, from 4 to 5 a.m. of 18th.

Most Windy day, 18th; Mean Velocity, 20.00 miles per hour.

Least Windy day, 11th; Mean Velocity, 3.17 miles per hour.

Most Windy hour, 1 p.m.; Mean Velocity, 12.15 miles per hour.

Least Windy hour, 9 p.m.; Mean Velocity, 8.04 miles per hour.

Fog on 5th, 8th, 13th, 14th and 17th.

Thunder, with Lightning, on 17th.

Solar halos on 14th, 19th and 21st.

Lunar haloes on 13th, 16th, 19th, 20th and 21st.

The amount of rain this month is the heaviest in any November except 1846, when 5.805 fell.

COMPARATIVE TABLE FOR NOVEMBER.

YEAR.	TEMPERATURE.					RAIN.		SNOW.		WIND.		
	Mean.	Excess above Average.	Maximum.	Minimum.	Range.	No. of days.	Inches.	No. of days.	Inches	Resultant. Direction.	Resultant. V'locity	Mean Velocity.
1849	42.8°	+ 6.8°	56.4°	26.5°	29.9°	10	2.815	2	1.0	N 39° W	1.55	4.78
1850	38.8	+ 2.8	62.8	11.0	51.8	7	2.955	1	S	N 42 W	1.43	5.27
1851	32.9	— 3.1	50.2	13.8	36.4	5	3.855	6	6.7	N 50 W	1.25	4.70
1852	36.0	0.0	50.4	18.2	32.2	7	1.775	3	2.0	N 59 W	1.53	6.50
1853	38.7	+ 2.7	55.6	12.8	42.8	15	2.425	6	2.7	N 9 W	0.55	5.52
1854	36.8	+ 0.8	55.4	13.8	41.6	13	1.115	4	1.3	West.	3.44	7.54
1855	38.6	+ 2.6	59.2	15.5	43.7	8	4.590	6	3.0	N 66 W	3.18	10.81
1856	37.4	+ 1.4	56.4	18.8	37.6	10	1.375	9	9.5	S 85 W	2.95	8.75
1857	33.5	— 2.5	58.2	— 3.5	61.7	14	3.235	9	6.9	S 61 W	5.45	9.25
1858	34.2	— 1.8	53.0	15.3	37.7	12	3.879	13	4.0	N 25 W	3.14	8.87
1859	38.9	+ 2.9	62.6	21.8	40.8	12	5.193	9	0.6	N 81 W	3.39	9.65
1860	37.9	+ 1.9	64.5	13.2	51.3	12	2.569	8	1.9	S 89 W	4.95	11.02
1861	37.1	+ 1.1	52.4	23.0	29.4	14	4.294	8	3.2	N 46 W	1.94	7.44
1862	35.6	— 0.4	58.0	16.2	41.8	11	2.205	11	5.3	N 46 W	3.00	6.60
1863	39.1	+ 3.1	67.0	17.8	49.2	13	3.656	6	0.1	N 88 W	3.50	7.86
1864	36.9	+ 0.9	60.2	21.0	39.2	11	3.765	8	4.5	S 72 W	3.82	7.64
1865	38.6	+ 2.6	63.2	23.6	39.6	5	0.975	7	1.1	N 79 W	2.98	7.90
1866	38.4	+ 2.4	54.2	21.8	32.4	13	2.963	4	2.2	N 88 W	3.06	6.96
1867	36.9	+ 0.9	60.4	9.6	50.8	8	1.835	9	0.9	N 87 W	4.02	7.76
1868	36.2	+ 0.2	50.5	20.1	30.4	14	5.150	10	4.3	N 35 W	2.10	8.16
1869	32.7	— 3.3	58.0	13.0	45.0	9	2.540	18	10.2	N 78 W	3.69	8.12
1870	36.6	+ 0.6	57.2	19.4	37.8	6	0.594	5	3.1	N 89 W	4.36	8.74
1871	30.6	— 5.4	47.1	0.0	47.1	10	2.655	12	4.5	N 45 W	4.08	10.35
1872	32.9	— 3.1	52.0	8.2	43.8	7	0.420	9	1.3	S 85 W	5.02	7.48
1873	27.6	— 8.4	51.4	0.8	50.6	5	0.510	18	19.6	N 50 W	3.08	6.67
1874	34.6	— 1.4	61.0	3.5	57.5	7	0.935	11	11.7	S 87 W	3.07	7.70
1875	31.7	— 4.3	51.0	— 5.0	56.0	6	1.000	8	7.8	N 66 W	3.63	9.73
1876	37.3	+ 1.3	58.8	5.4	53.4	13	1.748	7	9.1	N 20 W	0.52	7.44
1877	37.5	+ 1.5	55.0	17.2	37.8	16	5.450	5	1.6	S 77 W	1.37	9.75
Res'lts to 1876.	36.03	......	56.68	13.41	43.27	9.70	2.552	7.38	4.25	N 77 W	2.70	7.72
Excess for 1877	+ 1.44	......	— 1.68	+ 3.79	— 5.47	+ 6.30	+ 2.898	— 2.38	— 2.65	...	...	+ 2.03

MONTHLY METEOROLOGICAL REGISTER, AT THE MAGNETICAL OBSERVATORY, TORONTO, ONTARIO—DECEMBER, 1877.

Latitude—43° 39′4 *North.* *Longitude*—5*h.* 17*m.* 33*s. West.* *Elevation above Lake Ontario,* 108 *feet.*

Day.	Barom. at temp. of 32°.				Temp. of the Air.				Excess of Mean above Average	Tension of Vapour.				Humidity of Air.				Direction of Wind.				Velocity of the Wind.					Rain in inches	Snow in inches
	6 A.M.	2 P.M.	10 P.M.	Mean.	6 A.M.	2 P.M.	10 P.M.	MEAN		6 A.M.	2 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.	Res'l-tant.	6 A.M.	2 P.M.	10 P.M.	Res'l-tant.	MEAN		
1	29.658	29.754	29.895	29.7842	°26.5	°26.5	°19.2	°23.98	°− 6.55	.119	.119	.097	.110	83	83	92	85	W	N	N	N 28° W	5.4	8.5	8.0	5.71	6.67	...	...
2	30.000	.970	.900	.9450	15.0	30.0	33.0	26.00	− 4.04	—	—	—	—	—	—	—	—	N	S	S W	S 51 W	5.5	10.0	19.0	4.27	10.17	...	...
3	29.801	.732	.834	.7858	31.9	38.2	27.5	32.27	+ 2.72	.165	.117	.132	.138	92	49	88	77	S W	W	S W	S 43 W	20.0	11.0	0.8	11.23	11.62	...	...
4	.769	.590	.491	.6028	30.4	39.4	41.2	37.38	+ 8.28	.153	.185	.253	.201	91	76	97	88	S W	E	S E	S 27 E	4.0	5.5	4.0	3.20	5.15	.080	...
5	.318	.164	.223	.2195	42.7	44.4	35.5	41.17	+12.52	.269	.292	.152	.239	98	100	73	90	S E	S	S W	S 32 W	4.0	8.7	12.0	5.90	8.03	.090	...
6	.162	.375	.696	.4377	35.1	31.9	26.5	30.63	+ 2.47	.173	.122	.106	.128	85	68	73	74	S W	N W	W	N 85 W	15.0	22.0	9.0	12.80	14.98	...	S
7	.788	.673	.551	.6627	27.2	30.8	34.4	30.55	+ 2.83	.118	.148	.156	.144	80	86	78	84	S W	S W	S W	S 59 W	10.5	5.5	12.5	9.53	10.06	...	...
8	.588	.628	.809	.6902	32.2	34.2	28.2	31.27	+ 3.98	.170	.113	.114	.127	93	56	73	72	W	W	N W	S 89 W	6.5	13.5	10.0	9.81	10.76	...	0.2
9	.910	.950	.860	.9050	23.0	30.0	32.0	28.83	+ 1.98	—	—	—	—	—	—	—	—	N W	W	S	S 76 W	4.5	10.5	8.5	5.68	7.03	...	S
10	.578	.491	.647	.5708	33.3	39.1	38.0	36.55	+10.10	.170	.146	.186	.168	89	60	81	78	S	S W	S W	S 38 W	13.5	9.5	8.0	9.28	10.54	...	0.1
11	.419	.567	.791	.6122	39.8	44.9	36.2	39.32	+13.27	.217	.173	.176	.182	88	57	82	76	S W	W	W	S 73 W	10.5	21.0	4.4	11.11	12.79	...	...
12	.910	.852	.504	.7350	28.4	39.1	39.8	35.63	+ 9.98	.146	.197	.194	.181	94	82	80	87	W	S E	E	S 39 E	3.5	6.0	5.5	1.11	4.41	...	...
13	.322	.438	.804	.5567	43.4	43.0	30.1	37.82	+12.55	.261	.164	.127	.176	92	59	76	75	S W	W	N W	N 67 W	9.5	30.0	28.0	17.72	19.53	.040	...
14	30.002	.871	.683	.8448	22.8	37.3	35.5	32.12	+ 7.23	.097	.104	.142	.116	82	46	69	65	N W	S W	S W	S 69 W	4.0	10.0	16.0	8.62	9.77	...	...
15	29.626	.452	.480	.5190	35.8	45.6	44.5	41.75	+17.20	.148	.199	.228	.189	70	65	78	71	S W	S W	S W	S 52 W	11.0	11.0	6.8	11.32	11.42	...	...
16	.680	.800	.750	.7517	33.0	41.0	37.0	37.00	+12.79	—	—	—	—	—	—	—	—	W	N	N	N 84 W	4.4	0.8	4.2	2.90	3.75	...	...
17	.642	.734	30.018	.8195	35.5	47.2	32.6	37.12	+13.22	.202	.197	.106	.161	97	60	57	71	S W	N W	N	N 59 W	8.0	15.0	12.5	5.70	8.04	...	...
18	30.152	30.058	29.893	30.0302	26.8	29.9	35.8	30.95	+ 7.35	.109	.111	.177	.139	75	67	84	79	E	E	E	N 77 E	10.5	10.0	5.0	8.04	8.63	.050	...
19	29.746	29.692	29.770	29.7395	39.1	47.7	47.7	44.65	+21.32	.215	.314	.324	.287	90	95	98	96	E	S W	W	S 10 W	4.0	6.5	6.0	1.69	4.02	.070	...
20	.913	30.059	30.147	30.0468	44.3	42.3	37.1	41.00	+17.93	.280	.219	.181	.222	96	82	81	85	N W	E	E	N 56 E	12.0	6.5	12.5	4.25	8.15	.010	S
21	30.094	30.059	30.084	30.0790	36.9	37.8	36.6	37.08	+14.23	.184	.214	.213	.205	83	94	98	92	E	N E	N E	N 86 E	6.5	5.4	4.5	5.98	6.29	.040	...
22	30.086	30.094	30.113	30.0977	37.3	39.8	39.1	38.73	+16.12	.221	.235	.234	.230	99	95	98	98	N E	N E	N E	N 64 E	3.4	4.0	5.5	3.95	4.00	.010	...
23	30.150	30.090	30.080	30.0967	38.0	35.0	34.0	35.33	+12.93	—	—	—	—	—	—	—	—	E	N E	N E	N 69 E	8.5	10.5	9.5	8.82	8.94	.010	...
24	30.016	29.924	29.846	29.9202	32.9	32.6	32.9	32.85	+10.63	.186	.172	.165	.174	99	92	88	93	N E	N E	E	N 62 E	7.0	7.5	5.0	6.71	6.80	...	...
25	29.750	.660	.630	.6717	30.0	32.0	32.0	31.33	+ 9.29	—	—	—	—	—	—	—	—	N E	N E	N E	N 54 E	8.1	8.0	5.5	6.51	6.60	.010	...
26	.584	.557	.590	.5810	32.6	37.1	34.4	34.55	+12.68	.167	.172	.174	.170	91	77	88	85	N E	E	E	N 57 E	3.5	3.8	4.5	3.56	3.65	.090	...
27	.626	.653	.729	.6778	35.1	40.0	37.3	37.05	+15.32	.165	.169	.179	.165	80	68	80	75	N E	E	N E	N 61 E	5.0	4.5	3.2	4.53	4.64	...	S
28	.766	.750	.783	.7750	32.9	41.4	32.6	34.87	+13.25	.175	.167	.142	.162	94	64	76	80	N E	E	N E	N 70 E	3.5	4.8	3.0	3.21	3.42	...	...
29	.782	.720	.642	.7100	30.4	33.3	29.7	30.75	+ 9.23	.146	.150	.131	.142	86	78	79	82	N E	E	N E	N 46 E	7.0	6.0	9.5	7.19	7.29	...	...
30	.560	.400	.370	.4333	31.0	34.0	30.0	31.50	+10.05	—	—	—	—	—	—	—	—	N E	N	N	N 11 E	8.6	10.0	10.0	8.10	8.69	...	...
31	.423	.495	.548	.4967	25.7	22.8	17.4	21.22	− 0.18	.101	.074	.082	.086	72	61	86	76	N	N	N	N 10 W	17.0	15.0	1.7	11.47	11.53	...	S
	29.7362	29.7178	29.7471	29.7354	32.55	37.04	33.80	34.23	+ 9.37	.174	.171	.167	.170	88	73	82	81	...	...	...	...	7.88	9.77	8.21	...	8.30	0.500	0.3

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR DECEMBER, 1877.

NOTE.—The monthly means of the Barometer and Temperature include Sunday observations. The daily means, excepting those that relate to the wind, are derived from six observations daily, namely, at 6 A.M., 8 A.M., 2 P.M., 4 P.M., 10 P.M., and midnight. The means and resultants for the wind are from hourly observations.

Highest Barometer..............................30.188 at 8 a.m. on 18th. } Monthly range=
Lowest Barometer..............................29.154 at 4 p.m. on 5th. } 1.034.

Self-registering Ther.
- Maximum temperature ....49°4 on 17th. } Monthly range=
- Minimum temperature..............................14°6 on 2nd. } 34°8.
- Mean maximum temperature ....39°66. } Mean daily range=
- Mean minimum temperature ....28°61. } 11°05.
- Greatest daily range............18°8 from a.m. to p.m. of 2nd.
- Least daily range................ 3°3 from a.m. to p.m. of 21st.

Warmest day ....19th; mean temperature ....44°65 } Difference=23°43.
Coldest day...........31st; mean temperature ....21°22 }
Maximum Radiation { Solar ....101°0 on 28th. } Monthly range=
{ Terrestrial .... 9°0 on 2nd. } 92°0.

No Aurora observed.

Possible to see Aurora on 10 nights; impossible on 21 nights.

Raining on 11 days; depth, 0.500 inches; duration of fall, 49.6 hours.

Snowing on 7 days; depth, 0.3 inches; duration of fall, 5.7 hours.

Mean of cloudiness, 0.76.

WIND.

Resultant direction N. 76° W.; resultant velocity 1.78 miles.

Mean velocity 8.30 miles per hour.

Maximum velocity 35.0 miles, from 5 to 6 a.m. of 13th.

Most windy day 13th; mean velocity 19.53 miles per hour.

Least windy day 28th; mean velocity 3.42 miles per hour.

Most windy hour noon; mean velocity 10.44 miles per hour.

Least windy hour 1 a.m.; mean velocity 7.15 miles per hour.

Fog on 5th, 16th, 17th, 21st, 22nd, 23rd and 24th.

Solar halo, 12; lunar halo, 15th.

COMPARATIVE TABLE FOR DECEMBER.

YEAR.	TEMPERATURE. Mean.	Excess above aver'ge	Maximum.	Minimum.	Range.	RAIN. No. of days.	Inches.	SNOW. No. of days.	Inches.	WIND. Resultant. Direction.	Vel'y	Mean Velocity. Miles.
1849	26.5°	+0.9°	40.8°	−6.5°	47.3°	5	0.840	12	9.6	N 82° W	2.56	6.23
1850	21.7	−3.9	48.8	−9.0	57.8	2	0.190	18	29.5	N 44 W	2.93	7.40
1851	21.5	−4.1	44.0	−14.8	58.8	6	1.075	15	10.7	N 82 W	4.00	7.37
1852	31.9	+6.3	51.0	13.2	37.8	7	3.995	10	20.1	S 69 W	1.03	6.54
1853	25.3	−0.3	46.4	−8.4	54.8	4	0.625	13	22.3	N 35 W	2.39	4.98
1854	21.9	−3.7	44.8	−7.0	51.8	5	0.590	12	17.2	N 44 W	4.30	8.56
1855	26.8	+1.2	47.0	−5.2	52.2	6	1.845	10	29.5	S 88 W	5.29	11.38
1856	22.9	−2.7	42.2	−9.1	51.3	6	1.790	20	16.3	S 87 W	4.62	11.56
1857	31.9	+6.3	46.0	4.7	41.3	7	3.205	14	9.0	N 89 W	2.50	6.84
1858	27.4	+1.8	45.4	4.2	41.2	11	1.657	18	10.4	N 78 W	1.66	9.36
1859	17.9	−7.7	54.8	−6.0	60.8	3	1.035	23	37.4	N 53 W	4.29	10.77
1860	24.0	−1.6	39.0	−7.0	46.0	3	1.362	21	13.5	N 62 W	4.66	10.14
1861	31.1	+5.5	55.2	5.5	49.7	6	0.560	8	6.8	N 72 W	3.50	7.96
1862	28.8	+3.2	50.1	−3.4	53.5	5	1.945	8	10.4	N 73 W	3.17	7.58
1863	27.0	+1.4	53.4	−1.5	54.9	10	2.960	17	7.1	N 41 W	1.61	9.40
1864	24.7	−0.9	50.4	−10.4	60.8	9	2.045	18	27.1	S 82 W	4.94	9.98
1865	27.7	+2.1	54.2	5.7	48.5	7	1.727	11	5.2	S 81 W	3.07	7.33
1866	25.1	−0.5	51.0	−5.0	56.0	7	2.790	13	15.5	S 88 W	4.98	9.91
1867	21.6	−4.0	49.5	−12.8	62.3	7	1.408	21	13.6	S 81 W	4.82	10.32
1868	22.5	−3.1	44.2	−3.2	47.4	1	0.005	18	15.5	N 71 W	4.05	9.80
1869	28.7	+3.1	45.0	6.0	39.0	10	2.590	9	7.1	S 80 W	2.31	8.44
1870	26.5	+0.9	45.2	−5.8	51.0	6	2.430	16	15.9	N 89 W	5.06	11.46
1871	19.9	−5.7	48.2	−21.0	69.2	4	0.940	20	14.2	S 70 W	6.91	11.52
1872	18.7	−6.9	40.0	−13.8	53.8	3	0.390	24	38.0	N 87 W	5.51	9.06
1873	29.8	+4.2	48.2	6.4	41.8	10	0.995	12	19.2	WEST.	2.95	5.93
1874	25.7	−0.1	44.0	−7.5	51.5	5	0.050	15	11.1	S 84 W	5.93	8.72
1875	27.2	+1.6	61.0	−13.2	74.2	9	1.620	13	18.7	N 54 W	1.75	10.42
1876	17.2	−8.4	40.1	−9.5	49.6	0	0.000	23	36.5	N 68 W	5.68	11.83
1877	34.2	+8.6	49.4	14.6	34.8	11	0.500	7	0.3	N 76 W	1.78	8.30
Res'lts to 1876.	25.56	...	47.50	−4.80	52.30	5.68	1.509	14.11	15.70	N 77 W	3.50	8.86
Excess for '77.	+8.68	...	+1.9	+19.40	−17.50	+5.32	−1.009	−7.11	−15.4	...	...	−0.56

GENERAL METEOROLOGICAL REGISTER

FOR THE YEAR 1877.

GENERAL METEOROLOGICAL

MAGNETICAL OBSERVATORY,

Latitude 43° 39′ 4″ North. Longitude 5h. 17m. 33s. West. Elevation above

	JAN.	FEB.	MAR.	APR.	MAY.	JUNE.	JULY.
	°	°	°	°	°	°	°
Mean Temperature	17.55	28.81	25.59	43.26	53.94	62.36	69.91
Difference from average (37 years)	− 5.39	+ 6.23	− 3.46	+ 2.63	+ 2.26	+ 0.52	+ 2.48
Thermic anomaly (lat. 43° 40′)	−15.25	− 5.89	−14.51	− 6.94	− 4.16	− 2.24	+ 1.21
Highest temperature	40.8	44.9	45.1	67.2	83.9	85.9	88.7
Lowest temperature	− 13.9	4.9	− 0.6	18.7	29.7	41.1	50.3
Monthly and Annual Ranges	54.7	40.0	45.7	48.5	54.2	44.8	38.4
Mean maximum temperature	24.32	36.01	32.99	51.83	63.55	71.73	80.15
Mean minimum temperature	9.99	20.94	17.91	35.15	43.21	52.23	59.56
Mean daily range	14.33	15.08	15.08	16.68	20.34	19.50	20.59
Greatest daily range	26.9	28.9	29.6	28.2	31.4	28.6	33.2
Mean height of the Barometer	29.6884	29.6977	29.5896	29.6308	29.6438	29.5571	29.5598
Difference from average (36 years)	+.0414	+.0723	−.0123	+.0411	+.0719	−.0162	−.0330
Highest barometer	30.144	30.352	29.960	30.058	30.010	29.867	29.907
Lowest barometer	29.020	29.282	28.728	29.155	29.196	29.104	29.126
Monthly and Annual Ranges	1.124	1.070	1.232	0.903	0.814	0.761	0.781
Mean humidity of the air	84	74	78	62	64	71	67
Mean elasticity of aqueous vapour	0.087	0.122	0.188	0.170	0.276	0.404	0.478
Mean of cloudiness	0.69	0.60	0.72	0.45	0.50	0.51	0.43
Difference from average (23 years)	+ 0.05	− 0.10	+ 0.09	− 0.15	− 0.05	+ 0.01	− 0.07
	°	°	°	°	°	°	°
Resultant direction of the wind	S 87 W	N 64 W	N 49 W	N 28 E	N 40 W	S 38 W	S 62 W
" velocity of the wind	5.20	4.62	5.26	4.37	2.26	0.37	0.89
Mean velocity (miles per hour)	9.50	8.91	11.79	10.25	7.29	7.11	6.66
Difference from average (29 years)	+ 0.96	+ 0.06	+ 2.55	+ 1.87	+ 0.25	+ 1.75	+ 1.52
Total amount of rain	0.030	0.000	2.450	2.271	1.348	0.900	2.720
Difference from average (37 years)	−1.197	−0.889	+0.890	−0.140	−1.786	−1.920	−0.432
Number of days rain	2	0	7	9	10	14	11
Total amount of snow	13.4	2.9	19.1	...	...	...	...
Difference from average (34 years)	− 3.67	−15.51	+ 5.20	− 2.44	− 0.15	...	...
Number of days snow	15	6	21	0	0	...	...
Number of fair days	14	24	8	21	21	16	20
Number of Auroras observed	0	0	1	2	3	3	0
Possible to see Aurora (No. of nights)	13	14	15	19	21	17	24
Number of Thunderstorms	0	0	0	2	2	8	9

REGISTER FOR THE YEAR 1877.

TORONTO, ONTARIO.

Lake Ontario, 108 feet. Approximate Elevation above the Sea, 350 feet.

AUG.	SEPT.	OCT.	NOV.	DEC.	1877.	1876.	1875.	1874.	1873.	1872.	1871.
° 69.16 + 2.84 + 0.66	° 61.20 + 3.10 − 0.30	° 49.76 + 4.02 − 4.04	° 37.47 + 1.44 − 5.73	° 34.23 + 8.68 − 1.77	° 46.10 + 2.11 − 4.90	° 43.98 − 0.01 − 7.02	° 40.77 − 3.22 −10.23	° 44.30 + 0.31 − 6.70	° 42.99 − 1.00 − 8.01	° 42.92 − 1.07 − 8.08	° 45.93 + 1.94 − 5.01
83.1 53.5 29.6	81.7 38.3 43.4	79.6 31.3 48.3	55.0 17.2 37.8	49.4 14.6 34.8	88.7 − 13.9 102.6	92.9 − 9.5 102.4	88.0 − 16.0 104.0	95.0 − 7.5 102.5	89.5 − 18.4 107.9	96.0 − 13.8 109.8	89.5 − 21.0 110.5
77.92 61.04 16.88 23.6	71.19 52.18 19.01 31.2	56.73 42.65 14.08 25.7	43.12 31.45 11.67 23.9	39.66 28.61 11.05 18.8	... ... 16.19 33.2	... ... 15.68 42.1	... ... 17.38 46.0	... ... 17.43 46.5	... ... 16.93 37.9	... ... 17.59 37.8	... ... 16.46 34.6
29.5507 —.0744	29.6682 +.0045	29.6337 —.0075	29.6600 +.0487	29.7354 +.0884	29.6346 +.0187	29.6017 —.0142	29.6151 —.0008	29.6452 +.0298	29.5964 —.0195	29.6079 —.0080	29.6066 —.0093
29.837 29.298 0.539	29.932 29.410 0.522	30.040 29.091 0.949	30.175 28.712 1.463	30.188 29.154 1.034	30.352 28.712 1.640	30.350 28.703 1.647	30.271 28.751 1.520	30.416 28.538 1.878	30.246 28.797 1.449	30.231 28.789 1.442	30.388 28.673 1.715
77	74	77	83	81	74	76	76	74	78	75	73
0.547	0.405	0.288	0.197	0.170	0.272	0.263	0.236	0.255	0.257	0.259	0.242
0.56 + 0.08	0.47 − 0.04	0.76 + 0.14	0.75 0.00	0.76 0.00	0.60 − 0.01	0.66 + 0.05	0.62 + 0.01	0.63 + 0.02	0.60 0.00	0.59 − 0.01	0.64 + 0.03
° N 85 W 0.69	° N 13 W 0.56	° N 70 W 0.92	° S 77 W 1.37	° N 76 W 1.78	° N 62 W 1.86	° N 51 W 1.98	° N 70 W 2.31	° N 61 W 2.67	° N 58 W 1.98	° N 72 W 2.91	° N 72 W 2.49
6.00 + 0.64	6.17 + 0.42	8.23 + 1.82	9.75 + 2.03	8.30 − 0.56	8.33 + 1.11	9.29 + 2.07	8.96 + 1.74	8.03 + 0.81	7.96 + 0.74	6.78 − 0.44	8.24 + 1.02
3.165 +0.381 14	0.415 —3.129 8	2.636 +0.281 14	5.450 +2.898 16	0.500 —1.009 11	21.885 —6.052 116	21.063 —6.874 117	18.980 —8.957 103	17.574 -10.363 103	20.232 —7.705 110	18.588 —9.349 115	22.771 —5.166 110
... ...	... ...	... — 0.86 0	1.6 — 2.65 5	0.3 —15.40 7	37.3 —35.48 54	113.4 +40.62 76	107.5 +34.72 70	67.7 — 5.08 75	113.8 +41.02 79	67.5 — 5.28 77	99.6 +26.82 84
17	22	17	10	14	204	186	201	197	170	185	187
1	1	1	1	0	13	13	17	28	60	67	55
24	21	17	11	10	206	171	212	197	203	236	209
10	0	1	1	0	33	19	26	23	22	28	22

TEMPERATURE.

	1877.	Average of 37 years.	Extremes.	
Mean temperature of the year	46°.10	43°.99	46°.36 in '46.	40°.77 in '73.
Warmest month	July.	July.	July, 1868.	Aug., 1860.
Mean temperature of the warmest month	69.91	67 43	75.80	64.46
Coldest month	January.	February.	Feb., 1875.	Feb., 1848.
Mean temperature of the coldest month	17.55	22.58	10.16	26.60
Difference between the temperature of the warmest and coldest months	52.36	44.85	...	...
Means of the deviation of monthly means from their respective averages of 36 years, signs of deviation being disregarded	3.59	2.48	3.59 in 1877.	...
Months of greatest deviation, without regard to sign	December.	January.	Feb., 1875.	...
Corresponding magnitude of deviation	8.68	3.81	12.4	...
Warmest day	July 25.	...	July 14, '68.	July 31, '44.
Mean temperature of the warmest day	76.90	77.77	84 50	72.75
Coldest day	Jan. 12.	...	Feb. 6, 1855. Jan. 22, 1857.	Dec. 22, '42.
Mean temperature of the coldest day	—6.12	—1.52	—14.38	9.57
Date of the highest temperature	July 16.	...	Aug. 24, '54.	Aug. 19, '40.
Highest temperature	88.7	90.99	99.2	82.4
Date of the lowest temperature	Jan. 12.	...	Jan. 10, '59.	Jan. 2, '42.
Lowest temperature	—13.9	—12.26	—26.5	1.9
Range of the year	102.6	103.25	118.2	87.0

BAROMETER.

	1877.	Average of 36 years.	Extremes.	
Mean Pressure of the year	29.6346	29.6159	29.6770 in 1849.	29.5602 in 1864.
Month of the highest mean pressure	December.	Sept.	Jan. 1849.	June, 1864.
Highest monthly mean pressure	29.7354	29.6637	29.8046	29.6525
Month of the lowest mean pressure	August.	May.	March, 1859.	Nov., 1849.
Lowest monthly mean pressure	29.5507	29.5719	29.4143	29.5886
Date of the highest pressure in the year	Feb. 13.	...	Jan. 8, 1866.	Jan. 14, '70.
Highest pressure	30.352	30.364	30.940	30.212
Date of the lowest pressure in the year	Nov. 2.	...	Jan. 2, 1870.	Mar. 17, '45.
Lowest pressure	28.712	28.685	28.166	28.939
Range of the year	1.640	1.679	2.133 in 1866.	1.303 in 1845.

RELATIVE HUMIDITY.

	1877.	Average of 35 years.	Extremes.	
Mean humidity of the air	74	77	82 in 1851	73 in 1858
Month of greatest humidity	January.	Jan. 7.	Jan., 1857.	Dec., 1858.
Greatest mean monthly humidity	84	83	89	81
Month of least humidity	April.	May.	Feb., 1843.	April, 1849.
Least mean monthly humidity	62	71	58	76

EXTENT OF SKY CLOUDED.

	1877.	Average of 24 years.	Extremes.	
Mean cloudiness of the year	0.60	0.61	0.66 in '69 '76	0.57 in 1856.
Most cloudy month	Oct., Dec.	December.	...	...
Greatest monthly mean of cloudiness	0.76	0.76	0.89	0.73
Least cloudy month	July.	August.	...	...
Least monthly mean of cloudiness	0.43	0.48	0.29	0.50

WIND.

	1877.	Result of 29 years.	Extremes.	
Resultant direction	N 62° W	N 61° W	...	...
Resultant velocity in miles	1.86	2.00	...	...
Mean velocity without regard to direction	8.33	7.22	9.29 in '76.	5.10 in '53.
Month of greatest mean velocity	March.	March.	March, 1874.	Jan., 1848.
Greatest monthly mean velocity	11.79	9.24	13.24	5.82
Month of least mean velocity	August.	July.	Aug., 1852.	Sept., 1860.
Least monthly mean velocity	6.00	5.14	3.30	5.79
Day of greatest mean velocity	Mar. 28.	...	Nov. 15, '71.	Dec. 2, 1848.
Greatest daily mean velocity	34.21	24.16	32.16	15.30
Day of least mean velocity	May 17.	...	...	...
Least daily mean velocity	2.42	...	...	...
Hour of greatest absolute velocity	Mar. 28, 2 to 3 p.m.	...	Dec. 27, '61. 9.10 a.m.	Mar. 14, '53. 11 am to Noon
Greatest velocity	43.0	40.00	46.00	25.6

RAIN.

	1877.	Average of 37 years.	Extremes.	
Total depth of rain in inches	21.885	27.937	43.555 in '43.	17.574 in '74.
Number of days on which rain fell	116	109	130 in 1861.	80 in 1841.
Month in which the greatest depth of rain fell	Nov.	September	Sept., 1843.	Sept., 1848.
Greatest depth of rain in one month	5.450	3.544	9.760	3.115
Month in which the days of rain were most frequent	Nov.	October.	June, 1869, Oct. 1864.	May, 1841.
Greatest number of rainy days in one month	16	13	22	11
Day in which the greatest amount of rain fell	Nov. 8.	...	Sept. 14, '43.	Sept. 14, '48.
Greatest amount of rain in one day	1.360	1.967	3.455	1.000

SNOW.

	1877.	Average of 34 years.	Extremes.	
Total depth of snow in inches	37.3	72.8	122.9 in '70.	38.4 in 1851.
Number of days in which snow fell	54	65	87 in 1859.	33 in 1848.
Month in which the greatest depth of snow fell	March.	February.	March, 1870.	Dec., 1851.
Greatest depth of snow in one month	19.1	18.4	62.4	10.7
Month in which the days of snow were most frequent	March.	Dec., Jan.	Dec., 1872.	Feb., 1848.
Greatest number of days of snow in one month	21	14	24	8
Day in which the greatest amount of snow fell.	March 21.	...	Mar. 28, '76.	Jan. 10, '57.
Greatest fall of snow in one day	7	10.2	16.2	5.5

DIFFERENCE OF CERTAIN METEOROLOGICAL ELEMENTS FROM THE NORMAL VALUES FOR EACH QUARTER, AND THE YEAR.

Quarter.	Barom.	Temper.	Rain.	Days Rain.	Snow.	Days Snow.	Velocity of Wind.	Clouded Sky.
	inches.	°	inches.		inches.		miles.	
Winter	+ .0338	— 0.87	— 1.196	— 6.05	— 13.98	+ 5.11	+ 1.17	— 0.02
Spring	+ .0323	+ 1.80	— 3.846	— 0.46	— 2.59	— 4.21	+ 1.29	— 0.06
Summer	— .0343	+ 2.81	— 3.180	+ 0.08	...	...	+ 0.86	— 0.01
Autumn	+ .0432	+ 4.71	+ 2.170	+ 13.05	— 18.91	— 11.41	+ 1.10	+ 0.05
Year	+ .0187	+ 2.11	— 6.052	+ 6.62	— 35.48	— 10.51	+ 1.11	— 0.01

PERIODICAL OR OCCASIONAL EVENTS, 1877.

February	11.	First lightning of year.
March	1.	Little or no frost in ground. First schooner arrived.
"	25.	Ice broke up in Bay.
"	27.	Wild geese flying north.
"	31.	Robins seen.
"	31.	Last snow of season.
April	12.	Butterflies numerous.
"	21.	Frogs croaking.
"	24.	First thunderstorm of year.
"	30.	Swallows seen.
"	30.	Marked absence of blue birds this spring.
May	1.	First trip of *City of Toronto*.
"	5.	Maples in flower.
"	15.	Plum trees in flower.
"	16.	Baltimore birds, Humming birds.
"	20.	Apple trees in flower.
"	22.	Wild strawberries in flower.
"	24.	Last frost and ice of season.
"	25.	Lilacs in flower.
"	26.	Chestnut trees in flower.
August	10.	Humming birds numerous.
"	20.	Some blue birds seen.
September	5.	Swallows last seen.
"	18.	First frost and ice of season.
October	20.	Last trip of season of *City of Toronto*.
November	5.	First snow of season.
"	17.	Last thunderstorm of season.
"	27.	Large number of robins.
December	31.	Bay open still.

PROSPECTUS

OF THE

ENCYCLOPÆDIA BRITANNICA,

NINTH EDITION.

Edited by THOMAS SPENCER BAYNES, LL.D., Professor of Logic, Rhetoric, and Metaphysics, in the University of St. Andrews.

IN submitting to the Public the PROSPECTUS of a New Edition of the ENCYCLOPÆDIA BRITANNICA, it is almost needless to explain that during the interval which has elapsed since the publication of the Eighth Edition, great advances have been made in every department of knowledge, and particularly in the Arts and Sciences. It has accordingly been found necessary to adopt a scheme of very extensive alteration in the preparation of the NINTH EDITION, amounting virtually to a reconstruction of the entire work. Thus, while the general character of the ENCYCLOPÆDIA will remain substantially unchanged, the whole of the matter retained from the last Edition will be subjected to thorough revision, and the necessary additions (estimated at considerably more than half the whole work) provided for from the best sources. The utmost care will be taken in selecting headings and deciding on methods of treatment, so as to embody the greatest amount of general information in the most accessible form. The more important topics will be dealt with systematically and at length, and particular attention will be given to all subjects of general and popular interest. The object aimed at is the production of a work which shall possess the highest character and value as a Book of Reference adapted in all respects to the circumstances and requirements of the time.

One of the distinctive features of the ENCYCLOPÆDIA BRITANNICA has always been the large number of original articles contributed by specialists in their respective departments.

It is now upwards of a century since the ENCYCLOPÆDIA BRITANNICA made its first appearance. The FIRST Edition, in Three volumes quarto, published in 1771, was little more than a Dictionary of Arts and Sciences; the SECOND (1778-1783), in Ten volumes, introduced the branches of Biography and History. The THIRD Edition (1797) extended to Eighteen volumes, to which a supplement of Two volumes was added. The FOURTH (1810), in Twenty volumes, was reproduced in a Fifth and Sixth with little alteration; and a very important addition was made, between the years 1815 and 1824, in a Supplement of Six volumes. The two subsequent Editions, the SEVENTH (1830-1842) and the EIGHTH (1852-1860), each in Twenty-one volumes, were in every respect greatly superior to their predecessors, and adequately supplied the demand for general information at the time of their publication.

It is proposed that the Ninth Edition shall be on the same scale as the Eighth, namely, in Twenty-one Volumes quarto, of about 800 pages each. Numerous engravings on wood and steel will illustrate the text. The work is to be issued at the rate, as far as practicable, of three Volumes per annum.

Volumes I. to VI. are now ready.

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AGENTS FOR ONTARIO TORONTO.

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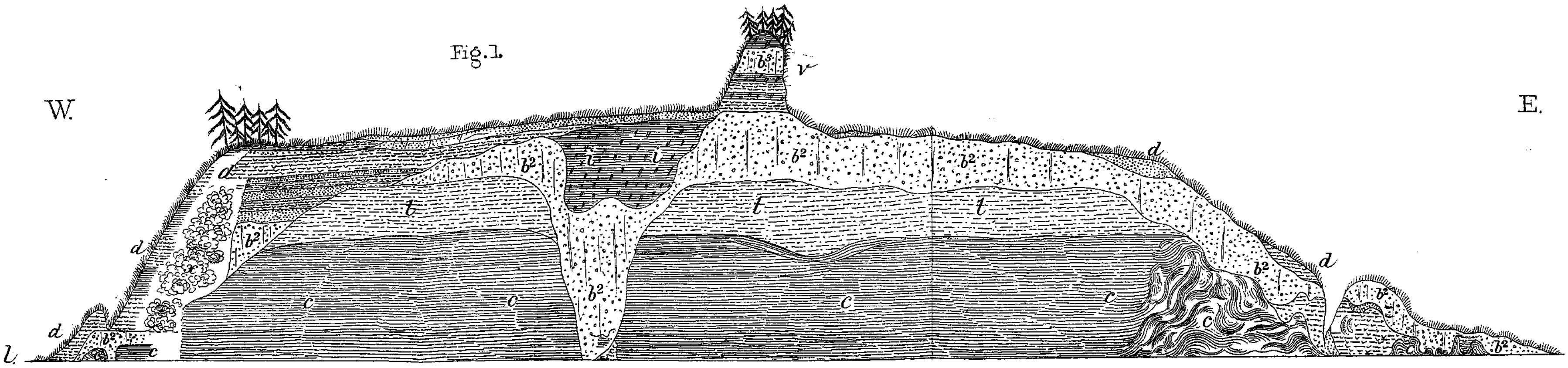
***** The Annual Subscription, due in January, Country Members, $3; in Toronto, $4.**

Fig. 1.



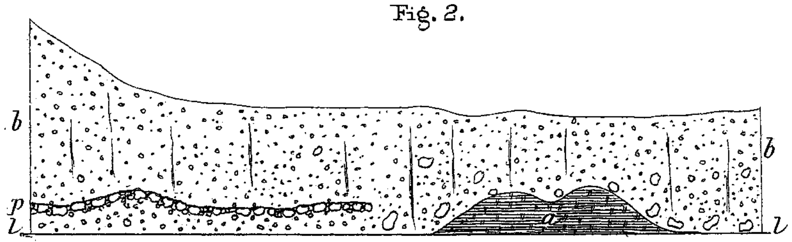
Scarboro' Heights facing Lake Ontario.

c. Interglacial fossiliferous Clays. t. Interglacial fossiliferous Sands. b^2. b^3. Till. i. Laminated Clays.

d. Sand and Gravel (Post-glacial) x. Beds concealed. l. Lake level.

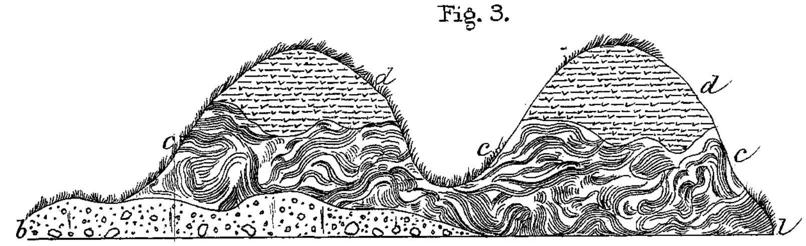
Length of Cliff about 9¼ miles. Height 170 to 190 feet, including the second Terrace v 290 feet.

Fig. 2.



Section of Cliff facing Lake Ontario, west of Toronto, showing Pavement of Boulders in Till.
a. Cambro-Silurian = (Hudson River) Flags and Shales.
b. Till or Boulder Clay.
p. Pavement of Boulders in Till. l. Lake level.
Height of Cliff 10 to 20 feet. Length of Section about one mile.

Fig. 3.



Section at Humber Bay. West of Toronto.
b. Till. Lowest Beds resting on the Cambro Silurian Flags.
c. Interglacial fossiliferous Clay. (Beds contorted.) l. Lake level.
d. Sandy Loam (Post-glacial) Height of Cliff 25 feet.
Length of Section 100 yards.