THE

CANADIAN JOURNAL

OF

NDUSTRY, SCIENCE, AND ART:

CONDUCTED BY

THE EDITING COMMITTEE OF THE CANADIAN INSTITUTE.

NEW SERIES.

VOL. I.

TORONTO:
PRINTED FOR THE CANADIAN INSTITUTE,
BY LOVELL AND GIBSON, YONGE STREET.
MDCCCLVI.

CANADIAN INSTITUTE.

EDITING COMMITTEE, 1856.

GENERAL EDITOR, - - - - DAN. WILSON, LL.D.

I. *Geology and Mineralogy:* E. J. Chapman, Prof. of Geology and Mineralogy, Univ. Coll. Toronto.

II. *Physiology and Natural History:* James Bovell, M.D., Prof. of the Institutes of Medicine, Trin. Coll. Toronto.

III. *Ethnology and Archæology:* Daniel Wilson, LL.D., Prof. of History and English Literature, Univ. Coll. Toronto.

IV. *Agricultural Science:* H. Y. Hind, M. A., Prof. of Chemistry, Trin. Coll. Toronto.

V. *Chemistry:* Henry Croft, D. C. L., Prof. of Chemistry, Univ. Coll. Toronto.

VI. *Mathematics and Natural Philosophy:* J. B. Cherriman, M.A., Prof. of Natural Philosophy, Univ. Coll. Toronto; and Rev. G. C. Irving, M. A., Prof. of Mathematics and Natural Philosophy. Trin. Coll. Toronto.

VII. *Engineering and Architecture:* F. W. Cumberland, C.E., and Alfred Brunel, C. E.

THE

CANADIAN JOURNAL

OF

INDUSTRY, SCIENCE, AND ART:

CONDUCTED BY

THE EDITING COMMITTEE OF THE CANADIAN INSTITUTE.

CANADIAN INSTITUTE
ESTABLISHED 1849

NEW SERIES. NUMBER 1.

JANUARY, 1856.

TORONTO:

PRINTED FOR THE CANADIAN INSTITUTE,

BY LOVELL AND GIBSON, YONGE STREET.

CANADIAN INSTITUTE.

The Canadian Journal is printed exclusively for gratuitous dis tion among the Members of the Canadian Institute, and such Instit and Societies as the Council may determine; but Members may ob extra copies at 2s. 6d. per number.

*** *Communications for the Journal to be addressed to the G Editor,* DR. WILSON, *University College, Toronto.*

THE CANADIAN JOURNAL.

NEW SERIES.

No. I.—JANUARY, 1856.

PRELIMINARY ADDRESS.

The first number of the "Canadian Journal" was published in August 1852, under the direction of the Council of the Canadian Institute, as "a medium of communication between all engaged or interested in scientific or industrial pursuits." As the organ of the Canadian Institute, it has contributed to the advancement of that society and shared in its success, until the number of members and subscribers has outgrown the original issue, and led to the closing of its first series.

A few words will suffice to define the objects aimed at in this new Series. The advancement of Canada in commercial and agricultural prosperity during recent years, is without a parallel in the history of the British Colonies; and there is abundant reason for believing that t is even now only on the threshold of a career of triumphant progress. It must be the desire of every well-wisher of the province, hat this advancement in industry and material wealth, should not be naccompanied by some corresponding manifestations of intellectual itality. There is no reason why Canada should not have her own terature and science, as well as her agriculture and commerce; and ontribute her share to the greatness of the British Empire by her ntal as well as her physical achievements. Already the published ports of the Magnetic and Meteorological Observatory have made name of Toronto familiar to European savans; and the labors of the geincial Geological Survey, under the guidance of Mr. Logan, have it is hopd results, the scientific value of which is universally recog- for the ut, meanwhile, such students of science as Canada has, stand, to a great extent, isolated in relation to each other, and look mainly for the appreciation of their labors to their scientific brethren in Europe. If Mr. Logan meets with copper or coal in the course of his geological survey, he communicates it to Canada, and all her journals give welcome circulation to the fact; but if his palæontological researches among our Canadian strata disclose novel truths in relation to the structure of the *Graptolite*, he goes to Paris or to London with the discovery, and communicates it to his scientific brethren—as Mr. Dawson originally published his Acadian geological observations,—through the medium of English Societies' Transactions. Thus the science of Canada has, as yet, no recognised or independent existence, and its students, if they would place themselves in *rapport* with those of other lands, can only do so by a sacrifice analogous to the naturalization by which a foreign emigrant attains to the privileges of American citizenship.

Subjects requiring such a medium of communication cannot be profitably treated of in a popular form. An enquiry into the action of the solar rays on nitrate of silver would doubtless appear sufficiently "caviare to the general," and yet its direct daguerrean photographic results are among the most popular of modern technological processes. The world hails with grateful plaudits the completion of an electric telegraph, forgetful of the indifference and incredulity awarded to such preliminary labours as those of Galvani, of which it is the product. If, therefore, we are to acquire such honors and rewards for ourselves, we must be contented to pursue the process through all its preliminary stages; and if we would have an economic and utilitarian science, the first step must be to afford facilities and encouragement for those who devote themselves to science, not for such utilitarian results, but for its own sake, for its abstract truths, and without a thought of the economic rewards to which they lead.

For such students of science, few as they must of necessity be in a new country like Canada, a medium of communication is required, to furnish a means of intercourse among themselves, as well as of interchange of thought and discovery with the scientific world at large. Such a medium this Journal is designed to afford. It is impossible to speak too modestly of its immediate operations. Science cannot be called into being by a wave of the editorial goos[e] quill, nor will a provincial literature rise up to meet the first dema[nd] consequent on the discovery of its absence. Yet here, perhaps, may not unfitly apply the trite proverb: "*c'est le premier pas q*[...] In some of these first steps we must claim the forbearan[ce] general reader. Perhaps it may be permissible to note as one of the most essential characteristics of European scientific journals that they recognise no such class of readers. No communication can be too minute, technical, or abstruse for them, so long as it involves any element of scientific truth ; and we trust to have the concurrence of all our readers in our purpose to open the pages of this Journal to strictly scientific communications, however unattractive the form may be in which they are presented.

In such departments as Geology and Mineralogy, Philology, Ethnology, Chemistry, or Mathematics, if this Journal does not prove an altogether premature and untimely birth, occasional communications must be looked for in a form appreciable only by a very limited class of its readers. Such communications, however, we have rather to fear than to hope, will be few ; and the greatest amount of success which can now be anticipated, is to sow a few of the first seeds for a future harvest of science. In so doing it may be permitted to one Provincial journal to cater for something higher than popular gratification. Nevertheless it will be seen that our aim is essentially practical, and while we seek rather to make the Journal useful than popular, the latter element will not be overlooked. Nor need it be so. Science has also its popular aspects, and literary criticism may legitimately embrace much which has charms for a variety of tastes. Enquiries into the varied resources and the mineral wealth of the country, and reports of the progress of the great engineering works of the Province must possess attractions for a still greater number. The disclosures of Geology include points appreciable by all as of the highest practical importance. Chemistry eliminates from recondite processes simplifications in the productions of the commonest manufactures, and discovers products of great commercial value. And while those enquiries yield such returns, the students of Natural Philosophy, Agricultural Science, and Natural History, have in each of their departments fields of investigation which cannot fail, when zealously explored, to contribute results of widely varied interest.

By and by, we doubt not, Canada will be able to maintain a literature which shall embrace independent representatives in each department of knowledge. But the time for such a division of labour lies still in the future ; and meanwhile the conductors of the "Canadian Journal" must ask equally for the charitable judgment of the scientific and of the popular reader. Specially would they crave the generous forbearance of the men of science of Europe, among whom it is hoped that those communications may be received in exchange for the scientific records of their long matured labours, and of the fruits of their well-organised system of mutual cöoperation. These first efforts cannot be otherwise than feeble, and the steps of their progress slow and unequal. But if the progress be real, however slow, they are well contented to find their reward in the hope that other men shall enter into their labours, and reap where they have sown.

DISPLACEMENT AND EXTINCTION AMONG THE PRIMEVAL RACES OF MAN.

BY DANIEL WILSON, LL.D.

PROFESSOR OF HISTORY AND ENGLISH LITERATURE, UNIVERSITY COLLEGE, TORONTO.

Read before the Canadian Institute, December 1st, 1855.

Among the many difficult problems which the thoughtful observer has to encounter, in an attempt to harmonise the actual with his ideal of the world as the great theatre of the human race, none assumes a more intricate and inexplicable aspect than the displacement and extinction of races, such as the Anglo-Saxon has witnessed on this continent for upwards of two centuries. In all ages history discloses to us unmistakeable evidence, not only of the distinctions which civilization produces, but of the fundamental differences whereby a few highly favoured races have outsped all others; triumphing in the onward progress of the nations, not less by an innate constitutional superiority, than by an acquired civilization, or by local advantages. And if we are still troubled with the perplexities of this dark riddle, whereby the Colonists of the new world only advance by the retrogression of the Red Man, and tread, in our western progress, on the graves of nations, it may not be without its interest to note some unmistakeable evidences of this process of displacement and extinction, accompanying the progress of the human race from the very dawn of its history.

One, and only one record supplies any authoritative or credible statement relative to the origin of the human race. Geology has indeed, by its negative evidence, confirmed in its response the inspired answer of the patriarch: "Enquire of the former age, and prepare thyself to the search of their fathers, for we are but of yesterday;" but it is to the Mosaic record we must turn for any definite statement on a subject concerning which the mythologies of all nations have professed to furnish some information. Every attentive reader of the Bible must have observed that the Book of Genesis, or the Beginning, is divided into two separate and perfectly distinct histories: the first, an account of the Creation, and the general history of mankind till the dispersion: the Genesis properly so called, extending over a period of considerably more than two thousand years, and contained in the ten first chapters, and nine verses of the eleventh; while the remaining chapters, and indeed nearly the whole of the historical Books of the Old Testament, are exclusively devoted to the one selected race, that of Abraham and his descendants.

Looking then to the first of these, and to its narrative in relation to the immediate descendants of Noah, the recognised protoplasts of the primary subdivisions of the human family, we perceive that certain very marked and permanent differences are assigned to each. Ham, the father of Canaan, by negation, is left without a blessing, while Canaan is marked as the progenitor of a race destined to degradation as the servant of servants. The blessing of Shem is peculiar, as if it were designed chiefly to refer to the one branch of his descendants, "to whom pertained the adoption, and the glory, and the Covenants, and the giving of the Law, and the service of God;" but to his various descendants a special rank is assigned in the world's future; special, predominant in relation to some branches of the human family; but yet inferior and of temporary duration when compared with the destinies of the Japhetic races, who, enlarging their bounds, and encroaching on the birth-right of the elder nations, are destined to "dwell in the tents of Shem," and Canaan shall serve them.

Thus from the very first we perceive that one important subdivision of the human family is stamped, *ab initio*, with the marks of degradation; while another, the Semitic, though privileged to be the first partaker of the blessing, to be the originator of the world's civilization, and to furnish the chosen custodiers of its most valued inheritance, through the centuries which anticipated the fulness of time: yet the nations of this stock are destined to displacement, for "Japhet shall be enlarged, and shall dwell in the tents of Shem."

Thus, also, from the very first we perceive the origination of a strongly marked, and clearly defined distinction between diverse branches of the human family; and this, coupled with the apportionment of the several regions of the earth to the distinct types of man, distinguished from each other not less clearly than are the varied *faunæ* of these regions, seem to leave no room for doubt that the *Genus Homo* was as clearly sub-divided into diverse varieties, if not into distinct species, as any other of the great mammalian types of species ranged over the earth's surface according to a recognised law of geographical distribution. At the same time it is apparent that such assigned differences do not, thus far, affect the question of the unity of the race.

To the claim of a common manhood for those strongly marked and greatly diversified sub-divisions of the human family, including its most immobile and degraded types, Shakespear has furnished no inapt reply :—

> "Aye, in the catalogue ye go for men;
> As hounds, and greyhounds, mongrels, spaniels, curs,
> Shoughs, water-rugs, and demi-wolves, are cleped
> All by the name of dogs: the valued file
> Distinguishes the swift, the slow, the subtle,
> The housekeeper, the hunter, every one
> According to the gift which bounteous Nature
> Hath in him clos'd; whereby he doth receive
> Particular addition, from the bill
> That writes them all alike: and so of men."*

Looking then to the recorded descendants of the Noahic forefathers of the human family, we can, partially at least, trace their primitive subdivisions and occupation of the ancient earth. The sons of Japhet, the final inheritors of preeminence are first recorded as dividing among them "the isles of the Gentiles," a term which, looking to the geographical limits known to the ancient world, may be assumed, with little hesitation, as referring to the islands of the Eastern Mediteranean, and probably the Grecian Archipelago, with the adjacent coast lands of Asia Minor, and of Europe.

There have been ingenious attempts made to assign to each of the Noahic generations their national descendants: the Cymri from Gomer, the Getæ from Magog, the Medes from Madai, the Ionian Greeks from Javan, &c.; but the majority of such results commend themselves to our acceptance at best as only clever guesses at truth. A considerable number of the names which occur in the Noahic genealogy undoubtedly remain very partially disguised by subsequent changes, as the appellations of historic or surviving races and kingdoms; of some of them, indeed, it appears from their dual or plural number, or their peculiar Hebrew termination, that they are used in the Mosaic record, not in reference to individuals, but to families or tribes, out of which nations sprung. Some of those have disappeared, or been transformed beyond the possibility of tracing the relations between their ancient and modern names; but of the most remarkable of the Hamitic descent we can be at no loss as to their geographical areas. The Canaanites occupied the important area of Syria and

* Macbeth, Act III, Scene i.

Palestine; and Nimrod, the son of Cush, moving to the eastward, settled his descendants on the banks of the Euphrates; so that of the distinctly recognisable generations of Ham, it is in Asia, and not in Africa, that we must look for them, for centuries after the dispersion of the human race.

But the Semitic races were also to share the Eastern Continent before they enlarged their area, and asserted their right to the inheritance of the descendants of Ham. By Nimrod, the grandson of Ham, the settlements along the valley of the Euphrates were originated, "and the beginning of his kingdom was Babel, and Erech, and Accad, and Calneh, in the land of Shinar," all sites of ancient cities which recent exploration and discovery seem to indicate as still traceable amid the graves of the East's mighty empires. But the eponymous of the rival kingdom on the banks of the Tigris was Asshur, the son of Shem, and in that region also it would appear that we must look for the locality of Elam, (Elymais), as well as others of the generations of the more favoured Shem; while nearly the whole habitable regions between their western borders and the Red Sea, appear to have been occupied from this very dawn of human history, by the numerous Semitic descendan's of Joktan, the protoplast of a branch of the human family to whose pedigree a special and curious attention is devoted in the Sacred Genealogies. By an expressive figure of speech Shem is spoken of as the father of all the children of Eber, of whom came Joktan and his sons, whose "dwelling was from Mesha, as thou goest unto Sephar, a mount of the East," and of whom as surely descended Mohammed and the Semitic propogators of the monotheistic creed of the Koran; as came the Hebrews, according to Jewish belief, and through them, the great prophet of our faith, from Eber, the assumed eponymous of those whom we must look upon, on many accounts, as important above all other Semitic races.

Deriving our authority still from the Sacred Records, we ascertain as the result of the multiplication and dispersion of one minutely detailed generation of the sons of Ham, through Canaan, that for eight hundred years thereafter they increased and multiplied in the favoured lands watered by the Jordan, and stretching to the shores of the Levant; they founded mighty cities, accumulated great wealth, subdivided their goodly inheritance among distinct nations and kingdoms of a common descent; and upwards of eleven hundred years thereafter, when the intruded tribe of Dan raised up the promised judge of his people, the descendants of Ham still triumphed in the destined heritage of the seed of Eber. At length, however, the Semitic Hebrew accomplished his destiny. The promised land became his possession, and the remnant of the degraded Canaanite his bond-servants. For another period of like duration, a period of more than eleven hundred years, the Semitic Israelites made the land their own. The triumphs of David, the glory and the wisdom of Solomon, and the vicissitudes of the divided nationalities of Judah and Israel, protracted until the accomplishment of the great destiny of the princes of Judah, constitute the epos of those who supplanted the settlers in the historic lands lying between the mountains of Syria and the sea, when first "the Most High divided to the nations their inheritance, when he separated the sons of Adam, and set the bounds of the people." Then came another displacement. The Semitic Hebrews were driven forth from the land, and for eighteen hundred years, Roman and Saracen, Mongol Turk and Semitic Arab, have disputed the possession of the ancient heritage of the Canaanite.

For very special and obvious reasons the isolation of the Hebrew race, and the purity of the stock, were most carefully guarded by the enactments of their great Law-giver, preparatory to their taking possession of the land of Canaan; yet the exclusive nationality, and the strictly defined purity of race admitted of exceptional deviations of a remarkable kind. While the Ammonite and the Moabite are cut off from all permissive alliance, and the offspring of an union between the Hebrew and these forbidden races is not to be naturalized even in the tenth generation, the Edomite, the descendant of Jacob's brother, and the Egyptian, are not to be abhorred; but the children that are begotten of them are to be admitted to the full privileges of the favoured seed of Jacob in the third generation.

This exception in favour of the Egyptian is a remarkable one. The ostensible reason, viz., that the Israelites had been strangers in the land of Egypt, appears inadequate fully to account for it, when the nature of that sojourn, and the incidents of the Exodus are borne in mind, and would tempt us to look beyond it to the many traces of Semitic character which the language, arts, and civilization of Egypt disclose. Mizraim, the son of Ham, and the brother of Canaan, is indeed ordinarily regarded as the first inheritor of the Nile valley, and this on grounds fully as conclusive as those on which other apportionments of the post-diluvian earth are assigned; but along with the direct evidence of Scripture, we must also take the monumental records of Egypt, which shew that that land was speedily intruded on by very diverse races, and that by the time its civilization was sufficiently matured to chronicle by pictorial and ideographic writings the history of that cradle-land of the world's intellect, its occupants stood in a relation to each other precisely similar to that in which we find the Semitic and Hamitic populations of Palestine in the days of Joshua. The ethnological affinities of Egypt are certainly Asiatic rather than African, although she stands isolated, and in some important respects unique in relation alike to the ancient and the modern world. The ethnologist must be tempted to look for the congeners of the ancient Egyptian rather among the Semitic Asiatics, speaking and writing a language akin to her own, than among the Berber, Ethiopian, or Negro aborigines, of Africa. But around the shores of that expressively designated *Mediterranean* Sea how striking are the varied memorials of the world's past. A little area may be marked off on the map, environing its eastern shores, and constituting a mere spot on the surface of the globe, yet its history is the whole ancient history of civilization, and a record of its ethnological changes would constitute an epitome of the natural history of man. All the great empires of the old world clustered around that centre, and as Dr. Johnson remarked in one of his recorded conversations: "All our religion, almost all our law, almost all our arts, almost all that sets us above savages has come to us from the shores of the Mediterranean." There race has succeeded race; the sceptre has passed from nation to nation, through the historical representatives of all the great primary subdivisions of the human family, and "their decay has dried up realms to deserts." It is worthy of consideration, however, for its bearing on analagous modern questions, how far the political displacement of nations in that primeval historic area was accompanied by a corresponding ethnological displacement and extinction.

It is in this respect that the sacred narrative, in its bearings on the primitive sub-divisions of the human family, and their appointed destinies, seems specially calculated to supply the initiatory steps in relation to some conclusions of general, if not universal application. However mysterious it be to read of the curse of Canaan on the very same page which records the blessing of Noah and his sons, and the first covenant of mercy to the human race, yet the record of both rest on the same indisputable authority. Still more, the curse was what may strictly be termed an ethnological one. Whether we regard it as a punitive visitation on Ham in one of the lines of generation of his descendants, or simply as a prophetic foretelling of the destiny of a branch of the human family, we see the Canaanite separated at the very first, from all the other generations of Noahic descent as a race doomed to degradation and slavery. Nevertheless, to all appearance, many generations passed away, in the abundant enjoyment, by the offspring of Canaan, of all the material blessings of the "green undeluged earth;" while they accomplished, as fully as any other descendants of Noah, the appointed repeopling, and were fruitful and increased, and brought forth abundantly in the earth, and multiplied therein, even as did the most favoured among the sons of Shem or Japhet. When some five centuries after the Canaanite had entered on his strangely burdened heritage, the progenitor of its later and more favoured inheritors was guaranteed by a divinely executed covenant, the gift to his seed of that whole land, from the river of Egypt to the great river, the river Euphrates, the covenant was not even then to take place until the fourth generation, because the iniquity of the Amorites—one of the generations of Canaan, used by synecdoche for the whole—was not yet full. When that appointed period had elapsed, and only the narrow waters of the Jordan lay between the sons of Israel and the land of the Canaanites, their leader and lawgiver, who had guided them to the very threshold of that inheritance on which only his eyes were permitted to rest, foretold them in his final blessing: "The eternal God shall thrust out the enemy from before thee, and shall destroy, and Israel shall dwell in safety alone." No commandment can be more explicit than that which required of the Israelites the utter extirpation of the elder occupants of their inheritance: "When the Lord thy God shall bring thee into the land, and hath cast out before thee seven nations greater and mightier than thou, thou shalt smite them and utterly destroy them; thou shalt make no covenant with them, nor shew mercy unto them." Nevertheless we find that the Israelites put the Canaanites to tribute, and did not drive them out; that the children of Benjamin did not drive out the Jebusites; but, according to the author of the book of Judges, they still dwelt there in his day; and so with various others of the aboriginal tribes. So also, the Gibeonites obtained by craft a league of amity with Israel, and they also remained—bondmen, hewers of wood, and drawers of water, yet so guarded by the sacredness of the oath they had extorted from their disinheritors, that at a long subsequent date we find seven of the race of their supplanters, the sons and grandsons of the first Israelitish king, sacrificed by David to their demand for vengeance on him who had then attempted their extirpation.

Even more remarkably significant than all those evidences of a large remnant of the ancient Hamitic population, surviving in the midst of the later Semitic inheritors of Canaan, is the appearance of the name of Rahab, the harlot of Jericho, in the genealogy of Joseph, as recorded by Mathew. The purity of descent of the promised seed of Abraham and David was most sacredly guarded through all the generations of their race, yet even in that line a singularly remarkable exception is admitted; and the son of Ham, and the seed of Canaan, have also their links in the genealogy of the Messiah.

Turning to another portion of the same subject, we trace in the Noahic genealogies the primitive occupants of ancient Phœnicia among the descendants of Ham, while, looking to other and independent sources of evidence pertaining to the people of historical Phœnicia, we find them a race philologically Semitic, but in so far as their mythology and legislation, and those of their Carthaginian offshoots, supply data, we should class them as a race psycologically Hamitic. The legitimate inference would seem to be, that in Phœnicia, as in Palestine, the Semitic and Hamitic races were brought together by the extension of the former over the area primarily occupied by the latter; and that then, unrestrained by any of the checks which so materially circumscribed the tendency to intermixture between the conquerors and the conquered, in the inheritance of the Hebrews, a complete amalgamation took place, though with such predominancy of the later intruded Semitic conquerors, as history supplies abundant illustrations of in the well-detailed pages of more recent national annals.

From all this it would seem to be justly inferred that ethnological displacement and extinction must be regarded in many, probably in the majority of cases, not as amounting to a literal extirpation, but only as equivalent to absorption. Such doubtless has been the case to a great extent with the ancient European Celtæ, notwithstanding the definite, the distinct historical evidence we possess of the utter extinction of whole tribes both of the Britons and Gauls, by the merciless sword of the intruding Roman; and such also is being the case with no inconsiderable remnant of the aboriginal Red Indians of this continent. Partially so it is the case even with the Negro population of the United States, in spite of all the prejudices of cast or colour. It is impossible to travel in the far West of this American continent on the borders of the Indian territories, or to visit the reserves where the remnants of the Indian tribes displaced by us in Canada and the States, linger on in passive process of extinction, without perceiving that they are disappearing as a race, in part at least by the same process by which the German, the Swede, or the Frenchman, on emigrating into the Anglo-saxonised States of America, becomes in a generation or two amalgamated with the general stock.

I was particularly impressed with this idea during a brief residence at the Sault Ste. Marie this summer (1855). When on my way to Lake Superior, I had passed a large body of Christianised Indians, assembling from various points both of the American and the Hudson's Bay territories, on one of the large islands in the River Ste. Marie, and while waiting at the Sault a considerable body of them returned, passing up in their canoes. Having entered into conversation with an intelligent American Methodist missionary, who accompanied them, I questioned him as to the amount of intermarriage or intercourse that took place between the Indians and the whites, and its probable effects in producing a permanent new type resulting from the mixture of the two very dissimilar races. His reply was: "Look about you at this moment, comparatively few of these onlookers have not Indian blood in their veins;" and such I discovered to be the case, as my eye grew more familiar with the traces of Indian blood. At all the white settlements near those of the Indians, the evidence of admixture was abundant, from the pure half-breed to the slightly marked remoter descendant of Indian maternity, discoverable only by the straight black hair, and a singular watery glaze in the eye, not unlike that of the English Gypsey. The Indian may remain uncivilized, and perish before the advance of civilization, which brings for him only vice, famine, and disease, in its train; but such is not the case with the mixed race of a white paternity. Much, perhaps all of their aptitude for civilization may come by their European heritage of blood, but the Indian element survives even when the all-predominating Anglo-Saxon vitality has effaced its physical manifestations.

In this manner the ancient Celtic element of European ethnology doubtless still asserts no inconsiderable influence. The Briton of Wales retains nearly all his early characteristics; his philological and physiological peculiarities are alike unchanged. The Cornish Briton on the contrary retains only the last of these, his language having ceased to be a living tongue; while the continental Gaul has not only resigned his language for a neo-latin tongue, but he has so intermingled his blood with Roman, Frank, Norman, Iberian, and Arab, that he is no longer looked upon, like the Welshman or Irish Galwegian, as a pure Celt. Yet few, if any, doubt the predominance of the Celtic element, or hesitate to trace to that source, many of the characteristic peculiarities wherein the Frenchman differs so essentially either from the continental German or the Anglo-Saxon. In a like manner, though doubtless in a much less marked degree, it may be that the Red Indian of America may leave some permanent traces of his intermixture with that race by whom he is being displaced, proving here also that absorption, and not absolute extirpation, plays a part, at least, in the extinction of modern as well as primitive aboriginal races, when left to the operation of natural causes.

ON SOME NEW SALTS OF CADMIUM AND THE IODIDES OF BARIUM AND STRONTIUM.

BY HENRY CROFT, D.C.L.

PROFESSOR OF CHEMISTRY, UNIVERSITY COLLEGE, TORONTO.

Read before the Canadian Institute, January 12th, 1856.

Von Hauer has lately taken up the examination of the double chlorides and bromides of cadmium, the existence of which was first noticed by me in 1842, in a preliminary paper read before the Chemical Society of London. The investigation being interrupted very shortly after its commencement by my removal to Toronto, had never been resumed, and in the short paper laid before the Chemical Society, the formulæ had not been fully established, with the exception of that of the sodium compound, viz., Cd Cl + Na Cl + 3 Aq, which has since been confirmed by Von Hauer.

For the two cadmio-chlorides of potassium, the two cadmio-chlorides of ammonium, and the cadmio-bromide of potassium described by me in 1842, Von Hauer proposes the following formulæ :—

2 K Cl + Cd Cl	K Cl + 2 Cd Cl + H O
2 N H^4 Cl + Cd Cl	N H^4 Cl + 2 Cd Cl + H O
2 K Br + Cd Br	K Br + 2 Cd Br + H O

Von Hauer endeavours to establish the existence of three classes of salts, which he denominates chloro-sesquicadmiates, chloro-mono-cadmiates, and chloro-bicadmiates, represented generally by the following formulæ : 2 R Cl + Cd Cl + X H O — R Cl + Cd Cl + X HO, and R Cl + 2 Cd Cl + X H O ; and in a second paper he states that he has succeeded in preparing a number of double salts with the chlorides of barium, strontium, calcium, magnesium, manganese, &c. &c., which seem to support this theory.

The only examples of the monocadmiates as yet described are the sodium salt (1842) and Von Hauer's barium compound.

Na Cl + Cd Cl + 3 Aq
Ba Cl + Cd Cl + 4 Aq

In my former paper I mentioned the existence of a double iodide of cadmium and potassium, for which in an anhydrous state I proposed the formula K I + Cd I. As this, if correct, would place the salt in the class of the iodo-monocadmiates, and as according to Von Hauer these compounds are difficult to obtain, at least with the chlorides, I have made a few experiments on the subject of the double iodides and bromides, the results of which are as follows :—

Cadmio-iodide of Potassium.—Iodide of cadmium and iodide of potassium were mixed in atomic proportions (equal equivalents) and evaporated over sulphuric acid,—the double salt being exceedingly soluble in water separated only when the solution was reduced to a very small bulk and the crystals formed were not very perfect. They were in the form of distorted octohedra, acquiring from the extension of certain faces a resemblance to a rhombic prism with dihedral terminations. The fact that they were octohedra was proved by measurements made by my colleague, Professor Chapman.

1.788 grammes dried between bibulous paper gave :—

Water........................	0·096	=	5·36	
Sulphide of cadmium......	0·338	=	14·70	cadmium.
Iodide of silver	2·275	=	68·74	iodine.
Sulphate of potash.........	0·4603	=	11·62	potassium.

1.771 grammes very carefully dried in bibulous paper and afterwards over sulphuric acid, gave :—

Water........................	0·876	=	4·94	
Sulphide of cadmium	0·3520	=	15·46	cadmium.
Iodide of silver	2·2675	=	69·17	iodine.
Sulphate of potash.........	0·4183	=	10·60	potassium.

These numbers lead to the formulæ K I + Cd I + 2 H O.

			Cal	*I*	*II*
K	1	488·94	10·67	11·62	10·60
Cd	1	696·77	15·21	14·70	15·46
I	2	3171·14	69·21	68·74	69·17
H O	2	225·00	4·91	5 36	4·94
		4581·85	100·00	100·42	100·17

An analysis of the anhydrous salt made in 1·42 gave the following numbers, agreeing closely with the calculation :—

		Cal
K	11·47	11·22
Cd	16·46	15·99
I	72·85	72·79
	100·78	100·00

Cadmio-iodide of Sodium.—Iodide of Sodium was prepared by treating a solution of soda with excess of iodine, decomposing by sulphuretted hydrogen, warming, neutralizing with carbonate of soda and crystallizing.

The crystals are as described by Mitscherlich, who gives the formula Na I + 4 H O, while Girand found a quantity of water, which would lead to the formula Na I + 5 H O.

2·108 dried in bibulous paper, lost on heating 0·4393 = 20·83.

2·36 dried in bibulous paper and afterwards over sulphuric acid, lost on heating 0·46 = 19·49.

The formula Na I + 4 H O requires 19·44.

Iodide of cadmium and iodide of sodium were mixed in equal equivalents, and evaporated over sulphuric acid. The double salt separated in long brilliant prisms, which deliquesce very rapidly in a moderately damp atmosphere; they appeared to be four-sided prisms, but owing to their rapid deliquescence their form could not be accurately determined.

1·0285 grammes dried in bibulous paper gave :—

Water.....................	0·1450 =	14·09	
Sulphide of cadmium...	0·1950 =	14·74	cadmium.
Iodide of silver	1·2400 =	65·14	iodine.
Sulphate of soda.........	0·2218 =	6·98	sodium.

1.4844 grammes gave :—

Sulphate of soda......... 0·2783 = 6·06 sodium.

These numbers lead to the formula Na I + Cd I + 6 H O.

		Cal	I	II	
Na	1	287·20	5·95	6·98	6·06
Cd	1	696·77	14·43	14·74	
I	2	3171·14	65·65	65·14	
H O	6	675·00	13·97	14·09	
		4830·11	100·00	100·95	

Cadmio-iodide of Ammonium.—Iodide of ammonium, obtained by digesting iodine with hydrosulphide of ammonium was mixed with iodide of cadmium, in the proportion of equal equivalents; the solution on evaporation over sulphuric acid to a very small bulk, gave crystals similar in appearance to those of the potassium compound, remaining unchanged in a tolerably dry atmosphere. Heated in a tube it fuses and loses a considerable quantity of water.

1.7625 grms. gave

Sulphide of Cadmium 0.3685 = 16.26 Cadmium.

Iodide of Silver........ 2.3775 = 72.66 Iodine.

These numbers lead to the formula NH^4 I + Cd I + 2 H O.

		Cal		
NH^4	1	225.00	5.21	
Cd	1	696.77	16.14	16·26
I	2	3171.14	73.44	72·66
H O	2	225.00	5.21	
		4317.91	100.00	

Cadmio-iodide of Barium.

Iodide of Barium mixed in the same proportions with iodide of cadmium gave a mass of crystals which deliquesced so rapidly that it was impossible to examine their form.

2,281 grms dried in bibulous paper and weighed as quickly as possible, gave

Iodide of Silver.. ...	2.5405	=	59.98	Iodine.
Sulphate of Baryta...	0·6495	=	16.73	Barium.
Sulphide of Cadmium	0.3790	=	12.92	Cadmium.
Water as loss..........................			10.37	

These numbers lead to the formula Ba I+Cd I+5 HO.

			Cal	
Ba	—1—	854.85	—16.17—	16.73
Cd	—1—	696.77	—13.18—	12.92
I	—2—	3171.14	—59.99—	59.98
HO	—5—	562.50	—10.66—	10.37 as loss.
		5285.26	100.00	100.00

Cadmio-iodide of Strontium was obtained in the same manner. It crystalizes in large clear crystals efflorescent in very dry, but deliquescent in a moderately damp atmosphere. When heated it easily loses iodine, and absorbs carbonic acid. Owing to this circumstance the quantity of water in the following is rather too large, and of the iodine too small.

1.8105 grms gave

Loss on heating.........	0.3225	=	17.81	water.
Sulphate of Strontia....	0.4225	=	11.11	Strontium.
Sulphide of Cadmium ..	0.2720	=	11.68	Cadmium.
Iodide of Silver..........	1.9370	=	57.80	Iodine.

These numbers lead to the formula Sr I+Cd I+8 HO.

			Cal	
Sr	—1—	545.60	—10.27—	11.11
Cd	—1—	696.77	—13.11—	11.68
I	—2—	3171.14	—59.68—	57.80
HO	—8—	900.00	—16.94—	17.81
		5313.51	100.00	98.40

Owing to the small quantity of salt in my possession the crystals could not be obtained quite free from all admixture, and the analysis does not agree very perfectly with the calculation, but sufficiently so to establish the formula.

From these experiments we may conclude that Iodide of Cadmium combines with alkalic and earthy iodides in the proportion of equal equivalents; the formulæ of the new compounds just described being as follows:

$$K\,I + Cd\,I + 2\,HO$$
$$NH^4\,I + Cd\,I + 2\,HO$$
$$Na\,I + Cd\,I + 6\,HO$$
$$Ba\,I + Cd\,I + 5\,HO$$
$$Sr\,I + Cd\,I + 8\,HO$$

In this respect they partly correspond with, and partly differ from, the Zinco-iodides described by Rammelsberg in Poggendorff's Annalen, B. 43; the formulæ of which are as follows:

$$K\,I + 2\,Zn\,I$$
$$NH^4\,I + Zn\,I$$
$$Na\,I + Zn\,I + 3\,HO$$
$$Ba\,I + 2\,Zn\,I$$

In analyzing the above mentioned cadmio-iodides, the iodine was first precipitated by nitrate of silver, the excess of silver separated by hydrochloric acid, and the cadmium precipitated by sulphuretted hydrogen, &c., &c.

If we attempt to separate the cadmium at once as sulphide, we meet with the difficulty alluded to by Stromeyer, viz., that iodide of cadmium is decomposed very slowly by sulphuretted hydrogen.

Some experiments were made to ascertain whether this difficulty of decomposition is owing to the existence of a double salt of sulphide with iodide of cadmium, but without any favorable results.

Cadmio-bromide of Sodium.—This salt crystalizes from a mixture of equal equivalents of the two bromides in small brilliant six-sided plates, grouped together so as somewhat to resemble the analogous double chloride. Owing however, to the small amount of bromine in my possession, the quantity of salt obtained was but little, and the crystals were not so free from an admixture of other salts as to yield a satisfactory analysis.

1.316 grms. gave

Loss by heating	0.1465	=	11.13 Water.
Sulphide of Cadmium	0.4219	=	24.93 Cadmium.
Bromide of Silver	1.7355	=	56.13 Bromine.
Sulphate of Soda	0.2750	=	6.76 Sodium.

The numbers although not agreeing very well with the calculation, seem to lead to the formula $Na\,Br + 2\,Cd\,Br + 5\,HO$.

			Cal	*I*
Na	1	287.17	5.47	6.76
Cd	2	1393.54	26.58	24.93
Br	3	2998.89	57.21	56.13
HO	5	562.50	10.74	11.13
		5242.10	100.00	98.95

It will seem from this that the bromide and chloride of cadmium have a tendency to form bi-cadmiates, and di-cadmiates (sesqui-cadmiates of Van Hauer) while the iodide forms only mono-cadmiates.

In preparing the above compounds the following observations were made on the crystalized iodides of barium and strontium.

Iodide of Barium may be prepared by digesting iodine with the sulphide of barium, or with hydrate of baryta, and separation of the iodate, the solution on evaporation yields fine needles of hydriodate of baryta, according to Gay Lussac. The anhydrous salt is not deliquescent according to Gay Lussac, but very much so according to Henry. The composition of the so-called hydriodate has not been ascertained.

The salt was prepared according to the second of the above mentioned methods, and also by neutralizing hydriodic acid with carbonate of baryta. The solution yielded tolerably large yellowish prisms, massed together so that the form could not be determined. In a damp atmosphere they deliquesce, but in a dry one effloresce, forming a white powder.

When heated they melt in their water of crystalization, swell up and decrepitate strongly, forming a white mass which fuses on further application of heat, and on raising the temperature still higher evolves iodine. The yellow color of the salt is due to the mother liquor.

1.071 lost on heating .. 0.273 = 25.49 Water.
1.803 " " 0.466 = 25.84 "
1.803 gave sulphate of Baryta 0.804 = 26.20 Bariun.

These numbers require the formula Ba I+7 HO.

			Cal	*I*	*II*
Ba	1	854.85	26.48	26 20	
I	1	1585 57	49.13		
HO	7	787.50	24.39	25.49	25.84
		3227.92	100.00		

Iodide of Strontium was formed in the same way; it crystalizes in six-sided tables, deliquescent in a damp, efflorescent in a dry atmosphere, exhibiting when heated the same characters as the salt of barium.

1.693 lost on heating............	0.391	=	23.09 Water.
" gave Sulphate of Strontia	0.662	=	18.62 Strontium.

The formula seems to be Sr I+6 HO.

			Cal	
Sr	1	545.60	19.44	18.62
I	1	1585.57	56.51	
HO	6	675.00	24.05	23.09
		2806.17	100.00	

REMARKS ON A CANADIAN SPECIMEN OF THE PROTEUS OF THE LAKES.

BY J. GEORGE HODGINS,

DEPUTY SUPERINTENDENT OF SCHOOLS FOR UPPER CANADA.

Read before the Canadian Institute, December 15th, 1855.

The imperfect knowledge which exists in relation to the history and habits of this singular class of reptiles, added to some peculiarities in the specimen which forms the special object of remark, are, it is hoped, sufficient to confer on the subject of this paper a special interest in the estimation of Canadian Naturalists. The specimen referred to was procured from the Bay of Toronto, Lake Ontario, and having been caught and preserved for some time, alive, it afforded opportunities of observation of the habits of reptiles of this class, such as are not probably of very frequent occurrence.

Dr. Williamson, the gentleman into whose possession it first came, and who has presented it to the Provincial Museum in the Normal School Building, obtained the specimen from some boys who were fishing with a hook baited with a worm, off Tinning's Wharf in this City, on the 22d of June last. It suffered some ill treatment at the hands of its captors, which probably hastened its death. Immediately on getting the animal into his possession, Dr. Williamson placed it in a vessel filled with soft water, mixed with a little mud and *debris*. It appeared lively at first, and on being touched would move about by the aid of its tail, with all the appearance of life and vigor. The water was changed daily and a few worms were given to it from time to time, but it never seemed to have any inclination to touch them.

Dr. Williamson furnishes the following information in reference to it: "The Proteus was out of the water only while I carried it from Tinning's wharf to my house—it may be half an hour. I placed it in a bucketful of rain water when I arrived at home in the evening. On the following day it was out of the water again while I carried it to the Normal School, say a quarter of an hour. On arriving there it was put into a basinful of lake water, where it remained for a day or two, until we had a tin cistern prepared for its reception, when it was transferred to that and placed in it in mud and water. It did not thrive among the mud, but grew sluggish, recovering, however, always upon changing the water. After being thus kept for three or four days, clean water was substituted, and worms supplied in abundance. There was no other kind of food offered to it; but a very fine leech (exceedingly active) was observed in the cistern with it a day or two before it was removed to die. The leech was not thicker than a stout knitting needle, and did not appear to have preyed on the animal—although it was suggested at the time that it might have had something to do with its demise. I cannot avoid the conclusion from all I saw about this specimen of the Proteus of our lakes, that it might have lived much longer had it not been injured by trampling on it at the wharf, by the boys who captured it, and from whom it had received considerable injury, including, as I believe, the loss of the fifth toe of one of the legs, the indications of which are still traceable on the foot, showing that it must have corresponded with the other limb."

Its breathing was active and regular, and the motion and appearance of the three fringed sponge-like branchial tufts on each side of the head, as they were dilated and compressed were most graceful and beautiful. The dilation and compression of these branchiæ were generally simultaneous and uniform; but at times they were irregular and feeble, more particularly towards the close of its life. The color of the upper surface of the animal during life was olive green, somewhat mottled, and tinted here and there with shades of black. The under surface was of a light brown color. Its length is about twelve inches. It has four legs, with four toes on the anterior and five on the posterior. The member of the posterior limb to which the designation of a fifth toe is given, is, however, peculiar, and constitutes, indeed the special characteristic of the specimen in question, which appears to distinguish it from other and well-defined species of this branch of the Batrachian family of reptiles. It would rather suggest the idea of a quadrumanous thumb, were not all natural analogies opposed to such a supposition in relation to an animal so low in the scale of nature; to the superficial observer it appears indeed more like an elongated heel, but a close inspection clearly discloses indications of three claws or sub-toes. From one of the hind feet this toe has disappeared—probably broken off when captured. Indeed marks of abrasure are visible, and the indications of the wound may still be observed, notwithstanding the limb having since healed. The head is very much depressed, the mouth truncated, with a minute nostril at either angle of the upper lip, eyes pretty well forward in the head, which although when alive not very apparent, are now, from the action of the spirits of wine in which it is preserved distinctly visible. During life the skin was quite smooth and was covered with a glutinous milky fluid. As these animals are popularly held to be poisonous, experiments were tried with portions of this fluid on the tongue of a frog and common turtle, but without any apparent result. The tail is long and vertically compressed, as in all such aquatic animals, so as to serve as a rudder and means of propulsion in the water. Amphibious as the animal undoubtedly is, it was never tested otherwise than by observing it at intervals coming to the surface of the water, apparently to take in a mouthful of fresh air, as it invariably opened its mouth for an inhalation. It is clear however, from the construction of the fringed *branchiæ*, that it could not remain long out of the water without serious injury to those delicate formations.

To this it may be further added that the animal seemed harmless and inoffensive. It did not avoid the light, nor seem to withdraw itself suddenly on the approach of an observer, as though actuated by fear. It would open its mouth when irritated, but without seemingly making any effort to snap or bite. On the 8th of July it died, having lived about two weeks from the time of its capture.

The specimen under examination evidently belongs to the Perennibranchiate group of Batrachians. Besides the genus Proteus, this group includes also the Axolotl, Siren, and Menobranchus. The Menobranchus lateralis, a genus believed to be peculiar to North America, is found in the Mississippi, and in the great lakes, Superior, Huron, Michigan, Erie, and Ontario.*

Major Delafield, whose attention was specially directed to the Menobranchus, obtained some specimens from Lake St. Clair, more than thirty years ago, and he states that the animal frequently

* Dr. K. Boys, of Barrie, in a letter to Professor Croft, in reference to the specimen exhibited to the Canadian Institute by Mr. Hodgins, remarks: "The animal is common enough in Lake Ontario; I generally used to find a specimen or two every season thrown upon the shore killed by the boys. It seems to inhabit chiefly the vicinity of the wharves in Toronto, and I think I was told that the fishermen often catch it in dragging the point of the Island."

attains the length of two feet. Two other species of this genus are known: the Menobranchus Maculatus, found in the Alleghany River, and in Lakes George and Champlain; and the Menobranchus Punctatus,* found in the Santee River, South Carolina, which is said to be most useful in that State, in ridding the rice fields of destructive and noxious vermin. These species have all four toes on each foot.

The specimen in question measures only twelve inches in length, so that it is small in comparison with those obtained by Major Delafield from Lake St. Clair. It appears to me to differ more or less from each of the varieties pertaining to this continent; and more especially from the *Menobranchus lateralis*, or Proteus of the Lakes, in having a much flatter head, one more toe on each of the posterior feet, and that of a very peculiar conformation, as before described. It has no lateral stripe of black, nor is it spotted like the species found in the Alleghany and Santee Rivers. The points of difference therefore between this specimen and the genus Menobranchus are so important that I can scarcely consider it as identical with the Proteus of the Lakes or the other species referred to. The only remaining competitor is the Proteus of New Jersey, which is briefly noticed in the seventh volume of Silliman's Journal (p. 68). This animal, though said to possess the same number of toes on each of its feet, differs in color, and in the absence of any external nostril—which in our specimen is very apparent. It approaches, however, nearer to an exact resemblance of this specimen than any of the preceding genera; but not sufficiently near to establish its identity with it. I am therefore impelled to the conclusion, after comparison and investigation, that the specimen is a distinct branch of the Batrachian family, and may be considered as a new genus—the *Proteus Canadensis*—its chief points of difference being in the flatness of its head, the absence of any lateral stripes, and the formation of the fifth toe on the foot of the posterior leg.

As an amateur, I have to claim the indulgence of the members of the Institute for any want of clearness or scientific accuracy in this paper. If I have not sufficiently established the point aimed at, still I trust the members of the Institute will agree with me in the conclusion that even, if so marked a difference in one of an interesting class of reptiles is not sufficient to constitute it a distinct genus, that difference is nevertheless such as to merit their notice and careful observation.

---

† The *Iconographic Encyclopedia* distinguishes these reptiles by the terms, *Necturus lateralis* (a drawing of which is given), *N. maculatus* and *N. punctatus*. J. G. H.

REPORT OF COMMITTEE.

The Committee appointed by the Canadian Institute to report on a specimen of the Proteus of the Lakes, exhibited at a meeting of the Institute on the 15th of December, 1855, by J. G. Hodgins, Esq., and supposed by him, for reasons assigned in his paper, to be a new genus, for which he suggested the name of *Proteus Canadensis*, have arrived, after a careful examination of the specimen, at the following conclusions:—

First, that the supposed fifth toe on one of the hind feet, is an unnatural or "monstrous" development of a second foot, exhibiting three, or more strictly, four toes—the central or larger division shewing a very perceptible union of two of the abortive organs.

Secondly, that in its dental characters, the position of the nostrils, the form of the lips and head, the general condition of the skin, and other particulars, the specimen in question corresponds exactly with the *Menobranchus Lateralis*, to which the Committee would consequently refer it.

The Perennibranchiate Batrachians include four genera, characterised as follows:

A. *Palatal teeth in several rows. Teeth also in several rows on the inner surface of the lower jaw.*

Siren:—Hind limbs undeveloped.

Axolotl:—Two pairs of limbs. Toes, four in front; five behind.

B. *Palatal teeth in a single row. No teeth on the inner surface of the lower jaw.*

Menobranchus:—Toes, four in front; four behind.

Proteus:—Toes, three in front; two behind.

The single row of palatal teeth, exclusive of the row upon the intermaxillaries at the margin of the mouth, places Mr. Hodgins' specimen in the second or higher group, and the number of the toes proves it to belong to the genus *Menobranchus*. Its further agreement with the Menobranchus *lateralis* has been already pointed out. According to the American naturalists, the occurrence of a dark lateral stripe, from which the name of the species was originally derived, is by no means a constant character.

ON THE VALUE OF THE FACTOR IN THE HYGROMETRIC FORMULA.

BY CAPTAIN A. NOBLE, R. A., F. R. S., QUEBEC.*

Read before the Canadian Institute, 12th January, 1856.

The results of the accompanying table for computing the dew point from readings of the dry and wet bulb thermometers, are derived from observations taken at Quebec during last winter, by Mr. Campbell and myself. These results will be obvious at a glance; but a few remarks upon the instruments employed, and upon the degree of reliance to be placed upon them may not be uninteresting.

The dry and wet bulb thermometers (for which we were indebted to the kindness of Professor Cherriman, director of the Magnetic Observatory, Toronto) were made by Negretti and Zambra, and their index errors were ascertained above 32° by Mr. Glaisher, and below 32° by ourselves, by comparison with a Kew standard. The divisions upon these thermometers were too small to read 0.1° with great accuracy, and in discussing our observations at low temperatures we were, in consequence, obliged to reject such as would, with an error of 0.1° in the reading, introduce a considerable error in the factor.

You will observe that the table does not extend below –16°, although we have repeatedly, every winter, the mercury below –20°, and occasionally below –30°. The only thermometer, however, which we could trust as a wet bulb in investigations so delicate was not graduated below –16°.

For obtaining the dew point by direct observation, we used the condensing hygrometer invented by M. Regnault. We obtained dew with this beautiful little instrument at all temperatures, (limited by the graduation of the thermometer, –35°,) the only requisites when the thermometer is very low being time and pure ether.† I can testify from experience that this hygrometer obviates all the inconveniences of Daniell's which M. Regnault enumerates in his Hygrometrical Researches.

In order to shew the reliance that may be placed upon our results, we have put opposite each factor in the table the probable error and measure of precision of the single data, (from which the factor (f) was derived,) and also the probable error, measure of precision and limits of certainty of the adopted factor. The nomenclature and

* This paper was originally prepared in the form of a letter addressed to C. R. Weld, Esq., Sec. R. S., London.

† The ether we employed below –20° was the first that passed over, resulting from the distillation of washed ether with quicklime.

notation are those employed by Encke in his Memoir on the Method of Least Squares.

The measure of precision (h), as was indeed to have been expected, decreases with the temperature. This fact is not, however, of so much importance as might at first appear; for the dew point is given by the equation

$$T=t-f(t-t');$$

where T is the temperature of the dew point, t that of the air, $(t-t')$ the difference between the dry and wet bulb thermometers, and f the factor, whose value is given in the table.

Now taking the temperatures 42° and 22°, it appears from the table that the probable error of f, from a single observation, is at the latter temperature three times as great as at the former, but $(t-t')$ is, on an average, about three times as great at 42° as at 22°. Hence the probable error of the dew point at both temperatures is very nearly the same.

We have extended our table to 51° for the purpose of comparison with the "Greenwich factors." I must however remark that it is probable that the factors above 40° are rather greater than they would have been had the observations discussed extended through a longer space of time, the majority, at these temperatures, having been taken last spring, when the air was very remarkably dry; and experience shews thatwhen $(t-t')$ is unusually great the deduced factor, instead of being more accurate, is generally much too large.

As an instance I may cite an observation taken on the 21st April, when the temperature of the air was 43.6°, that of evaporation was 31.6°, and that of the dew point was 3.2°. The fraction of saturation on this occasion was only $\frac{19}{100}$, and the factor derived from this observation was 3.4, being much the largest deviation from the adopted mean, 2.53. The cause of this discrepancy is doubtless owing to the heat that the wet bulb thermometer derives from the radiation of surrounding objects, and, were observations sufficiently numerous, it might conduce to accuracy were the factors calculated for every degree of difference in the value of $(t-t')$.

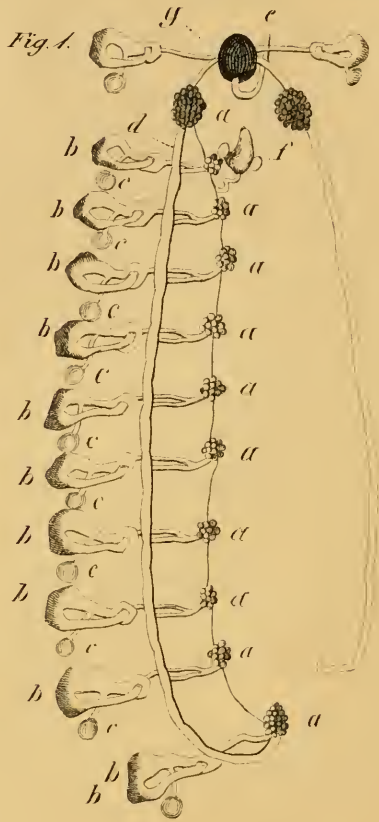
We purpose instituting a comparison between two wet bulb thermometers placed in similar boxes, the one coated with lampblack and the other with polished daguerreotype plates.

Below 32° our results do not appear to coincide with the factors deduced from the Greenwich observations, and the cause of the discrepancies must be left to time. As, however, we have had considerable experience at these temperatures, I may perhaps be doing service to observers in bringing before their notice two causes of error, to which we have found ourselves particularly liable when the thermometer is near 32° :—1st. If the air is a little above, and has been below 32°, there will frequently be a small button of ice at the foot of the wet bulb thermometer which is not easily perceived, and which will keep it at 32° when the temperature of evaporation is really above that point. 2nd. It is well known that under certain circumstances water may be cooled below 32° without freezing, and an example will perhaps best shew the error which this may occasion. Let us suppose that the temperature of the air is 27°, and that when the thermometer is wetted it sinks to 26° and then rises. Should it rise very slowly the probability is that 26° is the true temperature of evaporation, but if rapidly, the rise may be due to the conversion of the water into ice, and it will be prudent to observe whether or not the thermometer again commences to sink. We have frequently observed this phenomenon, and I am quite at a loss to what to ascribe its uncertainty. It has occurred both in a high wind and a calm, (the thermometers are protected from the full force of the wind,) and it also appeared to be quite uncertain at what temperature the water would freeze.

I am obliged to admit that the limits of certainty of the factors below zero are not so close as could be desired. This is partly attributable to our having to reject many observations made with a thermometer which was broken before its index errors were fully ascertained. Mr. Campbell and I must claim the indulgence of those who know the difficulty of taking observations requiring so much time and accuracy, at such temperatures, and frequently at six o'clock in the morning.

Temperature of Air. (t)	Factor. (f)	Number of Observations. (m)	Probable error of a single datum. (n)	Measure of precision of a single datum. (h)	Probable error of the adopted factor ($R=\frac{n}{\sqrt{m}}$)	Measure of precision of the adopted factor. ($H=h\sqrt{m}$)	It is, therefore, an equal chance that the true factor lies between.
48° — 51°	2.31	21	.30	1.590	.07	7.287	2.24 & 2.38
46 — 47	2.38	13	.26	1.822	.07	6.569	2.31 — 2.45
42 — 45	2.53	41	.40	1.189	.06	7.613	2.47 — 2.59
40 — 41	2.63	17	.41	1.163	.10	4.796	2.53 — 2.73
38 — 39	2.83	25	.48	.999	.09	4.994	2.74 — 2.92
34 — 37	3.02	64	.43	1.114	.05	8.912	2.97 — 3.07
32 — 33	3.33	25	.63	.767	.12	3.835	3.21 — 3.45
30 — 31	3.81	22	.61	.775	.16	3.633	3.65 — 3.97
28 — 29	4.40	27	.66	.723	.13	3.756	4.27 — 4.53
24 — 27	5.46	43	.82	.577	.13	3.787	5.33 — 5.59
22 — 23	6.06	15	1.20	.397	.31	1.535	5.75 — 6.37
20 — 21	6.93	6	1.40	.341	.57	.834	6.36 — 7.50
18 — 19	7.13	21	1.44	.331	.31	1.517	6.82 — 7.44
16 — 17	7.60	20	1.76	.271	.39	1.209	7.21 — 7.99
14 — 15	8.97	17	1.72	.277	.42	1.141	8.55 — 9.39
12 — 13	10.30	20	2.53	.188	.56	.842	9.74 — 10.86
10 — 11	11.50	11	2.19	.218	.66	.723	10.84 — 12.16
8 — 9	13.06	8	4.63	.103	1.64	.292	11.42 — 14.70
6 — 7	15.30	7	3.66	.130	1.38	.345	13.92 — 16.68
0 — 5	16.23	14	1.87	.255	.50	.955	15.73 — 16.73
–1 — –4	19.37	10	4.11	.116	1.30	.367	18.07 — 20.67
–5 — –10	21.64	6	4.65	.102	1.90	.251	19.74 — 23.54
–11 — –16	37.83	6	10.96	.044	4.48	.107	33.35 — 42.31

Fig. 1.



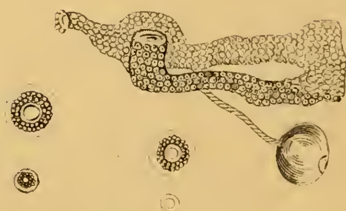


Fig 2.

Fig. 3

Bovell M.D. fec.

Maclear & Co. Lith. Toronto.

NOTES ON SOME POINTS IN THE ANATOMY OF THE LEECH.

BY JAMES BOVELL, M. D.

PROFESSOR OF THE INSTITUTES OF MEDICINE, TRINITY COLLEGE, TORONTO.

Read before the Canadian Institute, December 15th, 1855.

Dugès, Home, Jones, and other distinguished anatomists, in their descriptions of the structure of the Leech have assigned to certain highly developed parts in this Annelid, functions which it was by no means clear to many more recent observers, could legitimately be performed by them. It was reserved, however, for Dr. Williams, of Swansea, a highly distinguished comparative anatomist, to unravel the mystery, and to furnish proof of the errors into which his predecessors had fallen.

The existence of an elaborate circulating system seemed to necessitate an ærating one equally developed in character; but spiral vessels, on the type of insecta, no where being seen, the vascular-walled pouches, occupying the lateral regions of the body, seemed to be the organs of respiration, supplied freely with blood by vascular hearts. While many doubted the existence of so special an organization for respiration in this creature as was described, no one before Dr. Williams had assigned them to the generative apparatus, and as I believe that the observations which have been repeated here confirm the results arrived at by the Naturalist of Swansea, I thought it of sufficient interest to bring the subject before the Institute. I cannot, however, agree with Dr. Williams that the generative organs are rightly described, even by himself. In order to understand the subject, as now unfolded to us, it may be more advantageous to state the opinion of one of the highest authorities.

Mr. Jones, in his "Animal Kingdom," observes: "Two lateral vessels are appropriated to the supply of the respiratory system, and in them the blood moves in a circle quite independent of that formed by the dorsal artery and ventral vein, although they all communicate freely by means *of cross branches*, those passing from the lateral vessels to the dorsal being called by Dugès dorso-lateral, while those which join the lateral trunks to the ventral canal are the latero-abdominal branches. The movement of the blood in the lateral or respiratory system of vessels is quite distinct from that which is accomplished in the dorso-ventral system or systemic.

On examining one of the respiratory pouches, its membranous walls are seen to be covered with very fine vascular ramifications, derived from two sources; the latero-abdominal vessel gives off a branch which is distributed upon the respiratory sacculus; and there is another very flexuous vascular loop derived from the lateral vessel itself, which terminates by ramifying upon the vesicle in a similar manner. The walls of the loop are extremely *thick* and *highly irritable;* but on tearing it across, the internal cavity or canal by which it is perforated is seen to be of comparatively small diameter, so that we are not surprised that, although such appendages to respiratory sacs were detected and well delineated, their nature was unknown, *and they were supposed to be glandular bodies appropriated to some undiscovered use.*

The female sexual organs are thus described by the same observer: "The ovigerous, or female sexual organs, are more simple in their structure than those which constitute the male system; they open externally by a small orifice situated immediately behind the aperture from which the penis is protruded, the two openings being separated by the intervention of about five of the ventral rings of the body. The vulva or external canal leads into a pear-shaped membranous bag which is usually, but improperly, named the uterus. Appended to the bottom of this organ is a convoluted canal which communicates with two round whitish bodies; these are the ovaria. This description, therefore at once makes a vast disproportion between the male organs and the female, giving to the latter an unknown preponderance over the former; for all anatomists are agreed as to the physiological import of the rows of glandular bodies known as the testes. Now we will contrast with the above the statements and observations of Dr. Williams.

The testes are observed under the character of small white granular bodies, disposed at short distances in a longitudinal series on either side of the ventral median line of the body. When forcibly compressed, a white fluid exudes, which under the microscope is found to consist of nothing but sperm-cells, in various stages of evolution. To each of these testicular bodies two minute threads are attached. The larger and more obvious of these threads extends outwards at right angles with the median line, and joins a considerable chord running parallel with the median line. Examined in section, both the transverse threads and longitudinal chord prove to be tubes filled with fluid thickly charged with sperm-cells, a true male secretion. The longitudinal tube is common to *all* the testicular bodies; it begins at the most posteriorly situated of these bodies, and ends in that most anteriorly placed, median and azygos, to which the intromittent organ is appended; meeting at this mesial organ the corresponding duct of the opposite side. In addition to the tubulus just described as proceeding from the testes, another much smaller one may be detected on minute dissection running directly outwards, crossing underneath the large longitudinal duct and becoming united to the base of the ovarian utricle. Traced in the direction of the head, the longitudinal duct is seen to enter into a glandular body, which in size is considerably greater than the testes situated posteriorly to it on the same side. In minute structure this body is precisely the same as the bodies of the testicular series; like them it is filled with sperm-fluid; the interior is a cavity. The secreting glandular structure is disposed around the circumference; the secreted product is thrown into the enclosed hollow. This description applies also in every particular to the other testicular bodies, which are like the former, hollow orbicular glands. The large longitudinal duct which serves as a common channel of communication between all the testes, emerges out of the gland under the character of a duct of greatly reduced size. This small tubular thread, traced with minute care, may be followed into the median glandule to which the penis is appended. In the median line also, and some little distance posteriorly to the body just described, may be remarked a pear-shaped sacculus from the unattached fundus of which a cæcal coiled tubule is prolonged. Between this saccular and the other parts of the reproductive system, no communication of any description can be discovered. It seems simply destined to receive the intromittent organ developed in connection with the gland situated in advance of it on the median line.

It may be inferred from the character of the whole system of the testicular bodies, that the penis is not an ejaculatory organ; it seems subservient only to the purposes of sexual stimulation. By all anatomists, from the date of the first description of M. Dugès, this *sacculus* has been regarded as an uterus, and as, in fact, constituting the whole of the female element of the generative system. The convoluted cæcal tubule pendent from the fundus of this sacculus, including some undiscoverable gland structures on either side of it, are commonly indicated as the ovaria. Such anatomists, whilst entertaining opinions so remote from the truth, and withal so little probable on physiological grounds, never could have *seen* these parts. An ovarian system so utterly disproportionate to the testicular, *if it were true*, would find no precedent or parallel in the whole series of invertebrate animals.

In all hermaphrodite animals the female elements of the generative organs are invariably superior in size, more elaborately organized, and more important as constituent parts of the whole organism, than the male: wherefore should the converse of this rule obtain in the Annelida? A cursory glance at the organic necessities of the animal system should have sufficed to convince the physiologist that such a simply organized sac, so uncomplicated in structure, so unprovided with stromatous tissue for the production and development of ova, could not have proved adequate to those profound functions involving in intimate sympathy every other of the organism which are concerned in the continuation of the species. It was the necessity, thus perceived on theoretical grounds, for some series of organs which would *reasonably* answer to the general characters of a female system, which first led the author to the discovery of that which now remains to be explained.

In the Leech, the female system consists of a greater number of separate parts than the male, amounting to fifteen or seventeen on either side, while the testicular bodies are only nine. This system is composed of a linear succession of a bag-pipe shape, membranous sacculi, contracting at both ends into two separate ducts. One of these ducts, terminates an orifice communicating externally. It is through this orifice that the ova and young escape from the ovarian utricle into the external medium. In the Leech, the ova in *this* duct, in every case yet examined, present an obviously greater degree of development than those which are found in the duct which communicates with the neighboring testis. At certain seasons of the year, in the Earth-worm, this duct, which may be called the *inferior* duct of the ovario-uterine organ, is crowded with living young, emerging from the ova, and in process of final extrusion through the external orifice. The *hatched young* in the Leech have never yet been seen actually by the author in this situation, although the parts are accurately correspondent in the two worms. He cannot yet therefore state of the Leech what he can from actual observation of the Earth-worm, that it is viviparous; the *superior* duct of each ovarian uterus passes underneath the common longitudinal chord and opens into the true testicular duct, the two channels becoming united into one, just before entering the substance of the gland. It is desirable here to warn the anatomist, that in practice the demonstration of this fact demands great patience and minuteness of dissection.

The author now desires to solicit special attention while he attempts to explain the nature of the connexion which, according to his view, subsists between the male organ or testis on the one hand, and the egg-producing and egg-incubating organ or ovarian uterus on the other. It will, he trusts, suffice to elucidate satisfactorily the mechanism of *self-impregnation.* The testicular bodies secrete a true sperm-fluid, the cells of which can readily be detected by the eye both in the duct which leads to the great longitudinal chord, and in that which conducts into the ovarian uterus. The male seminal fluid travels from the testes into the ovarian uterus along the superior of these ducts. It may be actually detected in the cavity of this latter organ, where it comes into immediate contact with the ova whereby impregnation results. The ova thus fertilized travel gradually onward, and reach the inferior half of the ovarian uterus. As in the Leech, these ova may be discovered *as ova* at a point in the oviduct very near the outlet, it is probable that this Annelid is oviparous. This fact, which is little material, may be readily determined by examination instituted at the right season. The curved ovario-uterine membranous organ is really the part to which Dugès applied the name of "the cardiac vasiform heart," and which M. Quatrefages has denominated "la poche secrétrice!!" Dugès made a near approach to a correct *descriptive* anatomy of this organ. Quatrefages' delineations are extravagantly erroneous. To each ovarian uterus a beautifully delicate vesicle is attached. It is connected with the superior duct, or that which leads directly from the testis into the ovario-uterine saccule by means of a very slender tubule rising from the vesicle. This vesicle is the far-famed "respiratory sacculus" of the Leech; the duct communicating between it and the superior half of the ovarian uterus is the wondrous *respiratory heart vessel*, which for half a century has challenged the admiration of anatomists!

Let it now be seen what rational and probable physiological explanation these parts will bear. In the first place, it is obvious that there exists in this Annelid a direct communication by means of an open duct between the male and female elements of the reproductive system; that this system opens externally *only* at the orifice of the oviduct; that these orifices are designed for the extrusion of the ova or young from the body of the parent, and not for the reception of the sperm-fluid into the ovario-uterine tract; that the male fertilizing secretion passes directly along the duct into the ovarian uterus; and that thus the process of *self*-impregnation is *literally* accomplished, for it is not the sperm-fluid of *another* individual that fecundates the ova, but that of the *same* individual.

That conclusion may be affirmed with confidence, since the median copulative saccule into which the intromittent organ of *another* individual is inserted terminates in a convoluted cæcal tubulus. Between this median organ and the great bilateral series of ovario-uterine organs there is no communication whatever. If, therefore, during the union of two individuals a fluid is emitted by the male organ into the interior of the sacculus, it requires no further argument to shew that it can proceed no further, that it can reach no *other* part of the reproductive system. In congress therefore these two parts can subserve no other than the purposes of first: mechanically uniting the individuals, and secondly: of stimulating the sexual organs. During those periods when the fertilizing fluid is not required for the office of fecundation, it is probably discharged externally as a superfluous excretion in part through the intromittent organ. According to this explanation, to the larger testicular bodies should be assigned the mechanical uses only of seminal receptacles, compressing what they may contain, either backwards into the ovario-uterine organs, or forwards to be expelled through the penis as an excretion. The penis therefore is the only means *common* to the whole male system by which it communicates with the exterior, the so-called "respiratory sacculi," being the means by which each testis separately communicates with the exterior.

It is with considerable diffidence that I express a doubt as to the correctness of Dr. Williams' observations on two points, and as my dissections induce me to do so, I will now briefly refer to the annexed diagram, Plate 1, Fig. 1, to illustrate what I believe to be the true history of the organs which are respectively called ovipero-uterine sacs and testes.

The following references to figure 1, on the plate, will enable the reader to apply the observations offered here to the results which dissection exhibits with the aid of the microscope:

(*a*) *Ovaries.* (*b*) *Testes.* (*c*) *Vesicula Seminalis.* (*d*) *Common duct.*
(*e*) *Intromittent organ and bulb.* (*f*) *Uterus* (*?*) *or pouch.*
(*g*) *Termination of common duct in bulb.*

Except by Dr. Williams, hitherto no chain of connexion has been described between the so-called testes; they are in all the drawings shown as attached to the duct common to each so-called testis and sac. In my dissection made from the dorsal region, I find that a delicate vessel passes, as represented in the annexed plate, between each gland, forming an intimate communication between them. All these glands terminate in a common duct at the base of the intromittent organ.

Dr. Williams and others have described the base of this last-named instrument as possessing also a gland-structure, but no such structure exists; on the contrary the bulbous expansion evidently possesses contractile walls and presents no glandular appearance.

The so-called uterus is, as Dr. Williams states, a sacculus, terminating in a cul de sac, and I can find no trace of connection between it and the other bodies. In shape it is somewhat like the human stomach, and on its lesser curvature enfolds a glandular mass.

From the structure and position of the respective organs above described, it certainly seems that we ought to reverse their supposed offices; instead, therefore, of describing the glandular bodies at present considered testes, as such, it is much more reasonable to assign them to the ovarian system and to consider the uterine sacs of Williams as the male organs of generation. A few of the arguments which tend to support such an opinion are that the spermatic fluid is invariably projected from organs, while the germ fluid or ova are more silently propelled along ducts or tubes. Again, Williams curiously enough makes the following statement which is important: "It is here essential to add that the ova are first produced in a stromatous layer which constitutes one of the coats of the ovarian uterus, and that a large number of them are contained in a common capsule until they attain a certain degree of development, after which they may be recognized near the outlet of the oviduct in a single and free state. *Ova are never found in the so-called respiratory* saccules, but on the contrary and invariably, *a small quantity of sperm-fluid.* Each of these sacs is perforated at the point where it is attached to the integument by an orifice which opens directly externally. This vesicle which from the date of the writings of Dugès has been described as 'the respiratory sac,' is a true vesicula seminalis; *it is designed to receive* the superfluous portion of the sperm secretion as it passes from the testes to the ovarian uterus. Spermatozoa can always be discovered in the vesicles." According to the above plan the sperm-fluid must overflow the common duct and then pass by a second lateral duct into the distant and detached vesicula seminalis. Surely there is no such complication in nature. On the contrary the following is the simple and intelligible mode which she adopts: The bodies described as testes are the ovaries, these open into the common duct; the structures designated ovarian-uteri are the testes with their attached vesicula seminalis; these bodies possessing, as shown by Williams, irritable contractile walls, discharge the sperm-fluid into the common duct and thus fertilize the germ-fluid.

The office of the detached sac, said to be an uterus, and supposed by Williams to be a mere arrangement for attaching individuals in copulation, seems to be really more strictly a uterus, although on this point more proof is needed. My reasons for inclining to the old opinion is that during this last summer I twice found Leeches with a circlet of young Leeches attached to the mouth of this curious sac, and in a specimen presented to the Institute, not only are the young ones shown so situated, but after the death, or more probably in the death of the Leech, ova were extruded and now lie in the glass cell with the parent. These ova are spherical and of a peach color.

This fact I think indicates that the fertilized ova are deposited in the uterus which as quickly as hatched attach themselves for a time to the orifice of the outlet, as shown in Fig. 3.

Fig. 2—*Vascular Contractile Testes, &c.*

Fig. 3—*Leech with Young Ones.*

COLEOPTERA COLLECTED IN CANADA.*

By William Couper, Toronto.

For synonyms, &c. see Melcheimer's Catalogue.

ELAPHRUS

CLAIRVILLEI, Kirb. N. Z. 4, 61.

Antennæ and head black, the latter glossy, minutely punctured and slightly tinged bronze-green, having a transverse elevated line in front, and a conoidal elevation on top between the eyes in which is a deep pit; thorax black, glossy, longer than wide, and impressed thus: ·Y·—with a slight tinge of copper bronze on the dorsal margin; elytra of the same color as thorax, each contains 21 circular impressions, punctured and tinged with blue, and surrounded by an elevated ring—the punctures in the region of scutellum are much smaller than the marginal series; beneath green and copper bronzed; femoræ rufous at the base. Length 4 lines. Island of Toronto.

Kirby describes his insect as having the base of the posterior femoræ rufous; in my specimen they are all rufous at the base. Sir J. Richardson captured only the single described specimen, otherwise, had there been duplicates to examine, he would probably have given the color as characteristic to the whole, and not confined to the posterior femoræ alone. In my specimen all the elytral impressions are ringed; in Kirby's, the rings of the marginal series are obsolete.

? INTERMEDIUS, Kirb. N. Z. 4, 62. Lec. Ann. Lyc. 4, 448.

Antennæ black, set with short rigid hairs, thickest at the apex; head bronzed copper, minutely interspersed with bright green the space between the eyes less elevated than in *E. Clairvillei*, and occupied by a central longitudinal impression; thorax of same color as head, the Y impression is not so deep, but the side-punctures are more distinct than in the latter species; elytra minutely punctured, and with less brilliancy—the copper color darker, with a quadrangular series of impressions without any elevated ring. Some of the

* See, for previous notes, *Canadian Journal* (Old Series) 1855.

impressions have a slight elevation in the centre—marginal series smaller, and in some specimens nearly obsolete; body beneath bronze-green; femoræ green, tibiæ rufous. Length 4 lines. Island of Toronto.

The sutural quadrangular elevation which unites the elytra "just before the middle" in Kirby's specimen, is almost obsolete in the above; in every other respect it agrees with his description. Kirby's insect was taken by Sir John Richardson, at Great Bear Lake, in lat. 66°—67°.

NECROPHORUS

? MELSHEIMERI, Kirb. N. Z. 97.

Jaws black, minutely punctured, and tufted on each side beneath the base with orange-colored hairs; head black, minutely punctured in front, with a subtrapezoid orange-colored nostril-piece, and a transverse sulcus between the antennæ: eyes black, smooth, lobed behind—the lobes punctured and set with short rigid hairs; knob of the antennæ orange-colored; neck ringed with yellow hairs; thorax margined, punctured, dilated and obliquely depressed anteriorly; scutellum bell-shaped, black and punctured; elytra black, densely punctured, the shoulders elevated, with two longitudinal abbreviated obsolete lines, and two orange-colored toothed bands—the anterior is transverse, but the posterior one does not reach the suture: both connect with the deeply orange-colored epipleura; postpectus on each side covered with tawny hairs; posterior femoræ truncate at the apex; tibiæ toothed and dilated; body beneath black, and densely punctured. Toronto, not common. Length 8½ lines.

OBSCURUS, Kirb. N. Z. 97.

Head black, finely punctured in front, and without a rhinarium or nostril-piece; the sides of the latter obliquely furrowed and separated transversely by an abbreviated line; has no prominent lobe behind the eyes; posterior part of the neck ringed with tawny hairs very distinctly seen when the head is bent down; antennæ black, three last joints of the knob orange-colored; thorax dilated, margined—the margin punctured, with a longitudinal groove through the disc; scutellum triangular, slightly elevated; elytra black, densely punctured, the anterior sutural region slightly depressed, the shoulders and two longitudinal lines elevated, as in the last species; epipleura deep red, from which an anterior dentated band of the same color nearly reaches the suture—the posterior one is kidney-shaped, and reaching neither epipleura nor suture; body beneath black; postpectus covered with short glossy hairs; the tibiæ are dilated and toothed. Toronto, not common. Length 8½ lines.

NECROPHILA

TERMINATA, Kirb. N. Z. 103.

Antennæ and head black, the frontal impression between the eyes oblong; thorax minutely and confluently punctured, margined yellow—the discoidal spot black, and very slightly lobed at the sides, with a yellow sphenoid spot inserted posteriorly; elytra brown black, and minutely punctured, with two longitudinal obsolete ridges and a row of distinct punctures on each side of the suture—yellow at the apex; beneath black. Length 9 lines. Toronto, not common.

AFFINIS, Kirb. N. Z. 103.

Head and antennæ black, the frontal impression not so deep; thorax pale yellow, very finely punctured—discoidal spot smaller and differently formed than in the last species—the lateral lobes are larger and more oblique—the posterior part is rather of a deltoid form and slightly sphenoid in the centre with yellow; elytra of a brown silky color, with the same irregular elevations and sutural rows of punctures as in *terminata;* the apex of elytra yellow, body beneath, and legs black. Length 9 lines. Toronto, rare.

This and the preceding species are nearly related to *N. Americana*, Linn., the true northern type of the genus. Kirby describes four species which he states are closely related to the latter. *N. Canadensis* is evidently the ♀ of *Americana.* I have noticed invariably both the form of the thoracic discoidal spot, and the color of epipleura, to vary in almost every specimen; also, in the smaller specimens the sutural termination of elytra are not so acuminate; probably it may be, as he states, a sexual character.

LATHROBIUM

PUNCTICOLLIS, Kirb. N. Z. 86. Erichs. p. 604.

Head obovate, minutely punctured; antennæ, mandibles and palpi dark chesnut; thorax "oblong square with all the angles rounded, punctured, but not thickly;" elytra of a dark chestnut color, longer than wide—not much longer than thorax, and thickly punctured; posterior part of the body black, and covered with very short glossy hairs; beneath black glossy; legs bright mahogany; tibiæ armed with a spine. Length 5 lines. Toronto, common. Taken in lat. 54°—*Kirby*.

DERMESTES

LARDARIUS Linn. Fabr. El, 1, 312. Le Règne Animal, Insectes, tab. 36, fig. 10.

Head and thorax black, the latter with several minute yellow spots; scutellum black; elytra posteriorly black, glossy—base yellow, with three black dots, thus ·.· on each elytrum. Length $4\frac{3}{4}$ inches.

Common in Canada. It feeds indiscriminately on all animal substances, and is found throughout summer, on the Island of Toronto, in putrified fish.

BYRRHUS

? CYCLOPHORUS Kirb. N. Z. 117.

Thorax dark chestnut color, glossy, and intermixed with short cinereous hairs; scutellum very black and triangular; elytra not so dark as the thorax, glossy and covered with short rust-colored hairs; three longitudinal stripes on each, and a transverse double band of pale cinereous hairs in form thus ≈; body beneath and legs dull ferruginous. Length $2\frac{1}{4}$ lines. Taken by Mr. F. H. Ibbetson, at the Lake of Two Mountains.

The naturalists to the northern expedition captured only one specimen, which Mr. Kirby describes as having *two* black stripes on the elytra, and its length $3\frac{1}{4}$ lines. Mr. Ibbetson's specimens vary in size; they are evidently related, as in some of them the third stripe is obsolete.

BRACHYS

TESSELLATA Fab. El. 2, 218. *ovata*, Web. Obs. Ent., p. 78; *aurulenta*, Kirb. N. Z. 162; *aerosa*, Mels. Pr. Acad. 2, 148.

Body obovate, black-blue, glossy; antennæ black-blue, shorter than thorax; head has a sinus in front, and covered with glittering copper-colored decumbent hairs; thorax transverse, impunctured, lobed and impressed on each side posteriorly, and interspersed with copper-colored decumbent hairs; scutellum transverse, smooth, impunctured, rounded anteriorly, and acuminate posteriorly; elytra with three longitudinal ridges—the two inner ones are not so distinct as the external one, which is more acute, running from the shoulder in an undulated line nearly to the apex of elytrum. The elytra are minutely punctured in double rows, those on each side of suture are very distinct; ornamented with copper spots and undulated silver bands formed of decumbent hairs; beneath dark-blue, glossy, truncate at the apex. Length $2\frac{1}{2}$ lines.

The northern species of Brachys are small, but extremely beautiful; in habit they vie with the larger *Buprestidæ*. In summer they are found on the upper surface of the leaves of oaks, on which they subsist. Common in the neighborhood of Toronto.

RHINARIA

SCHOENHERRI Kirb. N. Z. 203. Sch. Cur. 7, 369.

Body oblong, pear-shaped, covered with hoary pile; antennæ black, and nearly the length of the head, the knob ovate, acute; the rostrum sub-cylindrical, with three slightly elevated oblique lines in front joining between the eyes, the latter are round, prominent; thorax rather narrowest anteriorly, and more granulate than the head; scutellum conspicuously white; elytra with nine perfect rows of punctures, and from the density of the pile in some specimens they are not quite visible: on each elytrum there are three longitudinal white stripes, and four rows of distinct black tufts—depressed at the apex; tibia clavate. Length 6½ lines. Toronto, rare.

The genus *Rhinaria*, founded by Kirby (Linn. Trans. xii, 430, *t.* xxii, *p.* 9), from the above typical form, and the only species as yet discovered north of Mexico.

LEPTURA

VAGANS, Oliver, 73, 46. Lec. J. Acad. 2d. 1, 337. *brevis* Kirb. N. Z. 182.

Head black, thickly and minutely punctured, and interspersed with erect hoary hairs; antennæ 10-articulate, the four first joints are black, and the fifth to apex are yellow at the base; thorax globose, anteriorly constricted, posteriorly depressed, deeply and confluently punctured, having some erect hairs of the same color as on the head; scutellum "linear, covered with decumbent hairs;" elytra densely and deeply punctured, rounded and spread apart at the apex, with a lateral longitudinal stripe, commencing behind the shoulder, "of the color of the yolk of an egg;" beneath black, minutely punctured; legs with yellow decumbent hairs. Length 5 lines. Toronto, rare.

The elytra in this insect are wider across the shoulders, and the "body shorter in proportion to its width."

SCALARIS, Say, J. Acad. 278.

Entirely dark ferruginous above, of a silver gloss beneath, antennæ 10-articulate, the third joint from base shortest; head much inclined, interspersed with slender erect silken hairs, and minutely punctured posteriorly—separated from the thorax by a conspicuous ring; thorax minutely punctured, somewhat narrower in front, with a central abbreviated depression—the posterior angles acute; scutellum triangular; elytra shorter than the body, covered with ferruginous decumbent glossy hairs, which occupy the greater part of the anterior, thence they extend on each side of the suture—the mark is compressed twice.

In this insect the elytra are remarkable for their great marginal compression towards the apex. Length 1 inch 2 lines. Taken by Mr. Ibbetson, at Manitoulin.

NOSODERMA

? OBCORDATUM Kirby (Boletophagus), N. Z. 236.

Body oblong, depressed, of a rusty color above; antennæ with large globular articulation at base, and the apical joints thicker than the antecedent ones; head short, eyes black; thorax granulate, of same width as elytra—the sides depressed, rounded posteriorly, with two anterior obtuse angles, and finely serrated beneath—disc elevated, on which are several tubercles; scutellum black, elevated; elytra with three ridges longitudinally arranged—the two anterior form a series of tubercles, and the exterior reaches from base to apex, where there are two large tubercles on each elytrum—margin of a darker color, and densely serrated beneath. Length 4 lines. Toronto, rare.

In some characters it agrees with Kirby's specimen. The rare occurrence of the species in this neighborhood prevent a determination of the sexes at present. Their attachment to *Boleti* and other vegetable excrescences confine them to old forests.

OPLOCEPHALA—Neomida

BICORNIS. Oliv. Ent. 3, 55. Kirb. N. Z. 235 (Arrhenoplitis). *virescens* Lap. 23, 341. *Hispa* F. Mant. p. 215.

♂ Antennæ black, the three first joints attenuated and rufous; clypeus armed with a pair of minute teeth; head dark green, glossy, armed behind the eyes with a pair of cylindrical vertical horns, which are rufous at the apex; thorax rounded at the sides and minutely punctured; scutellum triangular; elytra dark green, glossy, slightly furrowed and punctured in the furrows; beneath black, glossy, and punctured; legs rufous. Length 2 lines.

♀ same color as ♂; the head is transversely impressed between the eyes, and unarmed.

This species is one of the most common of our fungivora; in summer they devour fungi and other excrescences on decayed trees, and in winter they hybernate and are found congregated in large numbers under the bark.

STATYRA—arthromacra

AENEA Say, Long's Exp. 2, 287. *donacioides* Kirb. N. Z., 237.

Antennæ longer than the head and thorax, tawny-yellow, black at base—11-articulate: 3d to 10th of equal length, downy and ringed with black—apical articulation longest; above black-bronzed, glossy, with a slight tint of green—thickly and irregularly punctured; thorax cylindrical; elytra wider than thorax, rounded posteriorly; body beneath glossy, breast densely punctured; femoræ clavate; joints of tarsi tawny-yellow. Length 5 lines. Toronto, on young oak trees. Rare.

One distinctive character by which this insect may be determined is, that the tarsi are conspicuously dilated, and, behind the cysts the joint supporting the ungues is surrounded by a transparent ring at the base. At "first sight," its resemblance to a *Donacia*, as Mr. Kirby states, is merely from color; that alone probably led him to name it as above cited. No species of *Lagridæ* are known to frequent aquatic plants, while the *Donacidæ* are entirely confined to marshy localities.

REVIEWS.

Acadian Geology: An Account of the Geological Structure and Mineral Resources of Nova Scotia and portions of the neighboring Provinces of British America. By John William Dawson, F.G.S.* Edinburgh: Oliver & Boyd. 1855.

The author of this well-timed volume has been favorably known to the scientific world for some years, by the publication of various able memoirs on points connected with the geology of Nova Scotia. These have appeared principally in the Proceedings and Journal of the Geological Society of London, in the Proceedings of the Royal Society of Edinburgh, and in the Journals of the Legislature of Nova Scotia. In the work now before us, Principal Dawson has gathered together the results of his personal observations during the last ten or twelve years on the geology of the districts cited above. The mass of valuable facts thus collected, is here presented to the public in a very readable form; and the work is furthermore liberally supplied with a number of well-executed views and wood cuts, besides a large geological map of the entire province of Nova Scotia, Prince Edward's Island, and part of New Brunswick. To be thoroughly appreciated, Mr. Dawson's book should of course be read in Nova Scotia itself, or employed as a guide to the numerous interesting localities of which it contains descriptions. But, apart from its local value, the work is not without many points of general interest; and in its masterly treatment of the leading questions which come under review, it may be referred to with profit by all interested in the progress of geological inquiry. Take, for instance, the following description of certain alluvial deposits of marine origin, spread in places along the deeply indented coasts of the Bay of Fundy:—

"The western part of Nova Scotia presents some fine examples of *marine alluvial soils.* The tide-wave that sweeps to the north-east, along the Atlantic coast of the United States, entering the funnel-like mouth of the Bay of Fundy, becomes compressed and elevated, as the sides of the bay gradually approach each other, until in the narrower parts the water runs at the rate of six or seven miles per hour, and the vertical rise of the tide amounts to sixty feet or more. In Cobequid and Chiegnecto Bays, these tides, to an unaccustomed spectator, have rather the aspect of some rare convulsion of nature than of an ordinary daily phenomenon. At low tide, wide flats of brown mud are seen to extend for miles, as if the sea

* Principal of McGill College, Montreal.

had altogether retired from its bed; and the distant channel appears as a mere stripe of muddy water. At the commencement of flood, a slight ripple is seen to break over the edge of the flats. It rushes swiftly forward, and, covering the lower flats almost instantaneously, gains rapidly on the higher swells of mud, which appear as if they were being dissolved in the turbid waters. At the same time the torrent of red water enters all the channels, creeks, and estuaries; surging, whirling and foaming, and often having in its front a white, breaking wave, or "bore," which runs steadily forward, meeting and swallowing up the remains of the ebb still trickling down the channels. The mud flats are soon covered, and then, as the stranger sees the water gaining with noiseless and steady rapidity on the steep sides of banks and cliffs, a sense of insecurity creeps over him, as if no limit could be set to the advancing deluge. In a little time, however, he sees that the fiat, "hitherto shalt thou come and no farther," has been issued to the great bay tide: its retreat commences, and the waters rush back as rapidly as they entered.

The rising tide sweeps away the fine material from every exposed bank and cliff, and becomes loaded with mud and extremely fine sand, which, as it stagnates at high water, it deposits in a thin layer on the surface of the flats. This layer, which may vary in thickness from a quarter of an inch to a quarter of a line, is coarser and thicker at the outer edge of the flats than nearer the shore; and hence these flats, as well as the marshes, are usually higher near the channels than at their inner edge. From the same cause, the more rapid deposition of the coarser sediment, the lower side of the layer is arenaceous, and sometimes dotted over with films of mica, while the upper side is fine and slimy, and when dry has a shining and polished surface. The falling tide has little effect on these deposits, and hence the gradual growth of the flats, until they reach such a height that they can be overflowed only by the high spring tides. They then become natural or salt marsh, covered with the coarse grasses and *carices* which grow in such places. So far the process is carried on by the hand of nature; and before the colonization of Nova Scotia, there were large tracts of this grassy alluvium to excite the wonder and delight of the first settlers on the shores of the Bay of Fundy. Man, however, carries the land making process farther; and by diking and draining, excludes the sea water, and produces a soil capable of yielding for an indefinite period, without manure, the most valuable cultivated grains and grasses. Already there are in Nova Scotia more than forty thousand acres, of diked marsh, or "dike," as it is more shortly called, the average value of which cannot be estimated at less than twenty pounds currency per acre. The undiked flats, bare at low tide, are of immensely greater extent.

The differences in the nature of the deposit in different parts of the flats, already noticed, produce an important difference in the character of the marsh soils. In the higher parts of the marshes, near the channels, the soil is red and comparatively friable. In the lower parts, and especially near the edge of the upland, it passes into a gray or bluish clay called "blue dike," or, from the circumstance of its containing many vegetable fragments and fibres, "corky dike." These two varieties of marsh differ very materially in their agricultural value. It often happens, however, that in the growth of the deposit, portions of blue marsh become buried under red deposits, so that on digging, two layers or strata are found markedly different from each other in color and other properties; and this change may be artificially produced by digging channels to admit the turbid red waters to overflow the low blue marsh.

The red marsh, though varying somewhat in quality, is the best soil in the province, and much of it compares favorably with the most celebrated alluvial soils of the old and new worlds. The following analysis of recently deposited marsh mud from Truro, will serve to show the composition of this kind of soil.

	Moisture,	·5
	Organic matter,	1·5
Soluble in Water.	Chlorine, } as common salt,	·095
	Soda, } as common salt,	·115
	Potash,	·013
	Sulphuric Acid, } as gypsum,	·073
	Lime, } as gypsum,	·061
	Alumina,	·005
	Magnesia,	·004
Soluble in Hydrochloric Acid.	Carbonate of Lime,	3·60
	Oxide of Iron,	2·74
	Alumina,	1·20
	Magnesia,	·11
	Soda and Potash,	·8
	Phosphoric Acid,	·09
	Silicious Sand (very fine),	88·00

So valuable is this soil, though nearly destitute of organic matter, that it is found profitable to cart it upon the upland as a manure. Its best varieties have now been cropped without manure for more than two centuries without becoming unproductive; though there can be no question that under this treatment a gradual diminution of its fertility is perceptible. The weakest point of the marsh land, judging from the above analysis, is its small proportion of phosphates. It is probable, however, that this is in part compensated by the presence of fish bones and other matters of organic origin, which do not appear in an analysis. Yet I have no doubt that the cheapest manure for failing marsh will be found to be bone dust or guano, which, by supplying phosphates, will restore it nearly to its original condition. There seems no reason to suppose that a soil with the fine mixture of mineral ingredients present in the marsh mud, requires any artificial supply of ammoniacal matters. Draining is well known to be essential to the fertility of the marshes, and many valuable tracts of this land are now in an unproductive condition from its neglect. The fertility of failing marsh may also be restored by admitting the sea to cover it with a new deposit. This remedy, however, involves the loss of several crops, as some years are required to remove from the new soil its saline matter. It is, however, observed, that in some situations the newly diked marsh produces spontaneously a crop of couch grass and other plants, the seeds of which must have been washed into the sea by streams and deposited with the mud.

The low or inner marsh, which I have previously mentioned, under its other names of blue marsh and corky dike, is much less valuable than the red. It contains, however, much more vegetable matter, and sometimes approaches to the character of a boggy swamp; so that when a quantity of it is taken out and spread over the upland, it forms a useful manure. It emits a fetid smell when recently turned up, and the water oozing from it stains the ground of a rusty color. It produces in its natural state crops of coarse grass, but when broken up is unproductive, with the sole exception that rank crops of oats can sometimes be obtained from it.

The chemical composition of this singular soil, so unlike the red mud from which it is produced, involves some changes which are of interest both in agriculture and geology. The red marsh derives its color from the peroxide of iron. In the gray or blue marsh, the iron exists in the state of a sulphuret, as may easily be proved by exposing a piece of it to a red heat, when a strong sulphurous odour is exhaled, and the red color is restored. The change is produced by the action of the animal and vegetable matters present in the mud. These in their decay have a strong affinity for oxygen, by virtue of which they decompose the sulphuric acid present in sea water in the forms of sulphate of magnesia and sulphate of lime. The sulphur thus liberated enters into combination with hydrogen, obtained from the organic matter or from water, and the product is sulphuretted hydrogen, the gas which gives to the mud its unpleasant smell. This gas, dissolved in the water which permeates the mud, enters into combination with the oxide of iron, producing a sulphuret of iron, which, with the remains of the organic matter, serves to color the marsh blue or gray. The sulphuret of iron remains unchanged while submerged or water-soaked; but when exposed to the atmosphere, the oxygen of the air acts upon it, and it passes into sulphate of iron or green vitriol,—a substance poisonous to most cultivated crops, and which when dried or exposed to the action of alkaline substances, deposits the hydrated brown oxide of iron. Hence the bad effects of disturbing the blue marsh, and hence also the rusty color of the water flowing from it. The remedies for this condition of the soil are draining and liming. Draining admits air and removes the saline water. Lime decomposes the sulphate of iron, and produces sulphate of lime and oxide of iron, both of which are useful substances to the farmer.

This singular and complicated series of processes, into all the details of which I have not entered, is of especial interest to the geologist, as it explains the causes which have produced the gray color and abundance of sulphuret of iron observed in many ancient rocks, which like the blue marsh have been produced from red sediment, changed in color from the presence of organic matter. It also explains the origin of those singular stains, which, in rocks colored by iron, so often accompany organic remains, or testify to the former existence of those which have passed away."

In Nova Scotia, as in Canada, a wide break in the geological scale, occurs below the drift, although of a less extensive character than with us. Two formations—one of vast importance—absent in Canada, are there met with. These are the Permian (?) and the Carboniferous formations: the latter occupying in New Brunswick and Nova Scotia proper, a wide extent of territory. Devonian and, without doubt, Silurian strata likewise occur there; but the beds of these epochs are in general much disturbed, and rendered metamorphic by igneous action. From their less altered positions, however, numerous fossils have been collected, some of which are figured in the present work. The occurrence of still older metamorphic rocks, chiefly associated with the granites of the Atlantic coast, is also shewn to be exceedingly probable.

Much doubt at one time existed as to the true age of the red sandstone strata of these regions. Sir Charles Lyell was the first to prove that a considerable portion belonged to the Lower Carboniferous period. Satisfactory proofs of the posterior age of another portion, are entirely due to Mr. Dawson's researches. The only debateable point that remains for future elucidation, affects the question as to whether these newer strata belong to the Permian or to the Triassic epoch. The author's opinion referring them to the former, is probably the correct one. In Nova Scotia, this upper formation is chiefly limited to the inner coast of the Bay of Fundy; but it appears to occupy, on the other hand, the entire area of Prince Edward's Island. At Walton, near the mouth of the Shubenacadie, N. S., Mr. Dawson met with it resting in slightly inclined beds on the upturned edges of the lower strata; and he gives in his book, from one of his earlier papers communicated to the Geological Society, an exceedingly interesting section illustrative of this want of conformability between the two formations. The new red sandstone in Nova Scotia is every where traversed by extensive outbursts of trap belonging to the same geological period. Cape Blomidon, Cap d'Or, and other bold and picturesque headlands of the Bay of Fundy, are thus constituted. These trap localities offer to the mineralogist a rich harvest of zeolitic and other specimens. As in the older trap of Lake Superior, native copper is also present, but in comparatively small and unimportant quantities. Following Dr. Jackson and others, Mr. Dawson attributes the origin of the copper to deposits from solutions by electro-chemical action: although he states at the same time, "why this deposit should have occurred in trap rock does not appear very obvious"; and, furthermore—"when we take a piece of native copper from Lake Superior or Cap d'Or, with the various calcareous and silicious minerals which accompany it, nothing can be more difficult than to account on chemical principles for these assemblages of substances, either by aqueous or igneous causes." There can be no doubt that the precipitation of metallic copper by natural voltaic agencies is a phenomenon of actual occurrence; and, looking, amongst other circumstances, to the small amount of copper present in the trap of Nova Scotia, we might be justified, were further considerations kept out of view, in adopting the author's conclusions for that particular locality. But, with regard to the origin of the Lake Superior copper, occurring in such vast and apparently inexhaustible masses in the more ancient trap of that district, we hold the opinion of Agassiz and other observers, to be the true one, viz.—that, like the igneous rock with which it is so intimately blended, the copper is itself of igneous origin. If we allow the copper to be an igneous product, its occurrence in these igneous rocks of different geological ages, and in widely-remote localities—as in the Silurian trap of Lake Superior, the Triassic or

Permian trap of Connecticut, New Jersey and other States of the Union, in the same trap of Nova Scotia, of Baumholder in Rhenish Prussia, &c., becomes clearly intelligible; whilst, on the electro-chemical theory, its connection with this igneous rock, as truly stated by Mr. Dawson, is without any obvious explanation. This alone would be a strong argument in favor of its igneous origin; and when we consider the enormous amount present in the Lake Superior trap, and the absence of secondary products, such as must have resulted from the precipitation of this immense volume of metal from an aqueous solution, the case becomes still further strengthened. The only real objection to the igneous view, arises from the presence of zeolites and calc-spar, often in the closest association with the copper. Allowing the zeolites present in most traps, to be, as a general rule, after or secondary products arising from a decomposing process in the trap itself, we cannot obviously apply this argument to the copper. We know furthermore that many basalts—tough and unweathered—actually contain both zeolites and carbonates as constituents of their mass. That such constituents, moreover, cannot in all cases at least, be the result of alteration and decomposition, is plainly proved by the presence of *metallic iron* in certain basalts, as shewn by the interesting researches of Dr. Andrews. Nay, our author himself, in a very able discussion of the facts connected with the formation of the iron veins of the Cobequid Hills, assigns to *ankerite*—a compound of the isomorphous carbonates of lime, protoxide of iron, and magnesia—an eruptive or igneous origin. His views, in this respect, may not meet the approbation of all geologists, but we regard them as perfectly legitimate. An extensive examination of very numerous specimens of vein-stones and mineral aggregations, with particular reference to this question, has established in our mind the firm conviction that carbonate of lime does at times undoubtedly originate, or crystallize, from a directly igneous source. Indeed, all modern researches tend to shew, that there exists in nature scarcely a single mineral substance which is not sometimes produced by aqueous and sometimes by igneous agencies. With regard to the occurrence under particular conditions of hydrated minerals and carbonates in trap rocks, we may call to mind that volumes of steam and emanations of carbonic acid are largely given off from modern lavas, not immediately after their transmission from the volcanic orifice, but so soon as their temperature has cooled down below a certain point. If, by various readily-conceivable causes, the emission of these products be prevented, the formation of hydrated and carbonated compounds becomes a necessary result. In certain Etnean lavas, known by the somewhat loosely-applied term of Cyclophyre, the substance of the rock consists essentially of analcime and augite.*

Briefly to sum up our review of this vexed question, it appears to us that two phenomena have here mainly to be accounted for. First, the connexion of the copper with trap of different ages and localities; and, secondly, its association with carbonates and hydrated minerals. The former is satisfactorily met by the igneous hypothesis, but left altogether unexplained by the adoption of the electro-chemical or voltaic theory. The second phenomenon, if apparently opposed to the igneous explanation, is, when rightly considered, equally opposed to the other view. A single example, beyond the objections already cited, will suffice to uphold our assertion. It is well known that the Lake Superior copper frequently bears, even to the minutest striæ, the most distinct impressions and moulds of the accompanying calcite crystals—shewing incontestibly that these crystals must have been consolidated prior to the consolidation of the copper. Now, we have found, by actual experiment, that calc-spar in aqueous solutions of copper salts, is readily converted on the surface into malachite: whereas, the calc-spar crystals of Lake Superior, when extracted from their cupreous matrix, are perfectly white and unaltered upon the surface. Malachite, moreover, according to Whitney and Foster (Second Report, p.101), is all but unknown in the district, except as a mere superficial product due to the present action of the atmosphere. On taking leave of this subject, it should finally be pointed out, that carbonate of lime—equally with quartz, the zeolites, &c.—is a *non-conductor:* and hence in artificial precipitations of copper by the process under consideration, no deposit will take place upon this mineral unless its surface be coated with graphite or some other conducting substance.†

The most important rock-group of Nova Scotia belongs to the great carboniferous epoch. The coal-bearing rocks of this system,

* Some very interesting remarks and experiments by Professor Bunsen of Marburg. on the artificial formation of zeolitic silicates by heat, may be seen in Von Leonhard's Jahrbuch for 1851, p. 861. See also the Annual Address of the President of the Chemical Society of London (Professor Daubeny) for 1853.

† Two other views have also been advanced in elucidation of the origin of theso copper deposits. One assumes the copper to have been produced by the action of the trap on copper pyrites and other ores; but this theory fails to explain the occurrence of copper sulphides associated with the same erupted rock in neighbouring localities. The second theory supposes the copper to have originated from the reducing action of free hydrogen on volatile copper compounds, as Cu Cl. In controversion of this, the unparalelled amount of the copper may be referred to. At the same time, the origin of the little veinlets and arborescent ramifications may perhaps be rightly attributed to some effect of the kind in question; but their deposition within zeolites and other non-conducting bodies, by electro-chemical action on metallic solutions, is certainly devoid as yet of any satisfactory explanation.

so largely developed in the province, are not only of the greatest economic value, but also of the highest interest in a purely scientific point of view. The following synoptical arrangement of the rocks of this group, as occurring in Nova Scotia and New Brunswick, is given by Principal Dawson:

SYNOPSIS OF THE CARBONIFEROUS ROCKS OF NOVA SCOTIA.

UPPER OR NEWER COAL FORMATION.

Grayish and reddish sandstones and shales; with beds of conglomerate, and a few thin beds of limestone and coal, the latter not of economic importance.—Thickness 3,000 feet or more.

Characteristic Fossils.—Coniferous Wood, Calamites, Ferns, &c.

Localities.—Cumberland north of the Cobequid mountains, Northern Colchester, Pictou. Well exposed in the Joggins coast, and in the coast of Northumberland Strait west of Pictou Harbour.

LOWER OR OLDER COAL FORMATION.

Gray and dark-coloured sandstones and shales, with a few reddish and brown beds; valuable beds of coal and ironstone; beds of bituminous limestone, and numerous underclays with *Stigmaria*. Thickness 4,000 feet or more.

Characteristic Fossils.—Stigmaria, Sigillaria, Lepidodendron, Poacites, Calamites, Ferns, &c. Erect trees *in situ.* Remains of Ganoid Fishes, *Cypris*, *Modiola*, and Reptiles of three species.

Localities.—Cumberland north of Cobequid mountains; Pictou, especially East River; Port Hood, Inhabitants Basin, and other places in Inverness and Richmond; Eastern part of Cape Breton; parts of Colchester south of Cobequid mountains. Finest exposures: South Joggins, and near Sydney, Cape Breton.

LOWER CARBONIFEROUS OR GYPSIFEROUS FORMATION.

Great thickness of reddish and gray sandstones and shales, especially in upper part; conglomerates, especially in lower part; thick beds of limestone with marine shells, and of gypsum. Thickness 6,000 feet or more.

Characteristic Fossels.—Productus, Terebratula, Encrinus, Madrepores, and other marine remains in limestones. *Coniferous Wood, Lepidodendron, Poacites, &c.*, in shales and sandstones. Scales of Ganoid Fishes very abundant in shale, associated with lowest beds, in which are also small coaly seams and bituminous beds.

Localities.—Northern Cumberland, Pictou, Colchester, Hants, Musquodoboit in Halifax county, Guysboro' in part, parts of Inverness, Richmond, Cape Breton, and Victoria.

The actual superposition and arrangement of all this great thickness of beds are ascertained by the examination of coast and river sections, in which portions of the series are seen tilted up, so that they can, by proceeding in the direction toward or from which they incline, be seen to rest on each other. There is one coast section in the province so perfect that nearly the whole series is exposed in it. On the other hand, there are large areas in which the lower portion alone exists, and perhaps never was covered by the upper portions; and there are other areas in which the upper members have covered up the lower, so that they appear only in a few comparatively limited spots.

The area occupied by carboniferous rocks in Nova Scotia and New Brunswick is very extensive; and in Nova Scotia it is divided by ridges of the old metamorphic rocks into portions which may for convenience be considered separately. These are—

1. The Cumberland Carboniferous district, bounded on the south by the Cobequid hills, and continuous on the north-west with the great Carboniferous area of New Brunswick.

2. The Carboniferous district of Hants and Colchester, including the long band of carboniferous rocks extending along the south side of the Cobequids, and that reaching along the valley of the Musquodoboit river.

3. The Carboniferous district of Pictou, bounded on the south and east by metamorphic hills, and connected on the west with the Cumberland district, and that last mentioned.

4. The Carboniferous district of Sydney county, bounded by two spurs of the metamorphic hills.

5. The long stripe of Carboniferous rocks extending from the Strait of Canseaus westward through the county of Guysboro'.

6. The Carboniferous district of Richmond county, and southern Inverness.

7. The Carboniferous district of Inverness and Victoria counties.

8. The Carboniferous district of Cape Breton county.

To the first of the above geographical divisions—the Cumberland district—belongs the celebrated South Joggins section, so well known to geologists by Mr. Logan's elaborate description and measurements, comprising 14,571 feet of vertical thickness.* A graphic and very interesting account of this remarkable line of coast, illustrated by numerous drawings, is given in Mr. Dawson's book; and the other Carboniferous districts are also described in an equally comprehensive manner. But brief extracts from this portion of the work would be doing it an injustice, and hence we pass on to a concluding quotation, embracing a summary of what may yet be expected from future geological researches in these interesting regions :—

"As a fitting sequel to my account of the present state of our knowledge of Acadian geology, I may shortly mention in conclusion, the most promising directions of future enquiry, and the extent of the work that remains to be done.

The carboniferous system has for some time been the most productive field of investigation, and its structure in those localities where the best sections occur is well known. Its geographical limits, however, and its structure in the more inland and less exposed localities, require much farther study; and the extent and value of the coal-seams, ironstone, manganese ores, limestone, gypsum, freestone, &c., are yet imperfectly known, and well merit public as well as private efforts for their exploration. The fossil remains of this system still afford a large field for discovery. The great interest of the discoveries already made, shows that Nova Scotia is equal to any country in the world in the opportunities which it offers in

* "In 1841"—states our author in another part of the volume—"W. E. Logan, Esq., now provincial geologist in Canada, made a short tour in Nova Scotia, and contributed a paper on the subject to the Geological Society of London. In 1843, Mr. Logan in passing through Nova Scotia on his way to Canada, visited the South Joggins, and executed the remarkable section which he published in 1845 in his first Report on the Geology of Canada. This section, which includes detailed descriptions and measurements of more than fourteen thousand feet of beds, and occupies sixty-five octavo pages, is a remarkable monument of his industry and powers of observation."

this department; and in a country where so many curious relics of the ancient world are constantly being exposed and washed away in the coast cliffs, even persons themselves unacquainted with geology may advance the interests of science by preserving such specimens, and making them known to those who can decide on their scientific value.

The metamorphic districts present a large and almost unexplored field. The valuable metallic deposits already found in them encourage the expectation that farther useful discoveries may be made. The unravelling of the relations of these disturbed and altered beds would require long labour and much thought from the most practised and acute observers. The fossils which occur in the less altered portions of their margins are very numerous, and well deserve the attention of palæontologists, as belonging to an outlying portion of the great Devonian and Upper Silurian area of North America, far removed from the districts in which the fossils of that period are best known. This ground may in part be occupied by private observers and mining surveyors, but I have no hope that it will be fully worked out without the aid of a public survey.

The trap and new red sandstone of the Bay of Fundy are a vast storehouse of curious and beautiful minerals, of great interest to students in mineralogy. These rocks also furnish excellent opportunities for studying the phenomena of volcanic action as it existed in the secondary period. The solitary reptilian jaw found in Prince Edward Island holds forth the hope that, in the many miles of coast cliff of the new red in that island and in Nova Scotia, other discoveries of similar character may await zealous collectors.

In the surface gravels and drift, and in fissures of rocks laid open by excavations, fossil remains, whether of large animals like the mastodon, or of shells or land plants, should be carefully sought for. The deposition of marine mud in the Bay of Fundy has afforded many interesting illustrations of geological facts, and may afford more; and the agency of coast-ice in removing the masses of rock, and otherwise acting on the shores and cliffs, is a subject at present of much interest, and one of which the shores of the Acadian provinces present many illustrations."

In concluding our remarks on this important contribution to geological science, we must not omit to mention that the value of the work is much enhanced by a great number of chemical examinations of various samples of coal, undertaken by Principal Dawson himself.

E. J. C.

The Song of Hiawatha. By H. W. Longfellow. Boston: Ticknor & Fields. 1855.

A new poem by Longfellow might have been imagined to be an announcement welcome to all men, but especially to his countrymen—not generally indisposed to a sufficiently ostentatious pride in relation to all that is their own. Not such, however, is the case with this, the most genuinely native song that has yet given voice to the wild wood-notes of our ancient forests. Heedless of time or place, Longfellow should have made his Indian Cadmus reason like one of Milton's metaphysical devils, or a German professor of the nineteenth century, and all would have admired. But as it is, American critics seem to vie with one another in casting contempt and ridicule on a poem, which in a fine flow of simple, musical verse, artless and yet most artful, embodies the myth of the New World's heroic age. True, it has not anywhere the deep earnest meaning to be found even in Tennyson's quaint "Medley." But from its absence from this poem, it would be unjust to assume that the poet is therefore incapable of such. Sufficient is it that much of the profoundly suggestive thought of the "In Memoriam" would be as much out of keeping with this tenderly simple Indian epos, as the scholastic theses of mediœval doctors, if transferred from the school of Salerno of "The Golden Legend," to the Indian council lodge. Nevertheless "Hiawatha" has its inner meanings too, finely suggestive to the sympathetic mind; and appealing, not unsuccessfully, in its simple utterances, to those:

> "Whose hearts are fresh and simple,
> Who have faith in God and Nature,
> Who believe that in all ages
> Every human heart is human;
> That in even savage bosoms
> There are longings, yearnings, strivings
> For the good they comprehend not,
> That the feeble hands and helpless,
> Groping blindly in the darkness,
> Touch God's right hand in that darkness,
> And are lifted up and strengthened."

The monotonous cadence of the verse has been imitated by satiric critics, who have found no difficulty in turning it into burlesque and vulgar parody; while others, seeking a new point of attack, assail its originality, and find that the measure of the Indian "Hiawatha" breathes not of the forests of the wild West, but is stolen, in every note, from the old songs of Europe's Northmen. An amusing confusion in some of the charges thus advanced, betrays the ignorance of their originators of the essential difference in race and language between the Ugrian Fin and the true Scandinavian Norseman. The evidence, moreover, adduced, and complacently accepted, in proof of the poetic theft, is, oddly enough, in the form of *ex post facto* English translations. One Philadelphia critic, indeed, presents his extract from the old Finnish epic of "Kalewala," as confessedly "done into English from the German translation" of Anton Schiefner. Fancy a couplet of Pope produced in evidence of a theft from old Homer! Yet here the extravagance is even more glaring, for it is the translation of a translation in which we are to recognise the original.

Longfellow's familiarity with both the ancient and modern languages of northern Europe is well attested, and no doubt he knows, much better than his critics, that the alliteration and verbal repetitions, on which chiefly rest the evidences of his supposed plagiarism from Finnish or Norse poets, is not only adducible from the ancient poems of Scandinavia, but from those of his own fatherland—both Celtic and Anglo-Saxon. It is no very rare blunder of the shallow critic to mistake for something peculiar and individual, a characteristic common to a whole age. The following extract from Layamon's "Brut d'Angleterre" may suffice as an early example of the alliterations and verbal recurrences which so puzzle the critics of New York, but were nevertheless familiar to their Anglo-Saxon forefathers ages ago, in that semi-Saxon translation of the thirteenth century. To Layamon's old version we add our own Canadian one, not as an attempt to convert its simple inventory into *poetry* like that of Longfellow, but merely to shew the ease with which such verse may be rendered into the measure of "Hiawatha:"—

"Tha the king igeten hafde
And al his mon-weorede,
Tha bugen ut of burhge
Theines swithen balde.
Alle tha kinges: and heroe here-thringes,
Alle tha biscopes: and alle tha clarckes,
Alle tha eorles: and alle the beornes,
Alle tha theines: alle tha sweines,
Feire iscrudde: helde geond felde.
Summe heo gunnen œrnen,
Summe heo gunnen urnen,
Summe heo gunnen lepen,
Summe heo gunnen sceoten,
Summe heo wræstleden
And wither-gome makeden," &c.

Both Kemble and Thorpe have edited this ancient translation of Wace's "Brut," but in the absence of their versions, we take the semi-Saxon from Ellis, and in the following rendering of it into modern English, adhere pretty closely to the literal text:—

There the king then having feasted,
And his multitude of warders,
Forth there hastened out of burgh
All the people very quickly.
All the kings and throng of servants,
All the bishops, all the clergy,
All the earls, and all the nobles,
All the thanes, and all the peasants,
Gaily mantled, thronged the meadows
And betook them to their pastimes.

Some contended with their arrows,
Some contended with their lances,
Some contended in the races,
Some contended in the leaping,
Some contended in the wrestling,
And in games of emulation, &c.

Alliteration is the earliest form of rhyme, and is characteristic of all the old poetry of northern Europe. We find it in full use, alongside of Latin in rhyming leonines, in the "Piers Ploughman," temp. Edward III., the immediate precursor of the regular rhyming heroics of Chaucer. Its revival in the, so called, rhymeless octosyllabics of "Hiawatha" was too delicate a chord for the dull ears of critics, open only, like those of their American Mocking-bird, to stolen sounds; yet in the following, the alliteration, though irregular and intermittent, is as musical as any rhyme:—

"Thus continued Hiawatha:
That this peace may last forever,
And our hands be clasped more closely,
And our hearts be more united,
Give me as my wife this maiden,
Minnehaha, Laughing Water,
Loveliest of Dacotah women.
* * * *
And the lovely Laughing Water
Seemed more lovely, as she stood there,
Neither willing nor reluctant,
As she went to Hiawatha,
Softly took the seat beside him,
While she said and blushed to say it:
I will follow you my husband!
This was Hiawatha's wooing;
Thus it was he won the daughter
Of the ancient Arrow-maker,
In the land of the Dacotahs!"

The verse to our ear is charming. The models assumed to have suggested its form and measure, were free to all poets, just as nature is free to them, and here is the one poet who has turned them to account in a song of the forest echoes. Its alliterative monotone is unmistakeably suggestive of the child-like simplicity with which the unsophisticated Indian improvisatore may be conceived to well forth his rythmic tale to willing ears. Yet this monotone is most skilfully used. It is like the music of a Paganinni, bringing melody from one string, such as meaner artists expend in vain all the appliances of their art and instruments to equal. A singularly pleasing combination of monotone and variety is effected by the recurrence of the same idea, and of the words, in successive and in distant lines; sometimes with a scarcely perceptible variation, like the first slight turn of the kaleidoscope, the same and yet changed: a trick of art which—instead of looking to ancient and foreign originals—we fancy to have its model in another of America's own native poems, "The Raven," of that reckless outcast genius, Edgar Allan Poe. To us at least, all dissimilar as the two poems are, in rythm, and in idea, the music of the one rings in the ear with a memory of the other, as of changes rung on the same village bells.

The art with which all art is concealed is not the least source of the charm of "Hiawatha." It has nothing artificial about it; none of the modern drawing-room fopperies with which Macpherson overlaid his Celtic "Ossian." Nothing incongruous brings the fashions of Broadway into the forest glades; but all its metaphors and similes take their tinge from the wilds of the far west, even when giving form to thoughts which the Indian has scarcely realised. How graphic is this:—

"As unto the bow the cord is,
So unto the man is woman;
Though she bends him, she obeys him,
Though she draws him yet she follows,
Useless each without the other!"

How finely, too, the very profoundness of the forethought of the Indian Cadmus, who would teach his people letters and the art of picture-writing, is tempered into consistent harmony with the forest children and their simple arts, by the introductory illustrations:—

"In those days, said Hiawatha,
Lo! how all things fade and perish!
From the memory of the old men
Fade away the great traditions,
The achievements of the warriors,
The adventures of the hunters,
All the wisdom of the Medas,
All the craft of the Wabenos,
All the marvellous dreams and visions
Of the Jossakeeds, the Prophets!
Great men die and are forgotten,
Wise men speak; their words of wisdom
Perish in the ears that hear them,
Do not reach the generations
That, as yet unborn, are waiting
In the great mysterious darkness
Of the speechless days that shall be!"

It is not necessary to occupy space with large quotations. The reader who enters into the true feeling of this genuine song of the New World, will find himself borne along with something of the exhilarating pleasure with which it may perchance have been his fortune to glide down some of our great rivers in an Indian's birch canoe; and will not willingly pause till he reaches the beautiful closing scene of Hiawatha's departure. Hiawatha, like the Arthur of the Britons, or the Barbarossa of Germany, is to come again. But now he has waved his farewell, launched his canoe, and whispered to it "westward!"

"And the evening sun descending
Set the clouds on fire with redness,
Left upon the level water
One long track and trail of splendour,
Down whose stream, as down a river,
Westward, westward, Hiawatha
Sailed into the purple vapors,
Sailed into the dusk of evening.
And the people from the margin
Watched him floating, rising, sinking,
Till the birch-canoe seemed lifted
High into that sea of splendor,
Till it sank into the vapors
Like the new moon, slowly, slowly
Sinking in the purple distance.
And they said: Farewell forever!
Said: Farewell, O Hiawatha!
And the forests, dark and lonely,
Moved through all their depths of darkness,
Sighed: Farewell, O Hiawatha!
* * * *
Thus departed Hiawatha,
Hiawatha the beloved,
In the glory of the sunset,
In the purple mists of evening,
To the regions of the home-wind,
Of the Northwest wind Keewaydin,
To the Islands of the Blessed,
To the Kingdom of Ponemah,
To the land of the Hereafter!" D. W.

What is Technology?—An Inaugural Lecture. By George Wilson, M.D., F.R.S.E., Regius Professor of Technology, Edinburgh University. Edinburgh, Sutherland & Knox. 1855.

During the past year a new chair has been established in the University of Edinburgh, viz., that of Technology, to which Dr.

George Wilson, Director of the Industrial Museum of Scotland, has been appointed.

The establishment of this chair has excited considerable interest on account of its being new, not only to the University of Edinburgh, but also to all the British Colleges, although it always has its place in the Continental seats of learning. Moreover, the real meaning of the term, and the extent and range of subject embraced by the professorship, were so little understood, as to give rise in the minds of some to apprehensions of interference with already existing chairs. Professor Wilson, in his inaugural and introductory lecture, has defined very clearly the meaning of the term and the extent of the science, and has shown at the same time that his teaching need not in the slightest degree interfere with that of his brother professors.

Technology, the *Science of the Arts*, or, as generally restricted, the *Science of the Useful Arts*, has never heretofore been admitted as a separate branch of study in any of our Universities, although from the practical nature of the subjects treated of, it must be allowed to be one of the greatest importance. Great advantages must undoubtedly be derived from young men, when about to enter on the world, having an opportunity of attending lectures in which the various manufactures are minutely described, the numerous improvements which are constantly taking place elucidated, and the scientific principles on which the varied processes depend, fully explained.

In the instance now referred to, and under the present talented incumbent, we may expect that the usefulness of the chair will be very great, and widely acknowledged, especially from its connection with that exceedingly valuable institution, the National and Industrial Museum of Scotland.

"The Industrial Arts included in the domain of Technology admit of a simple division into mechanical and chemical arts, according as they are mainly related to Physics or to Chemistry." It is to the latter division that Professor Wilson's attention will be principally directed, although several of the subjects of which he proposes to treat, belong more strictly to the former; for instance, the process of carding, spinning and weaving; the use of electricity in the electric telegraph; the employment of the same agent in electrotyping, and the action of light in photography. The two latter subjects stand midway, as it were, between the physical and the chemical divisions. Among the subjects which are properly treated of in a course of lectures on Technology, the following may be mentioned: The economy of heat and light, the different means of ventilation, the nature and properties of the various fuels, their employment in furnaces and lamps for the production of light and heat, and the construction of such apparatus, the manufacture of gas for illuminating purposes, of candles, soap, matches, gunpowder and other explosives.

A very important branch is that which treats of the manufacture of pigments and the application of colors to textile fabrics. The application of chemical science to the processes of dyeing and calico printing, has produced the most important changes during the last twenty or thirty years, and much still remains to be done in this department. The manufacture of the different alkalies and of those of their salts which are of industrial importance, the extraction of the various metals from their ores, and the preparation of the numerous useful compounds formed by them, the manufacture of china, pottery and glass in all their different varieties; the processes of paper-making, glass-etching and staining, of printing and engraving, of cooking, baking, and preserving meats, of manufacturing sugar and starch, as well as an infinity of others too numerous to mention, all come within the range of this most extensive science.

In the University of Berlin and in others in the larger towns of Germany, the plan is adopted of illustrating the lectures, not merely by specimens of the various manufactures and accurate sectional models, but also by personal inspection of the factories themselves. Every week the lecturer makes an excursion to some foundry, gas-work, porcelain manufactory, brewery or other factory, which he has been describing during the week, and gives to his students on the spot what may be compared to the clinical lectures of the physician. Such a plan has great advantages, but is only applicable in large towns where manufactories abound. In Canada a Professor of Technology would be rather restricted in his selections.

The importance of the subject of Technology is, at present, so obvious that it is to be hoped the example of Edinburgh will be speedily followed by other Universities both in England and in this country. One or two passages from the Lecture which has suggested these remarks, will serve to illustrate its style and mode of treatment of the subject. After some preliminary observations, the definition of the science is thus specified in certain of its relations:—

"It is by a quite conventional limitation, that the word Art, τεχνης (*technes*,) denoted by the first dissyllable of Technology, is held to signify useful, utilitarian, economic, or industrial art, for the useless arts, such as legerdemain, or the art of conjuring, are eminently technical, and still more so are the worse than useless arts, such as cheating at cards, and other sorts of dishonest gambling.

"Nor is the limitation less conventional which excludes the Fine Arts from the domain of Technology; for no arts call for more skilful workmen than Painting, Sculpture, and Music, and none are more technical in their modes of procedure. Far less are the Fine Arts excluded, because they are regarded as useless or hurtful. The Technologist avoids them for exactly the opposite reason. Poetry, Painting, Sculpture, Music, and the sister arts, are in the highest degree useful, inasmuch as they minister to the wants of the noblest parts of our nature; but in so ministering they excite such emotions of pleasure, or its inseparable correlative, pain, that the sense of their usefulness is lost in the delight, or awe, or anguish, which they occasion. So much is this the case, that while men thank each other for the gift of bread when hungry, or of water when they are thirsty, or of a light to guide them in the dark, they return no thanks for a sweet song, or a great picture, or a noble statue; not that they are unthankful for these, but that the duty of thanksgiving is forgotten in the pleasure of enjoying, or the strangely fascinating pain of trembling before a work of creative genius.

"And the artist himself, singularly enough, in a multitude of cases, makes no complaint at this thanklessness, and counts it no compliment to his work to call it useful. The end of Æsthetic or Fine Art, he will tell you, is the realisation of beauty, not utility; as if the latter were rather an accidental or unavoidable and unfortunate accompaniment of the former, than the welcome inseparable shadow which attends it, as the morning and evening twilight, tempering his brightness, go before and after the sun. But such a description of the aim of his labours, though natural to the artist, is unjust to his art. The true object of Æsthetic or Fine Art is not beauty, but *utility, through or by means of beauty*.

"It may be that the poet, the painter, the sculptor, the musician, often think only of the emotional delight which their works will awaken in the hearts of their brethren. But these works, in the very act of delighting, serve those whom they delight. It is surely as useful a thing, on occasion, to fill the eager ear with music, or the longing eye with the glories of form and colour, or the aching heart with thoughts of joy, as it is to fill the hungry stomach with food, or to clothe the naked body.

"It is not, then, because the utility of the Fine Arts is questioned, that they are excluded from the domain of Technology. Neither is it because the feeling of their usefulness is lost in that of their delightfulness; but because they are not useful in the sense of being *indispensable*. The Utilitarian Arts do not stand contrasted with them, as loving ugliness or hating beauty; they have no direct concern with either. Their defining characteristic is not that they deal with what is beautiful or unbeautiful, but with what is *essential* to man's physical existence. The Fine Arts are, in a certain sense, superfluous arts. The savage does not know them. The great mass of civilized mankind pass from the cradle to the grave, almost untouched by their charms. Few men can spend more than a small portion of their lives upon them. Even the greatest artists are such only at long intervals. Shakespeare was not always poetising, or Raphael painting, or Mendelssohn singing. Lengthened seasons of unproductive sadness mark the lives of them all. Like the fabled pelican, they feed others with their life-blood; and it would almost seem as if, in proportion to the delight which they gave to others, they were miserable themselves. Wordsworth, whose own life was a happy exception to this rule, declares of his brethren as a class, that 'they learn in suffering what they teach in song.' 'A thing of beauty,' Keats has told us, 'is a joy for ever,' but no poet has affirmed that it is a joy at all times."

Again, the fancies employed in the illustration of the following contrast between the products of instinct and reasoning intelligence, are happily put before the student of Technology:—

"It is with every-day life, and every-day cares, that Technology, in one aspect, has to do; with man, not as 'a little lower than the angels,' but 'as crushed before the moth,' and weaker than the weakest of the beasts that perish; with man as a hungry, thirsty, restless, quarelsome, naked animal. But it is also the province of Technology to show, that man, because he is this, and just because he is this, is raised by the industrial conquests which he is compelled to achieve, to a place of power and dignity, separating him by an absolutely immeasurable interval from every other animal.

"It might appear, at first sight, as if it were not so. As industrial creatures we often look like wretched copyists of animals, far beneath us in the scale of organisation, and we seem to confess as much by the names which we give them. The mason-wasp, the carpenter-bee, the mining caterpillars, the quarrying sea-slugs, execute their work in a way which we cannot rival or excel. The bird is an exquisite architect; the beaver a most skilful bridge builder; the silk-worm the most beautiful of weavers; the spider the best of net-makers. Each is a perfect craftsman, and each has his tools always at hand. Those wise creatures, I believe, have minds like our own, to the extent that they have minds, and are not mere living machines, swayed by a blind instinct. They will do one thing rather than another, and do that one thing in different ways at different times. A bird, for example, selects a place to build its nest upon, and accommodates its form to the particular locality it has chosen; and a bee alters the otherwise invariable shape of its cell, when the space it is working in forbids it to carry out its hexagonal plan. Yet, it is impossible to watch these, or others among the lower animals, and fail to see that, to a great extent, they are mere living machines, saved from the care and anxiety which lie so heavily upon us, by their entire contentment with the present, their oblivion of the past, and their indifference to the future. They do invent, they do design, they do exercise volition in wonderful ways; but their most wonderful works imply neither invention, contrivance, nor volition, but only a placid, pleasant, easily rendered obedience to instincts which reign without rivals, and justify their despotic rule, by the infallible happiness which they secure, There is nothing, accordingly, obsolete, nothing tentative, nothing progressive, in the labours of the most wonderful mechanicians among the lower animals. It has cost none of these ingenious artists any intellectual effort to learn its craft, for God gave it to each perfect in the beginning; and within the circle to which they apply, the rules which guide their work are infallible, and know no variation.

"No feathered Ruskin appears among the birds, to discuss before them whether their nests should be built on the principles of Grecian or Gothic architecture. No beaver, in advance of his age, patents a diving-bell. No glow-worm advocates, in the hearing of her conservative sisters, the merits of new vesta-lights, or improved lucifer matches. The silk-worms entertain no proposition regarding the substitution of machinery for bodily labour. The spiders never divide the House on the question of a Ten Hours Working Bill. The ants are at one on their Corn-laws. The wasps are content with their Game-laws. The bees never alter their tax upon sugar; nor dream of lessening the severities of their penal code: their drones are slaughtered as relentlessly as they were three thousand years ago; nor has a solitary change been permitted since first there were bees, in any of their singular domestic institutions.

"To those wise creatures the Author of All has given, not only infallible rules for their work, but unfaltering faith in them. Labour is for them not a doubt, but a certainty. Duty is the same thing as happiness. They never grow weary of life; and death never surprises them. Wonderful combinations of individual volition, pursuing its own ends, and of implicit surrender to Omnipotent will, subduing all opposition, they are most wonderful in the latter respect and are less to be likened to us, than to perfect self-repairing machines, which swiftly raise our admiration from themselves, to Him who made and who sustains them.

"We are industrial for other reasons, and in a different way. Our working instincts are very few; our faith in them still more feeble; and our physical wants far greater than those of any other creature.

"Had the assembled lower animals been invited to pronounce upon what medical men call the 'viability,' or managers of insurance offices 'the chances of life,' of the first human infant, their verdict would have been swift, perhaps compassionate, but certainly inexorable. The poor little featherless biped, pitied by the downy gosling, and despised by the plumed eaglet, would have been consigned to the early grave, which so plainly in appearance awaited him; and no mighty Nimrod, with endless lion slaying hunter-sons, would have been seen to dawn in long perspective above the horizon, and claim the fragile infant as their stalwart father.

"Yet the heritage of nakedness, which no animal envies us, is not more the memorial of the innocence that once was ours, than it is the omen of the labours which it compels us to undergo. With the intellect of angels, and the bodies of earth-worms, we have the power to conquer, and the need to do it. Half of the industrial arts are the result of our being born without clothes; the other half of our being born without tools."

We refer to this able lecture rather for the purpose of commending the subject which it advocates, than its own literary merits, to the notice of our readers, but the above quotations, brief as they are, will suffice to shew that it has attractions no less on the latter score, than on the former.

H. C.

Junius Discovered. By Frederick Griffin. Boston: Little, Brown & Co. Toronto: A. H. Armour & Co. 1854.

"Junius Discovered" is the somewhat bold title attached to a volume, the first work of a Canadian author, who tells us that his pen has hitherto been untried, and that his native city and home of Montreal, in which it has been produced, possesses no public library, and few private literary resources of any avail to the student who undertakes the solution of this intricate and long vexed question. In spite of such obstacles to success our Canadian author has produced an interesting contribution to the miscellany of "Junius" literature, which has hitherto met with undue neglect. His great error lies in the conversion of the *may be* into the *must be*, which characterises so much of the logic employed in this favourite controversy.

Junius, occupying such a social rank or official position as furnished to him information of the most vital importance in relation to public men and measures in the eventful political era from 1767 to 1772, writes his series of carefully elaborated pseudonymous letters for the *Public Advertiser*, with the certainty that every sentence was watched by those whom he assailed with such acute vigour and bitterness, and that, as he says, in writing to Woodfall: "I must be more cautious than ever. I am sure I should not survive a discovery three days; or if I did they would attaint me by bill." What more certain, therefore, than that he purposely misled, in many instances, by his allusions. This he himself unhesitatingly takes credit for defying his antagonists to trace him through his various disguises, or to discriminate between the real and assumed characteristics of one, whose own words make so appropriate a motto to this inquiry after the substance of the illusory *umbra* calling itself Junius: "there never existed a man but himself who answered to so complicated a description." Taunting one of his assumed detectors, he says: "But Horne asserts that he has traced me through a variety of signatures. To make the discovery of any importance to his purpose, he should have proved either that the fictitious character of Junius has not been consistently supported, or that the author has maintained different principles under different signatures." What then is the value of the unknown quantity: truth, mixed up, for the very purpose of deception, with all this fiction? Till that is determined how shall we ever know whether we are taking our portraiture from the substance or the shadow; from the living original, or from the masked and disguised decoy, purposely stuffed out and set up to deceive? Nevertheless, because Junius uses such phrases, as: "*every ignorant boy* thinks himself fit to be a minister;" therefore he could not be less than fifty! Because he says to Sir W. Draper, a Cambridge man: "You might have learnt *at the University* that a false conclusion is an error," &c., therefore "Junius was educated at Cambridge!" And because, when familiarly making use of terms of law, he adds: "do not injure me so much as to suspect I am a lawyer, I had as lief be a Scotchman;" therefore he was *no* lawyer! Would not this logic be quite as good, under all the circumstances, if it affirmed the very opposite conclusion? Certainly, at least, the latter sentence has not prevented a Scotch philosopher, Sir David Brewster, from adding a *Mac* to the name of Junius, and putting him in kilts !—any more than the "fact" of his being "a Cambridge man," has prevented the discovery, by Grattan, and other equally competent judges, "from the internal evidence of the style, that Burke was the author of Junius." "Among other instances," says Curran, "Grattan used to insist upon it that no living man but Burke could have written that passage in one of the letters to the Duke of Grafton: 'You have now fairly travelled through every sign in the political Zodiac, from the Scorpion in which you stung Lord Chatham, to the hopes of a Virgin in the house of Bloomsbury.'"

By logic not much better, or worse, Junius has long since been identified as single-speech Hamilton; Butler, Bishop of Hereford; Major General Lee; Lieut. Col. Barré; Lord Ashburton; Lord Lyttleton; Lord George Sackville; the Earl of Chatham; the Duke of Portland; Wilkes; Horne Tooke; and Sir Philip Francis; to say nothing of sundry names of little note among the contemporaries of the long-sought letter-writer, yet not on that account less likely to include the true one. He has now been incontestably proved to have been a Peer, to have been a member of the House of Commons, to have been a Bishop, a Lawyer, a General, and a Colonial Governor; and equally certain to have been none of the six! Writer after writer has undertaken to solve the riddle; volume has succeeded volume from able pens, in support of their several favourities; and when our Canadian discoverer of Junius adds to these one more, he must not complain if we ask for conclusive proof before we can admit that Thomas Pownall, Governor of Massachusetts Bay, is the real and unquestionable Junius.

The following passage may suffice to give some idea of our author's style and treatment of his subject. The emphatic italics and capitals are his own. Having established, as he conceives, Governor Pownall's authorship of the well-known "Letter to an Honorable Brigadier-General," immediately after his return from America in 1760, he goes on to say:—

'Having now re-landed our worthy governor in his native country, and exhibited him in such close connexion with the earliest of the writings of Junius, as—at the least—to raise in the mind of the most doubting reader, some faint idea that, *after all*, our conjecture of the identity of the two, may, *possibly*, be well founded; we resume the narrative of such of the remaining events of Governor Pownall's life, as tend to establish the truth of our hypothesis.

'The energy and ability of such a man could not be allowed to remain long idle;

and, accordingly, we find him, a few months after his return to England, foregoing his appointment to the governorship of South Carolina, and accepting, with the rank of colonel, the office of comptroller general of the expenditure and accounts of the extraordinaries of the combined army in Germany, under the command of Prince Ferdinand, of Brunswick.

'In this appointment, we find why—in the language of Dr. Good—"Junius appears to have uniformly entertained a good opinion of, or at least, a partiality for, Lord Holland;" and why—in Junius' own words—he should "wish Lord Holland may acquit himself with honour," namely, from the charge of peculation, made in the petition of the city of London, presented to the King, July 5, 1769;—and why Junius "designedly spared Lord Holland and his family." His lordship was paymaster-general of the forces, from July 5, 1757, to June 8, 1765; and Governor Pownall, on accepting the comptroller-generalship, became one of his deputies, and bound to render to him the accounts of the office. In Lord Holland's "*Answer*" to "*Observations on the accounts of the paymaster-general*," to be found in the note A, immediately after the letter to Woodfall, No. 5, July 21, 1769, is the following paragraph:—"The accounts of Lord Holland for the years 1757, 1758, and 1759; likewise the accounts of his deputies, attending the army in Germany, from the commencement to the end of the late war, are also before the auditors for their examination, and his Lordship's account for the year 1760, is almost ready to be delivered to them." We learn, here, that Mr. Comptroller-General Pownall's accounts "to the end of the late war" had been transmitted to the auditors for examination; and, from an obituary notice of him, published in the year of his death, that they had been "examined and *passed with honour*." It is not at all improbable that Governor Pownall received his appointment on the recommendation of Lord Holland; and hence, the partiality of Junius to his lordship. We may also well suppose, that the great anxiety of Junius to remain unknown, would prohibit his entering upon the discussion of any subject—such as that of the public accounts of Lord Holland, as paymaster-general, connected as they, necessarily, must have been, with his own, as comptroller-general—that might bring his real name into prominence, and tend to direct towards him the attention of the legion of hunters who were in busy and constant search for the "mighty boar of the forest."

'The notice of Governor Pownall's appointment, as comptroller-general, gives us also occasion to explain a passage in the *Miscellaneous Letter IV.*, dated Aug. 25, 1767, which has puzzled every one who has attempted to solve the Junius mystery; and has, in many, induced the belief, that Junius must have been a member of the military profession. Speaking of Lord George Townshend (the before-mentioned brigadier-general), and his brother, Charles, Junius says,—"I am not a stranger to this *par nobile fratrum*. I have served under the one, and have been forty times promised *to be served* by the other." Paradoxical as it may seem (and considering the rank of colonel, which accompanied the appointment of comptroller-general as merely honorary rank), the civilian Governor Pownall could properly use, in its military sense, the expression,—"I have *served under* the one"—in reference to either the military or the civilian of the two brothers Townshend. Not long after Brigadier-General Townshend's return from Canada, he joined the allied army in Germany, and made a campaign with it, under Prince Ferdinand. During the same campaign, and in the same army, but in a civil department, Governor Pownall served; and, of course, in as truly a military sense as if he had belonged to the commissariat or medical departments, he *served under* General Townshend, although he might not have been under his *immediate* command. Thus much for the military brother:—now for the civilian. On the 24th of March, in the same year, the Right Honorable Charles Townshend was appointed Secretary at War; and as, to a certain extent, and in a general sense, the whole army may be said to be under the direction of—and, consequently, to *serve under* the Secretary at War; so each individual of the army may, in a general sense, be held to *serve under* him, although he may be, like Charles Townshend, *only a civilian.* The civilian Governor Pownall then, as comptroller-general, in Germany, while the civilian Charles Townshend was Secretary at War, in England, might, without any great stretch of conscience, say—and in a military sense too—that he had *served under* Charles Townshend, although neither the one nor the other of them, was, in a strict sense, a soldier:—the former was *of*—but not *in*—the army,—and the latter was neither *of*—nor *in*—but *over* the army; and both were non-combatants.

'A consequence of the treaty of Paris, of Feb. 10, 1763, was, the breaking up of the office in the army, in Germany, held by Governor Pownall, and his return to England; soon after which, he took up his residence at RICHMOND, where, it will be recollected, the court of George the Third, was established during the period in which Junius, as chief public political censor, *reigned* in England, unseen, unknown, but not unfelt.'

This, it must be admitted, is somewhat vague and indefinite, for the evidence that should so conclusively prove the "discovery" of Junius; and we rise from the perusal of the volume as a whole, notwithstanding the ingenuity of its line of argument, with an unsatisfactory sense of intangibility in the proof led on behalf of the new claimant for the Junius laurels. Much of this is no doubt inseparable from the very nature of the inquiry, and if some inconceivable discovery, such as it seems too late now to hope for, does not withdraw the mask, it is only by a series of ingenious inferences and analogies that this literary riddle has any chance of being solved. Nevertheless, we must confess to a sense of disappointment at finding our author following the example of previous writers in recognising resemblances between "*peculiarities*" of the Junius letters and of those of their assumed author, which are for the most part only peculiarities of his period; and what shall we say of such logic as this:—

'Notwithstanding all the *labour* of the author, and the corrections made by the original printer and publisher, "numerous errors of grammar and construction," says Mr. Butler, in his *Reminiscences*, "are to be discovered in these celebrated letters;" and to the like effect says Dr. Good and Lord Brougham. If such be the case then with writings originally prepared for publication, and subsequently, on republication, corrected, and recorrected, it is scarcely reasonable to look for the elaborated composition of the letters of Junius, in the private letters of Governor Pownall, written as these were without a view of their ever passing beyond the circle of his and his correspondent's immediate friends. The impartial reader will no doubt bear this in mind, whenever he catches the Governor *tripping in his* *grammar*, and will set down any occasional defect in grammatical construction, as another presumption in favour of the Governor's identity with Junius.'

The emphatic italics are the author's own! Still more are we disappointed with the subsequently discovered "evidence of so decisive a character," added in the appendix. Something of a greatly more decisive character must be produced, ere the justness of the title of "JUNIUS DISCOVERED" will be generally conceded to our Canadian knight-errant in this well contested field of literary adventure. But it is much to accomplish, in being able to produce a claimant for the laurels of Junius, concerning whom many arguments tend to suggest that he *may be* the true one. And this much we conceive Mr. Griffin to have established.

D. W.

A Treatise on Analytical Statics, with numerous examples. By J. Todhunter, M. A., Fellow and Assistant Tutor of St. John's College, Cambridge. Cambridge: Macmillan & Co. 1853.

Some twenty years ago a bulky octavo volume was published at Cambridge, entitled "The Mathematical Principles of Mechanical Philosophy," by Mr. Pratt, of Caius College. A second edition of that work was published in 1841, and since then it had continued to be an acknowledged text book in the University. It was in fact by far the most perfect book published on the subject of mechanical philosophy taken as a whole, and until the last few years the separate parts on Statics and Dynamics were about the best treatises which the English student could take up on those subjects respectively. And though, since the publication of Mr. Sandeman's admirable treatise on Dynamics of a Particle, and Mr. Griffin's valuable Syllabus of Dynamics of a Rigid Body, the dynamical portion of Mr. Pratt's work had become antiquated, it was still felt to be an indispensable to the mathematical student, as containing a vast mass of information much of which was not easily procurable elsewhere. This book has lately become out of print, and Messrs. Macmillan, of Cambridge, appear to have resolved to re-publish the statical and dynamical portions of it separately, and the task of preparing the former for publication was undertaken by Mr. Todhunter.

We are sorry to have to say that we are disappointed with the result. The disappointment is increased when we compare this book with Mr. Todhunter's other publications, which are so admirably adapted for the purposes of tuition: and especially do we regret the defects of this book because in spite of them we feel no doubt that it will become a recognised text-book on the subject—the general arrangement being very good, and the execution of a great part of it equally so, and the collection of examples being at once bountiful and judiciously selected. And yet in spite of this the book is disfigured by so many defects, and contains so much that absolutely demands the aid of the teacher, that it contrasts most unfavorably with the clear and systematic treatises which the author has published on the Differential Calculus, and on Analytical Geometry. Some of these objectionable points we will proceed to point out—our space will not admit of our entering into a detailed examination of the work.

Perhaps the portion of the work which most disappointed us was the first chapter, containing an exposition of the fundamental principles upon which the science is made to rest. There was unquestionably enough room for improvement: in fact we rather suspect that we should have treatises upon statics in sufficient abundance, if it were not that many a would-be author is diverted from the task by the dread of that unhappy preliminary chapter—"Introduction and Definitions," as it is called in Mr. Pratt's book—Mr. Todhunter, we suppose by way of making some variation, leaves out the "and" and calls *his* first chapter "Introduction, Definitions." Unfortunately this variation in the heading gives but too faithful a representation of the changes made in the chapter itself. Of course when a writer professes, as Mr. Todhunter does in his preface, that his work may be considered as a "re-publication with large additions," of a former treatise, we have no right to complain that a great portion of the new work—the main body of the essential propositions—should be substantially the same as in the earlier book. But we think that we have a right to complain when we find the self-same bald unsatisfactory definitions put forth in 1853 which passed muster some ten or fifteen years before. Nor is this all. Mr. Pratt's "Introduction and Definitions" are really taken almost literally from Poisson's Introduction to his "Traité de Mécanique." Out of this Introduction Mr. Pratt has taken the definitions in the harsh and almost pedantic form in which they are found in the original, and has intermingled some explanatory matter of his own. All this explanatory matter the new editor has ruthlessly swept away, and gives us Poisson, and nothing but Poisson—except indeed where the translation is occasionally defective. Let us give an example or two. Poisson opens his treatise with the abrupt announcement that "La matière est tout ce qui peut affecter nos sens d'une manière quelconque." This Mr. Todhunter has rendered "Matter is every thing that affects our senses." If we *must* have a definition of matter, surely it is worth while to make the wording as little liable to objection as may be: and Poisson's own words evidently shut out one verbal objection to which Mr. Todhunter's is liable, though it is only fair to remark that this imperfection is common to Mr. Pratt's version. Both the English writers, following Poisson, proceed to *define* "a body" as "a portion of matter limited in every direction, and consequently of definite form and volume"; the mass of a body as "the quantity of matter which it contains"; and a material particle as "a portion of matter indefinitely small in every direction." This is the substance of the first sentence in Mr. Todhunter's book, and we would ask in what respect the student is made wiser by reading these dry dogmatic definitions. And above all, why should such a form be adopted in 1853 for the commencement of a treatise on Statics? We have advanced a good deal in freedom of using analytical methods since Poisson wrote his treatise. Then the method of formal statement of definitions (derived apparently from the synthetical systems of the older geometry) was still in repute—and a writer must needs begin his treatise with a string of definitions, because Euclid does so. Hence, as far as we can see, that propensity to *over-define* which too often characterises English works on mathematics. We met with an instance lately which well illustrates this propensity: the author of a treatise on Dynamics published a few years ago at Cambridge, (Professor Wilson) after remorselessly defining almost every thing he can lay his hands on, tells us with a half-doubting forbearance, that "It would be useless to attempt to define space and time. No explanation could in any way render the ideas clearer." But in the sentence which immediately follows that which we have quoted, Professor Wilson does point out a distinction which the writers on "Introductions and Definitions" in treatises on Mechanics generally would do well to bear in mind. After saying that space and time require no definition, he adds, "The measures of them on the contrary require the greatest attention." It is, we conceive, because this distinction is attended to that the commencement of the later French treatises on Mechanics—such as those of Poinsot or Duhamel for instance,—is so much more attractive than the corresponding part of the works of Poisson and his translators. In the former writers we are allowed to have an idea in our own mind concerning the *mass* of a body, but when we come to the point where it is needed, we are told how mass is to be estimated numerically—we are informed when two bodies are said to have the same mass—then that the unit of mass is chosen arbitrarily—and that when we say that the mass of any body is represented by a certain number, as *n*, we mean that the body might be divided into *n* parts, each having the same mass as that which has been assumed as the unit. This definition of the mode of measuring mass is practically useful: but whose ideas were ever extended by being informed that the mass of a body is the quantity of matter which it contains? We may notice another illustration of the way in which the tendency to formal dogmatic definition has led M. Poisson and his followers into grievous difficulties. It is deemed necessary to define a state of motion—"A body," says Mr. Todhunter, translating Poisson, "is in motion when the body or its parts occupy successively different positions in space." And then, inasmuch as it would be somewhat hard to make this a working definition, the idea of relative motion is introduced in the following remarkable expressions: "but since space is infinite in extent, and *in every part identical*, (partout identique) we cannot judge of the state of rest or motion of a body without comparing it with other bodies, (or with ourselves M. Poisson adds) and for this reason all motions which come under our observation are necessarily *relative* motions." Now this complicated and objectionable sentence is rendered necessary entirely by the preceding formal definition of motion. Had this been omitted, we should have escaped the difficulty altogether. Thus Poinsot and Duhamel, granting us the privilege of understanding the meaning of the word 'motion,' proceed to explain the terms absolute and relative motion: shew that while we cannot be sure that any particle in the universe is really at rest, we may yet separate the idea of the motion of a particle from the idea of the material body itself; that we may conceive, that is, that a body might be absolutely as well as relatively at rest; and thus they come to the definition of force, or perhaps we had better say to the statement in a statical form of the principle of the inertia of matter, viz. that some cause must always be required to produce a motion in a body at rest, and that to such a cause we give the name of *force*.

And this will lead us to say a few words as to the grounds upon which theoretical mechanics are or ought to be based. Before we do so, however, we would most seriously protest against any imputation of quibbling or hair-splitting in making these objections to verbal definitions. Such defects are grievous hindrances to the usefulness of a book, as every one knows who has had experience in teaching. A tutor puts such a book as that of Mr. Todhunter into the hands of a pupil previously ignorant of the subject: the pupil finds the book commencing with a series of definitions, on which he naturally imagines that the science is to be built. The first of these, and a fair sample of them is, "Matter is whatever affects our senses" —passing over the objection arising from imperfect translation, he comes to his tutor next morning, and asks whether light and electricity are matter, as they certainly affect our senses. Tutor points out that the definition is rather loosely worded: points out that it might perhaps be made less imperfect by adding the words 'or that through which impressions may be conveyed to our senses': rather doubts whether such an addition will do much good, and finally remarks after all it is scarcely worth while wasting time over it, as the definition is not one of any practical value. Upon which the pupil stares, doubts, and finally asks whether then the definition had not better have been left out? To which query the reply is necessarily in the affirmative—after which the pupil's faith in the necessity and usefulness of the introductory chapter is probably reduced below zero; and after a few more examples of the kind it will be very difficult to induce him to pay attention to explanations and distinctions that are really essential.

We must now say a few words as to the fundamental principles on which the science of statics is made to rest, and the grounds on which they are required to be received. There are, we conceive, two grand principles on which the whole of the science depends, viz. the inertia of matter, and the transmissibility of force. The former principle as applied to Statics is this: "A body once at rest will remain at rest unless some force is applied to it: and any single force applied to a body at rest will necessarily set it in motion." In other words, matter has no power either to move itself or to prevent force moving it. This principle appears again in Dynamics, as the first law of motion, and the complete statement of the principle will be that "Matter has no power of itself to change its state of rest or motion," remembering that a body's state of motion is changed when either the direction or the rate of its motion is altered. This principle then is a fundamental one: it is one which lies at the very root of our systems of Mechanics: how are we to establish its truth? Or *can* we establish its truth at the outset? And especially can we so establish it as to trust the proof of it in the hands of a beginner? These questions M. Poisson, and after him both Messrs. Pratt and Todhunter answer in the affirmative. Poisson's remark, according to Mr. Todhunter's version, is as follows:

"All bodies are capable of motion (sont mobiles), but matter cannot spontaneously move itself, for there is no reason why a particle should begin to move in one direction rather than another. It is in fact a matter of ordinary experience that when a body is passing from a state of rest to a state of motion, we can always attribute the change to the action of some external cause."

This 'external cause' is further explained by Poisson, as one "sans laquelle nous concevons que ce corps pourrait d'ailleurs exister."

Now the sentence above quoted really appeals to two utterly different sources for support of the main proposition. The first argument is what we should say might be called an *argumentum ad ignorantiam*. We should object to it, not only because it is using a very dangerous argument on very doubtful ground, but because it fairly brings us into collision with the metaphysician. We say that it is a very dangerous argument ; and we say this because we conceive that an appeal is really made here to the reader's own mind to form an idea *a priori* of what necessarily *must* be the nature of material bodies—an appeal, which in many cases would obviously lead to a wrong result : which is in fact virtually an abandonment of the inductive method. If any one from long familiarity with the reasoning here employed should be inclined to defend it, we would refer him, as an easy *reductio ad absurdum ;* to the use made of this mode of arguing by Mr. Gregory, who employs it to shew that the 'atom' of chemistry is most probably spherical, "since no reason can be assigned why one dimension should exceed another." It is indeed very difficult to set any formal limitation to the cases in which this argument may be safely used. Certainly, however, it would be a very unsafe guide in speculating upon the physical properties of matter, in which manner it is really used here. The second objection to the argument is perhaps even more formidable. At any cost we must keep clear of Metaphysics in the commencement of a physical science. If the fundamental truth of Statics is to be made to rest upon popular conceptions of time or space, any writer on Metaphysics who attacks those conceptions involves our system of Statics also in doubt. This should not be ; if for example a Metaphysician insists that space and time instead of being real existences are merely modes of thought necessary to a finite mind, we should be able to answer (whatever may be our opinion of his theory) that our science is occupied exclusively with results of which these same finite minds take cognizance—that our process is to collect laws from observed facts, and then to trace out the remote consequences of those laws: and that consequently our results, whether accounting for or predicting phenomena apparent *to us*, may be depended upon, however metaphysical speculations might interfere with the objective correctness of our assertions. This answer we clearly cannot make if our belief of the inertia of matter in any way depends upon our persuasion that "space is infinite in extent and every where identical." Again, if the principle in question is to be established by an appeal to *experience*, it must be made in a much more guarded manner. When we speak of a body passing from a state of rest to a state of motion, both the rest and the motion must be *relative:* and it should at least be pointed out that we are obliged to draw an inference concerning a particle *absolutely* at rest, from the examination of a body *relatively* at rest. And when we come to consider the case of a body passing from a state of relative rest to one of relative motion, it is necessary to guard our language by another restriction, which may tend to increase the embarrassment of the learner. The *cause* to which the change of state is to be referred may be one applied either to the body observed or to the system relatively to which its state of rest or motion is estimated. A carriage is suddenly stopped and a person riding in it is, to use the popular language, thrown suddenly forward. He passes from a state of rest to a state of motion with regard to the carriage, exactly because *no* force is applied to him, and the case is an illustration, not of the statical but of the dynamical aspect of the principle of inertia, viz., that the body once in motion will continue to move unless some external cause be applied to stop the motion. So that if the statical principle of inertia is to be established by an appeal to experiment it must be in language somewhat more extended than that used by our Author, unless, indeed, his book is intended merely as a peg to hang lectures on. Before quitting this point we would state that our own impression is in favor of treating these fundamental principles, in the case of beginners, not exactly as axioms, but as facts which the learner must for the time take on trust. It is not until the mind has become familiar with the ideas of force, and of rest and motion, absolute and relative, that, as a general rule, it can take in the train of thought upon which such principles depend. It seems to us to be not only the easier but the safer course (and we would suggest this as a practical consideration to those of our readers who are engaged in teaching) to assume, and to tell the pupil that we assume, the truth of such principles as the inertia of matter and the transmissibility of force: build up the whole system of Statics and Dynamics provisionally, and then turn back and explain the foundations upon which such assertions rest, viz. that the more nearly the conditions of these laws are fulfilled the more nearly are their assertions verified; and that their truth may be considered established conclusively when we compare with observation the results of our system of Physical Astronomy which rests entirely upon the correctness of these principles.

The consideration of these elementary points has detained us so long that we shall have space only very briefly to notice some of the remaining points in Mr. Todhunter's book which appear to deserve attention. The main body of the work is a re-print of Pratt's Treatise, and the proofs are almost everywhere clear and satisfactory. Where Mr. Todhunter has made extensive additions of his own, as in the chapter on the centre of Gravity, they are such as to make us very greatly regret that he did not throw aside Poisson and Pratt, and publish a work of his own. The book as it stands is well adapted to the wants of a student at Cambridge, or at any University where the Cambridge system is followed. It is not adapted, as Mr. Todhunter's other works so emphatically are, to the use of persons reading by themselves, and, which is, in some respects, to be regretted, it does not fit in very well as one of a series of the same author's writings. In Mr. Todhunter's Differential Calculus, he treats the subject entirely by the method of Differential Co-efficients; he has only a short chapter on Differentials, and even there he studiously avoids the use of infinitesimals. In his Co-ordinate Geometry he is at much pains to adhere to this system, but in the Statics, as might be expected, he is almost compelled to resort to infinitesimals; and certainly a person whose ideas on the Differential Calculus were entirely derived from Mr. Todhunter's book on that subject would be rather amazed at the boldness with which Differentials are treated in the latter treatise. In some cases this boldness seems to us carried almost to excess. Thus, for example, when he is investigating the conditions of equilibrium of a string stretched over a cylinder, he has to consider the equilibrium of an indefinitely small element of the string, PQ. This element is kept at rest by the tensions at P and Q, and the resistance of the cylinder, *i.e.*, the resultant of the normal reactions at the several points of the element, which, says Mr. Todhunter, is ultimately in the direction of the normal at P. This is perfectly true, but it seems to us to want at least some explanation. The student's objection is that if we are at liberty to consider the normal action at the extreme point Q of the element as coincident with the normal action at P, we might also consider the direction of the tangential actions at the two points as ultimately coincident, which he finds is not the case ; and it requires a clearer insight into the doctrine of infinitesimals than the student will generally possess to see that the error in taking the directions of the normal actions as coincident will be of a higher order than that in treating the tangential actions in a similar manner, and that therefore in taking the limits the former error will disappear. Perhaps the best mode of remedying this defect would be the addition of a chapter on infinitesimals when a new edition of the Differential Calculus is called for. We have not examined the book before us with sufficient care to be able to say much as to the accuracy of the printing. One strange blunder, arising we presume from the printer, we may point out for the benefit of any of our readers taking up the book. It is at the end of article (186) where he is finding the approximate expression for the tension at the lowest point of the catenary, where in subtracting two expansions the first term of the difference is omitted. (The left hand side of each of the two last equations should be $\sqrt{\lambda^2}=h^2-k$). There is also, a few lines above, a singularly careless mistake, the points of support being described as nearly *in the same straight line*, instead of in the same horizontal line.

Before we conclude, there is one point to which we should wish to call the attention of our mathematical readers. In the chapter on the Composition of Forces, Mr. Todhunter gives us first Duchayla's proof of the Parallelogram of Forces, (we wish he had substituted Duhamel's far more elegant demonstration) and then adds Poisson's proof which does not assume the principle of the transmissibility of force. In passing we may remark that we never could see that this was any recommendation of this class of proofs. Writers are accustomed to say that proofs such as Duchayla's will not apply to the case of forces acting on a particle of fluid, or that the proof is imperfect because the proposition would be true even if the transmissibility of force did not hold, by which if they mean anything they must mean if no such thing as a rigid body ever existed. Such objections seem to us about equivalent to saying that a brick house cannot be built by means of a wooden scaffold. The rigid connections introduced into such proofs are purely imaginary, and when the result is established it matters not the least of what body the particle acted upon may form a part. But to return to M. Poisson's proof, to which our attention was directed by finding it in Mr. Todhunter's book. It may sound a bold assertion to make concerning a proof published by such a man as Poisson, but we cannot help coming to the conclusion that it is a complete fallacy. We cannot give the proof at length, but the following general description of it will enable us to point out where the fallacy lies. Assuming that the direction of the resultant of two equal forces will bisect the angle between the directions of the two forces themselves, he takes two equal forces, P, inclined at an angle $2x$, whose resultant is R, and assumes $R = P\,f\,(x)$; his object being to determine the form of the function f. By resolving each of the forces P into two equal forces, Q, inclined at an angle $2\,z$; he arrives at the equation

$$f\,(x).\;\; f(z) = f\,(x+z) + f\,(x-z) \ldots\ldots\ldots (1)$$

This functional equation he has to solve, *i.e.*, he has to find the most general solution, and to limit it by considerations derived from the special problem before him. This he proceeds to do as follows: "We see at once that $f(x) = 2 \cos c\,x$ is *a* solution, c being any constant quantity. We proceed to shew that this is the *only* solution, and that $c=1$." Mr. Todhunter, perhaps, scarcely conveys Poisson's meaning here. His words are: "Or je dis que cette expression de la fonction $f(x)$ est la seule qui satisfasse a l'équation (1), et que de plus dans la question qui nous occupe la constante c est l'unité."

As far as we can make out, the reasoning which follows is *not* intended to shew that the equation (1) admits of no other solution, (which we are required to take upon M. Poisson's assertion) but only that in the particular case before us $c = 1$. The steps by which it is endeavored to prove this are as follows. First, it is asserted that it is evidently true that $c = 1$, or that $f\,(x) = 2 \cos x$, when x is zero, for then the directions of the two forces P would coincide, and the resultant R would be $2P$, and we must therefore have $f\,(0) = 2$. Again he shews that the conditions of the problem are satisfied by assuming $f\,(x) = 2 \cos x$ in another particular case, viz., when $x = 60°$ in which case the resultant $R = P$, which involves the assertion $f\,(60°) = 1$ which as $\cos 60° = \frac{1}{2}$ is satisfied by writing $f\,(x) = 2 \cos x$. A most ingenious proof is then inserted to shew that if the relation $f\,(x) = 2 \cos x$ is satisfied for $x = 0$ and for any other value of x, it must be satisfied for *all* values of x. The proof of this assertion is derived entirely from the equation (1) itself, and inasmuch as the object in view is altogether to choose from the different solutions of the equation that one which suits the physical problem which led to it, we might *a priori* doubt the usefulness of such a course. In effect the reasoning is worth nothing. In the first place that $f(0) = 2$ may be deduced at once from equation (1) by putting $z = o$, and the succeeding reasoning literally gives us no information whatever. If, indeed, it could have been said that unity was the *only* value of c which would satisfy the conditions of the problem when $x = 60°$, the proposition would be established, but, unfortunately, this is not the case, for an infinite number of values might be given to c such that the conditions of the problem might be satisfied in this particular instance. For example we might put $c = 5$, for then we should have

$$f(60°) = 2 \cos (5 \times 60°) = 2 \cos 300° = 1,$$

as it should be: and the fallaciousness of Poisson's reasoning is at once apparent from this, that the very same words which he employs to shew that $f(x) = 2 \cos x$ is the proper solution of (1) might be employed to shew that $f(x) = \cos 5x$ ought to be selected.

We may notice that a very simple mechanical consideration will suffice for the selection of the true value of c, if it be granted that the solution of (1) is necessarily of the form $f(x) = 2 \cos cx$. When $x = 0$, the equal forces P act in the same direction and the resultant is the greatest possible; when $x = 90°$, the angle between the forces is 180°, and the resultant is zero, and it does not seem too much to assume that as x increases from 0°, to 90°, the resultant will diminish *continuously*. This being granted it is at once evident that c must be unity, for $\cos cx$ must vary from unity to zero continuously, as x varies from 0° to 90°. We are by no means prepared to say that this form of proof of the parallelogram of forces *can* be made perfect. The solution of functional equations always involves more or less of doubt and obscurity, and what is called the the "general solution" of such an equation is by no means necessarily *most* general that can be conceived. Certainly Mr. Todhunter deserves our thanks for giving us the classical proposition of Poisson instead of the method which had been substituted by Mr. Pratt, which is just as unsatisfactory as Poisson's and much more clumsy. We could have wished, however, that Mr. Todhunter had called attention to this singular fallacy. It seems scarcely fair to the student to put a proof in his hands, especially with such a name attached to it, without giving him so much as a hint that it contains anything unsatisfactory.

G. C. I.

SCIENTIFIC AND LITERARY NOTES.

GEOLOGY AND MINERALOGY.

GEOLOGICAL MAP OF CANADA.

The Special Correspondent of the *Montreal Gazette*, writing from Paris, on the 22d of November last, remarks:—M. Elie de Beaumont, President of the Geological Society of France, considers the small edition of the Geological Map of Canada, which has been published here, so excellent, that he has requested Mr. Logan to allow it to be introduced into the bulletins of the Society. It is one of the prettiest specimens of geological chromo-lithography that has issued from the press. The scale is one-tenth of Bouchette's Map of Canada. There are twenty-two colors on the map, representing the formations, and these have required fourteen lithographic blocks to print them.

WOLFRAM.

A well-crystallized specimen of Wolfram (the manganese variety $2 [FeO,WO^3] + 3 [MnO, WO^3]$), a mineral it is believed hitherto unremarked in Canada, has been lately met with in a granitic boulder, near Orillia, C. W. A detailed notice will be given in a future number. E. J. C.

FOSSILS FROM THE ESPLANADE CUTTINGS, TORONTO.

From this spot some good casts of the following fossils may be obtained:—Chætetes lycoperdon; Glyptocrinus decadactylus (stem fragments); Modiolopsis modiolaris, Ambonychia radiata; Murchisonia gracilis, Pleurotomaria subconica; Orthoceras lamellosum, O. coralliferum (or a species of Endoceras?) It is perhaps unnecessary to state that the above belong to the Hudson River group of the Lower Silurians. E. J. C.

GEOLOGY OF SCOTLAND.

A recent paper read by Sir R. Murchison to the Geological Society, announces the discovery of Upper Silurian fossils, in the parish of Lesmahagow, in Lanarkshire. The fossils were first found by Mr. Sliman, a native of the district, which has since been visited by Sir Roderick and Professor Ramsay. The succession of rocks from the coal and mountain limestone downwards is traced in Nethan and Logan waters, which are branches of the Clyde flowing north-eastward from the borders of Ayrshire. The rocks mentioned are followed by conglomerates and flagstones representing the old red sandstone, under which are dark gray, slightly micaceous, flag-like schists, containing crustaceans of the genera of Pterygotus and Eurypterus, with the Lingula cornea and Trochus helicites (shells). On the ground of these fossils, Sir Roderick considers the flag-like schists as the equivalents of the upper Ludlow rock, or tilestones of England. In the geological map of Scotland, therefore, a track of country about ten miles broad, colored as old red and coal by Dr. M'Culloch, must now be added to the Silurians. C. M.

COMPOSITION AND FORMATION OF STEEL.

At a recent meeting of the Boston Society of Natural History, Dr. Jackson gave an account of some researches into the composition and manner of formation of different kinds of steel.

As commonly known, steel is a combination of carbon and iron, made by heating flat bars of pure iron, in combination with charcoal. The carbon is first converted into oxide of carbon, and then unites with the iron as carburet. The result of this process is known as blistered steel, from the bubbles generated by gases upon its surface. Shear steel consists of parallel plates of pure iron and steel, welded by folding and uniting the bars of blistered steel. Cast steel is fused in pots of the most refractory material, and differs from cast iron which likewise contains carbon, in this respect, that cast iron is a mixture of coarsely aggregated matters, graphite and iron, whilst cast steel is a chemical combination of carbon and iron.

From the researches of Berthier, it is known that manganese will form an alloy with iron. When iron is mingled with a cousiderable portiou of manganese, a brittle compound results; but when combined with a very small proportiou of manganese, a steel of very fine quality is obtained, which has this advantage over carbon steel: carbon steel becomes coarse when tempered in thick masses, from segregation of the particles of carbon; but no such trouble arises with magnesian steel. Parties in England have lately introduced excellent wire for piano-forte strings, made of this kind of steel, as well as for cutting instruments, and other purposes. In the wire, Dr. Jackson has found 1.12 per cent. of manganese, and has established the fact that it resists, to a very remarkable degree, the action of hydrochloric acid. Sixteen years since, Franklinite iron was manufactured by Mr. Osborn into very hard and fine steel. This steel required tempering at a lower heat than carbon steel. Many of our manganesian irons might be manufactured into steel, by the simple process of fusion, and a steel of uniform character might be made without previous cementation with carbon.

Dr. Jackson explained the reduction of iron in blast and reverberatory furnaces. Manganesian iron ore is reduced to pure iron, or "comes to nature," in the language of the workmen, with much greater rapidity than carbon iron; heuce the two metals are often mixed to "come to nature" at a good time, requiriug less care and watchfuluess on the part of the workman. Manganesiau iron makes the best bar iron.

PHYSIOLOGY AND NATURAL HISTORY.

FREAKS OF NATURE.

The following singular illustration of the tendency of wild animals, when domesticated, to change their uniform natural color, is exhibited in a way both curious and unusual. A writer in the "Scottish Press" says:—Mr. Souter, of Boxgrove, has a game fowl which, four years sinee, was perfectly black, the second year it was brown, the third white, and at the present time it is speckled black and white.

Though more in aceordance with ordinary operations of nature, the following example of animals changing their color with the season of the year, is interesting as oecurring in our own vicinity. The Rev. Thomas Schreiber remarks in a note to the Editor:—Is the following circumstance a freak of nature, or is it a happy dispensation of Providence, mindful for every contingency to provide for the safety of the animal creation? Last summer several rabbits, black and grey in color, were turned out on the grounds about the Homewood, Toronto; during the autumn their progeny were of the same color: since the snow has covered the ground two litters have shewn themselves, one litter of seven *completely snow white*, the other litter of six, two of which are snow white, the others greyish white; a casual passer by, though close to them, would not discern them unless they were in motion.

HYACINTHS IN GLASSES.

The following mode of procedure may perhaps be only partially suitable to our keen Canadian winter climate, but the hint is worth noting for those who delight in these beautiful and fragrant substitutes for the summer Flora:—A correspondent of the *Field* says—"The following I have found to be an excellent way to start the roots of hyacinths for water (an uncertain process sometimes). I found it out by accident, and it may have been noticed by others before; but I have never seen it in print. I had potted 50 or 60, and placed them in a cool shade to plunge in saw-dust, but the weather being favorable for out door work they were left for a week or ten days. On looking at them, they had by rooting forced themselves out of the soil, and emitted a perfect circle of roots; this induced me to place all my roots intended for glasses this year, in small pots filled with light soil, just large enough to take the bulb (the motive for this was to keep the roots close, so that when they were about one inch long they would go into the neck of the glass without breaking). The roots soon filled the glasses, and this ensures a fine bloom; they were kept in a cool dark cupboard for a month, then gradually put into light and heat, the latter very moderate, the hyacinth being impatient of much and rapid heat."

ETHNOLOGY AND ARCHÆOLOGY.

INSCRIBED SIDONIAN SARCOPHAGUS.

At the November meeting of the Syro-Egyptian Society of London, Mr. Ainsworth gave some details of the discovery at Sidon of a Sarcophagus, with a Phœnician inscription on it. Dr. Benisch read a translation of the inscription by the Rabbi Isidor Kalisch, with remarks on the mode of decipherment. This translation was compared with others made by Dr. Dieterich, of Marburg; by the Duc de Luynes, in Paris, and by Mr. W. Turner, and a writer signing himself E. E. S., in the Journal of the American Oriental Society. Only comparatively slight discrepancies distinguish these independent translations, made almost simultaneously on both sides of the Atlantic, thus leaving no room to question that here we have another of the fruits of the singular impetus given to philological and palæographical research by the successful labors of Young and Champoleon. The language of Phœnicia, after being lost for upwards of two thousand years, is thus being deciphered, and its secrets placed within our reach by living scholars.

SKULLS OF THE ANCIENT ROMANS.

At the recent meeting of the British Association at Glasgow, a paper was read before the Ethnological section by J. B. Davis, F. S. A., "On the Skulls of the Ancient Romans." Three skulls were exhibited to shew the high cerebral development. One of these skulls was found in a sarcophagus at York, and another under the Via Appia. The teeth of two of them were stained with verdigris, from contact with the copper coin placed in the mouth to pay Charon, the ferryman to Hades. In one case, the fare, an obolus, was found beside the skeleton.

Dr. Black made a few remarks upon the general characteristics of the Roman skull, an example of which, found in a Roman shaft at Newstead, Roxburghshire, along with an iron spear, and a quantity of Roman pottery, is figured in Wilson's "Prehistoric Annals of Scotland," and its measurements given.

Mr. Cull added several observations upon the types of the Anglo-Saxon and Celtic skull, remarking that the round head which characterised the modern Irish was not the type of the ancient Celtic skull, which latter was elongated like that of the Anglo-Saxon.

OPATE INDIAN GIRL.

Considerable interest was excited some little time since, both in America and Europe, by the exhibition of a dwarf Indian boy and girl, about whom very marvellous fictions were told, affirming their having been carried off from a city of Central America, where the ancient Astec race and institutions still exist intact. The success which attended this exhibition, and the interest taken in the subject by some of the first scientific men, such as Latham, Owen, Burke, &c., have led others to follow the example, and there has recently been exhibited in some of the American cities a young female called an "Opate Indian," from her being affirmed to be a representative of the Opate Tribe ; one of those occupying Sonora, a range of country from 28° to 30° N. latitude, and about 33° of longitude W., from Washington. It appears, however, that whatever be the native place of this singular female, she is no proper representative of her tribe, but presents, in the most remarkable characteristics, an abnormal condition, peculiar to this individual instance. A singular growth of hair on her face along with a remarkable formation of her gums, giving to her face somewhat of the prognathous approximation to a mussle, have led some to the conclusion that she was not purely of human origin ; while others have equally hastily shown an inclination to look on her as a type of the transitional stage by which theorists have been disposed to assume the development of the ape into man. In the month of September last, the members of the Natural History Society of Boston took advantage of her visit to that city, to have her present at one of their meetings, for the purpose of examination, and Dr. Kneeland read a communication in reference to her, from which we extract the following notice :—

This girl, who is 22 years of age, four feet six inches in height, and of the weight of 112 lbs., is probably a member of some Indian tribe, inhabiting the Sierra Madre Mountains. These mountains run, for the most part, parallel to the Gulf of California, through the Mexican States of Sonora and Cinaloa ; their distance from the sea varies from 200 to 50 miles, and in the neighborhood of Mazatlan, they come still nearer to the coast. This girl has been called an *Opate* Indian. The Opate Indians are described by Mr. Bartlett, in his Personal Narrative, as a quiet agricultural people, living in thickly populated villages, noted for their bravery against the Apache tribe, and altogether superior to their neighbors, the Yaquis. But, on the other hand, she is said to have been obtained from the Sierra Madre Mountains in Cinaloa, in the neighborhood of Copala, which town is just on the edge of the mountains, about midway between Mazatlan and Durango. The girl, without doubt, belongs to some one of the Indian tribes between the Sierra Madre Mountains and the Gulf of California, in the Mexican provinces of Sonora and Cinaloa.

It is affirmed that her tribe live in caves, in a naked state, on an equality with brutes, and partake of their food. That would degrade her to a level with the Digger Indians of California, but these, though very degraded, are yet far above the brutes. The locality of the Digger Indians is several degrees further North than the Sierra Madre range. This resemblance to the brute is mentioned, as the popular belief seems to be, in her case as in the Aztec children, that she is a specimen of a race, half human and half brute.

The girl is modest, playful in her disposition, pleased with playthings like a child, and, at times, rather hard to manage, from her obstinate and impulsive character. She is intelligent, understands perfectly everything said to her, can converse in English, and also in Spanish; she has a good ear for music, and can sing tolerably well; she can also sew remarkably well, and is very fond of ornament and dress. Her appearance is far less disgusting than representations of her have shown her to be, although the enormous growth of hair on the face, and the prominence of the lips, from diseased gums, give her a brutish appearance. Her hair is long, very thick, black and straight, like that of the American Indian; hair, of the same color and character as that on the top of her head, grows on the forehead, quite to the eyebrows, varying from one half to an inch in length, having been partially cut off in the middle of the forehead; the eyebrows are very thick and shaggy, and the lashes remarkably long; the hair also grows along the sides and alæ of the nose, upper lip, cheeks, and about the ears, which are large, and with very large lobes; the chin is also well supplied with a black, fine beard, two or three inches long; the arms are hairy for a woman, though not for a man; on other parts of the body, there can be said to be no unusual growth of hair; there is great mammary development.

I have measured her head carefully, and it does not differ much from the average of these races, as given by Dr. Morton:—

	Long. diam.	Par. diam.	Front. diam.	Inter-Mastoid. Arch.	Occip. Front. Arch.	Horizontal Periphery.
Ordinary.	6.7 in.	6.	4.9	14.6	13.1	20.
Opate.	6.3	5.5	4.2	13.5	13.	20.

She has, therefore, a well-proportioned, though small brain. Her head varies somewhat from that of an American Indian. There is no characteristic prominence of the vertex, no flatness of the occiput or forehead, no want of symmetry in the two sides; the shape of the cheeks and the complexion are hardly Indian. The space between the orbits is large, and the eyes are very black and piercing; there is no obliquity to be noticed, as in the Mongol. The nose is flat, quite unlike the aquiline nose of the Indian, and yet not like that of the Negro. The mouth is very large, and the lips prominent, and rather thick; the gums are in a curious condition, being swelled all around, so as to rise above and conceal the teeth; they are not sensitive, and are so hard as to allow her to crack hard nuts with them. The growth in the upperjaw is chiefly a hypertrophy of the bone, and in the lower jaw, principally a disease of the gums resembling "vegetations." The molars, bicuspids, and canines are normal, though the latter are imbedded in the abnormal gum, while the back teeth are behind it. She has a decided chin, which would indicate her humanity, if nothing else did. She has a well formed arm, and a small symmetrical hand; she has also small feet. She is a perfect woman in every respect, performing all the functions of woman regularly and naturally.

She is evidently human, and nothing but human. She is quite unlike the mixed African—Is she an American Indian? It may be here remarked, that her complexion, soft skin, hair, and shape of the head, face and nose, remind one more of an Asiatic than an American type. Her disposition too is mild and playful, her manners gentle and communicative, differing from the sullen, taciturn, and forbidding ways of the Indian. It is well known, that some authorities maintain that the California Indians are of Asiatic origin,—Malays, who have been thrown in some way on the American shore, from the Pacific Islands. The notion also prevails among many of the tribes bordering on the Gulf of California, (among the Ceris, for instance,) that they are of Asiatic origin. The girl seems either of Asiatic origin, or of Asiatic and American Indian mixed. She is no specimen of a degenerate race, but an exceptional specimen, such as occurs, not unfrequently, in all races. Hairy women have lived before her, without any suspicion of brute paternity. The conformation of her mouth, in so far as it is abnormal, is more likely the result of disease, than a character of a tribe.

CHEMISTRY.

Ozone.—Dr Andrews has made a series of experiments on Ozone as derived from various sources. He finds that from whatever source it is obtained, its properties are always the same, contrary to the statements of some chemists. He fully confirms the idea that ozone is not a compound body, but oxygen in an altered or allotropic condition.

Protoxides of Iron, Manganese and Tin.—These oxides which are difficult to obtain by the ordinary processes, can be readily formed, according to Liebig, by heating the protoxalates of the metals, after they have been dried at about 250° F. The protoxide of iron is not quite free from metallic iron, the oxide of manganese is green, and burns when touched with a red hot body, the oxide of tin behaves in a similar manner, and the formation of these two compounds may be used as a good class experiment. Liebig confirms Rammelsberg's formula for the artificial protoxalate of iron, differing from the native salt (Humboldtite) by half an equivalent of water.

Iodo-nitrate of Silver.—Dr. Schnauss has examined the salt composed of iodide and nitrate of silver, first observed by Preuss. It is obtained by boiling the iodide with a strong solution of the nitrate, and crystallizes in acicular crystals. It blackens very rapidly when exposed to day-light, much more so than its constituents, and this probably accounts for the sensitiveness imparted to iodide films by the presence of free nitrate, a fact well known to photographers. Schnauss gives the formula $Ag\ O.\ N\ O^5 + Ag\ I$, but Weltzien, who has examined what seems to be the same salt, gives the formula $2\ Ag\ O.\ N\ O^5 + Ag\ I$.

Salts of Cadmium.—Von Hauer has published two papers on various double chlorides of cadmium, (see page 13 of this number), and throws out the suggestion that a subchloride may exist corresponding to Marchand's suboxide. Greville Williams has obtained analogous combinations of chloride of cadmium (and of bismuth and uranium) with organic alkaloids.

Double Cyanides.—By acting on the ferri-cyanide of potassium, with ammonia or soda and grape sugar, Reindel has obtained curious salts of the formula $K^3\ N\ H^4,\ Cy^4 + 2\ Fe\ Cy$ and $K^3\ Na,\ Cy^4 + 2\ Fe\ Cy$.

Oxygenation.—Kuhlmann has shown that certain essential oils possess the power not only of absorbing oxygen from the atmosphere, but also of communicating it to bodies susceptible of oxidation, and he shews how this fact may become of importance as affecting the colours used in painting, which may be changed by this as well as by other causes. He compares the action of oil of turpentine in these cases to that of the blood in respiration.

Hydrated Silica.—Liebig has found that the solubility of silica depends essentially upon the circumstance whether or not a sufficient quantity of water for its solution is present at the moment of its separation. If a solution of a soluble silicate, the strength of which per cubic centimetre is known, be gradually diluted with measured quantities of water, a point may be arrived at when, on the addition of acid, the fluid remains perfectly clear, and no silica is separated. In this way water can dissolve as much as one five-hundredth of silica.

Ammonia and its salts materially diminish the solubility of silica.

Action of Carbonates.—Rose has carefully examined the circumstances under which insoluble or nearly insoluble salts, such as the sulphates of baryta, strontia, and lime, &c., are decomposed by alkaline carbonates. When the soluble salt formed is capable of decomposing the insoluble salt produced, the decomposition is hindered, and can only be effected by constant removal of the soluble salt, or employment of an excess of the decomposing salt.

When no such decomposing action of the resulting soluble salt upon the insoluble one takes place, the decomposition goes on in accordance with the ordinary laws of affinity. An alkalic carbonate decomposes sulphate of baryta, and an alkalic sulphate decomposes carbonate of baryta, hence very imperfect decomposition can be produced from equivalent weights of these salts. An alkalic carbonate can decompose sulphate of strontia, but an alkalic sulphate has no effect upon carbonate of strontia, hence in this case a nearly complete decomposition is effected. The same is the case with the sulphates of lime and lead, and is doubtless connected with the partial solubility of these sulphates, for if the smallest quantity were to be formed and dissolved in the fluid, it would be immediately decomposed by the action of the alkalic carbonate.

Cement.—M. Sorel announces the formation of a very hard and durable cement by the action of chloride on oxide of zinc. The analogous chlorides may be substituted for that of zinc. The cement may be poured into moulds like plaster, becomes as hard as marble, is not affected by cold, moisture, or even by boiling water, and is but slowly acted on by strong acids. It has been long used as a cement for stopping teeth. It can also be employed as a very hard and durable paint.

Strength of Bases.—Rose has found that there is no more certain means of ascertaining the strength or weakness of the basic properties of the different metallic oxides than treating them with solutions of inodorous ammoniacal salts, especially of chloride of ammonium. All metallic bases of the composition $2 R + O$ and $R + O$ decompose the ammonia salt, while those of the formula $2 R + 3 O$, and others containing still more oxygen are unable to effect the decomposition even after long boiling. The only exception is in the case of glucina, but many chemists have been inclined to rank this among the oxides of the formula $R + O$, and very recently Debray has concluded that glucina must be regarded as an earth which has no analogue, standing midway between the bases $R + O$ and $2 R + 3 O$.

In a later paper Rose inclines to the formula $2 G + 3 O$ for glucina. He finds that glucina exposed to the heat of a porcelain furnace forms a dense caked mass, of specific gravity 3·021 and exhibiting under the microscope regular prismatic crystals like the native alumina or corundum. Alumina, when heated in the same manner, acquires a density of 3·99 or 4·0, and if from these numbers the atomic volumes be calculated for alumina and glucina, the numbers 157 and 160 are found, which agree very closely.

According to the formula G + O the atomic volume would be 52·3, and this should agree with that of magnesia. If this latter earth be heated in a porcelain furnace it is obtained in a crystalline form, and exactly similar in its properties to the *periclase* from Vesuvius. Its specific gravity is 3.694, and its volume 71. The oxide of nickel, examined by Genth, has the same volume. Hence there is no analogy between these two oxides and glucina. From these and other reasons Rose does not consider that the decomposition of ammoniacal salts by glucina warrants any alteration in the present formula.

Alcoholic Compounds.—Mercaptan.—Hermann has obtained Butylic mercaptan $C^8 H^{10} S^2$, analogous in its properties to the rest of the class.

Benzoic Alcohol.—Cannizzaro, by acting on toluene (derived from commercial benzine) with chlorine, has obtained the monochlorinated toluene which is identical with chloride of benzœthyle, when this is treated with acetate of potash, acetate of benzœthyle is formed, which with potash give benzoic alcohol $C^{14} H^8 O^2$.—By means of the monochlorinated toluene, and cyanide of potassium, cyanide of benzœthyle is readily obtained, and this with caustic potash yields toluic acid, a compound belonging to a higher series.

Propylic Alcohol.—Dusart produces propylene by the deoxidation of acetone; this is effected by distilling gradually a mixture of equivalent portions of acetate of lime, and oxalate of potash, dried as carefully as possible. The propylene is conducted into bromine, and the bromide of propylene purified by distillation. By the action of an alcoholic solution of potash, the compound $C^6 H^5 Br$ is obtained, which, heated with sulphocyanide of potassium, gives the oil of mustard. If the propylene be conducted into sulphuric acid and the product distilled with water, propylic alcohol is formed, as in Berthelot's process for forming common alcohol from olefiant gas.

Alcohol.—Marx has shown that the formation of alcohol from olefiant gas and sulphuric acid, lately proved by Berthelot, was described twenty-seven years ago by Hennel, in his paper on the formation of ether.

Bisulphocyanide of œtherine.—Sonnenschein has succeeded in replacing the chlorine in the chloride of œtherine by sulphocyanogen, produciug a compound homologous with oil of mustard.

Amylic Alcohol.—Pasteur has found that amylic alcohol consists of two bodies, which he calls active and inactive alcohols, the one possesses a rotatory power on the plane of polarization, the other possesses none. The alcohols cannot be separated directly, but the sulphamylate of baryta is found to consist of two salts, one of which is 2½ times more soluble than the other, the soluble one yields the active alcohol.

Sugars—Berthelot has re-examined the sugar of the Eucalyptus, and gives to the crystalline manna-like substance the name of Melitose. It does not act upon oxide of copper until after boiling with sulphuric acid, it is capable of fermentation but yields half its weight of a body, which is incapable of fermenting even after treatment with sulphuric acid, and which he calls Eucalyne. He has also examined a peculiar kind of sugar, said to be derived from the Pinus Lambertiana of California, he calls it Pinite, it is insusceptible of fermentation, and does not reduce oxide of copper.

Propionic Acid.—Limpricht and Von Uslar have endeavoured to prove that butyracetic acid is distinct from propionic, and that it is decomposed under certain circumstances into acetic and butyric acids. In the course of their investigations they also prepared and examined the anhydride of propionic acid, propionic ether, propione, propylal and propylene, the three last obtained by the distillation of dry propionate of baryta.

Stearone.—Heintz has shown that stearone $C^{35} H^{35} O$ is really produced during the distillation of dry stearate of lime, a fact which had been disputed by Rowney.

Hlienkamp has examined the action of sulphite of ammonia on nitrobenzole and nitrotoluole, and has obtained two new acids.

Rammelsberg has examined the composition and crystalline forms of the tartrate of ammonia, and the double tartrate of potassa and ammonia.

Muhlhauser has examined the products of the action of nitric and hydrochloric acids upon the protein compounds, and has found among others a volatile body, chlorazole, which is poisonous, burns the skin intensely, possesses a powerful odour, and explodes when strongly heated.

Fulminuric or Isocyanuric Acid.—Liebig and Schischkoff have described under these names a new tribasic acid isomeric with cyanuric acid, but forming entirely different salts with bases, obtained by the action of alkalic chlorides or iodides upon fulminating mercury. Many of the salts are finely crystallized and explode when heated.

Ononine.—Hlasiwetz has examined the body obtained by Reinsch from the root of Ononis spinosa, he finds that it is decomposed by baryta into an acid and a new glucosogenous body, which he calls Onospine, this again by dilute acids is resolved into sugar and a crystallizable substance Ononetine. The decomposition is analogous to that observed in populine.

Amides.—Rowney has examined a considerable number of the amides of fatty acids.

Veratrine.—Merck has made some experiments upon pure veratrine and some of its salts, and gives as the formula of the alkaloid $C^{64} H^{52} N^2 O^{16}$.

Igasurine.—Desnoix announces the the existence of a third alkaloid in nux vomica in addition to strychnine and brucine; it remains in the mother liquor after these two have been precipitated by lime. In its properties it is exceedingly similar to brucine.

Volatile bases.—Greville Williams has published in the Chemical Gazette of November last, the valuable paper read before the meeting of the British Association, on the basic constituents of coal tar, and on chrysene. The communication is not of a nature to allow of an abstract.

Napthaline.—Dusart has obtained two new compounds of napthaline, by acting on the protonitrate with potash and lime. He calls them nitrated phthaline and nitrophthalinic acid. From the former he obtained a new alkaloid Phthalidine having the formula $C^{16} H^{9} N$.

Nitroglycerine has been examined by De Vrij, who gives the formula $C^6 H^6 (N O^4)^2 O^6$. He prepares it by gradually adding 100 grms. of glycerine of specific gravity 1·262, to 200 cubic centims of monohydrated nitric acid cooled down to 14° F. As soon as the two liquids have united to a homogeneous mass, a quantity of sulphuric acid equal to that of the nitric acid, is gradually added, keeping the temperature below 32° F. the whole time to avoid an explosion. To purify it dissolve in ether and wash with water. It explodes at a temperature above 320, and also when struck.

Coumaramine.—An artificial alkaloid has been obtained by Frapolli from nitro-coumarine. H. C.

LITERATURE AND THE FINE ARTS.

SAMUEL ROGERS.

Samuel Rogers, the last survivor, if we except Walter Savage Landor, of the poets of England whom we specially associate with the age of Scott and Byron, died at London on the 18th of December, at the advanced age of ninety-three. His rank among England's poets has long been assigned to him, and we cannot doubt that posterity will confirm the decision which two generations of his cotemporaries have attested in regard to the author of "Italy" and the "Pleasures of Memory." It may be that the biographer of the poet will now produce to us some further evidences that the poetic genius which manifested its powers for a brief period so vigorously, preserved the same power in later years, however rarely put forth; but it is a singular fact that he who has just passed away from the circle of admiring friends and cotemporaries, belonged as a poet entirely to a former generation. Our recollections only mebrace the exhibitions of the poet's refined æsthetic tastes as manifested in the wedding of his verse to the younger sister art. The illustrated editions of the "Pleasures of Memory," and "Italy," chiefly by the pencils of Stothard and Turner, constitute an era in the history of English art. It was not merely the lavish expenditure of the wealthy poet, in the adornment of the offspring of his genius; for great as that was, it was probably equalled in the outlay for some of the ephemeral literary "Annuals" of the same period. But the exquisite taste of the poet was employed with such a delicate tact in guiding the artistic illustrations, that its influence only became fully apparent, when publishers seeking to rival his success, in vain employed the same arts and devices, only to be mortified by the discovery that even Turner shone in the pages of Rogers with an inspiration which their money could not purchase from his pencil.

The poet's house in St. James's Place, was a perfect treasury of art. In the preliminary steps for illustrating his poems he is reported to have spent £10,000. Many drawings made for the purpose were not used, the work in its completed form preserving to us only the choice selection of the poet's taste, from the contributions of art to illustrate his muse. The paintings which adorned the poet's residence, though comparatively few in number, were gems of their kind, and of these he has bequeathed to the nation three well-known pictures—the Titian "Noli me tangere;" the Giorgione, a small picture of a Knight in Armour; and the Guido, "Head of Christ crowned with thorns."

The correspondence of Rogers, if given to the world, as doubtless it will be in part at least, will furnish illustrations not only of the literary history of the nineteenth century, but also of the closing era of the previous one, when men flourished as his literary cotemporaries, whom we have learned to class among the ancients. His life must also embrace in its narration many historical reminiscences of other kinds, of no less lively interest.

"The biography of Samuel Rogers," says the *Times*, "would involve the history of Europe since George III., then in the bloom of youth, declared to his subjects that 'he gloried in the name of Briton.' It is now more than a quarter of a century since that monarch was carried to his grave in extreme age, worn out with mental and bodily disease. Let us take the most notable historic drama of the century, 1793-1815—the rise, decline and fall of Napoleon Bonaparte.

"This was but an episode in the life of Samuel Rogers. He was a young man of some standing in the world, fully of an age to appreciate the meaning and importance of the event, when the States General were assembled in France. If we remember right he actually was present in Paris at or about the time, and may have heard with his own ears Mirabeau hurling defiance at the court, and seen Danton and Robespierre whispering to each other that their time was not yet come. Let us go back to other events as standards of admeasurement. As the war of the French Revolution and that against Napoleon Bonaparte were episodes in the ripe manhood, so was the American war an episode in the boyhood of Rogers. He was of an age to appreciate the grandeur, if not the political meaning of events, when Rodney won his naval victories and when General Elliott successfully defended Gibraltar.

"He could remember our differences with our American colonies, and the battles of Bunker's Hill, Brandywine and Germantown, as well as a man now in manhood can remember the three glorious days of July and the Polish insurrection. To have lived in the days of General Washington, and to have heard discussions as to the propriety of admitting the independence of the North American Provinces, and to have been alive but yesterday seems well nigh an impossibility, but such was the case of Samuel Rogers. When he opened his eyes upon the world, that great and powerful country which is now known as the United States of North America, was but an insignificant dependency of the Mother country—a something not so important as the Antilles are at the present moment."

Some such remarks might doubtless be made with equal truth of any illiterate beggar, dying at the same advanced age in the parish workhouse; but we must remember that the poet had advantages which few of his time enjoyed. Born at Newington Green on the 30th July 1762, the son of a wealthy London banker, he enjoyed far more opportunities, and far greater means for observation, intellectual culture, and intercourse with men, than the titled Byron. The perusal of Beattie's Minstrel, it is said, first inspired him with the poet's longings, and having composed some verses which he deemed fit for the critic's eye, he proceeded to the well-known house in Bolt Court, Fleet Street, to submit them to the awful tribunal of the seer. The young poet rapped tremblingly at old Sam Johnson's door, and then his heart failing him, he ran off before it was opened. When next he summoned courage to knock and wait, it was only to learn that the great critic and moralist then lay a-dying.

Such associations with a past so remote to all our ideas as the age of Johnson, naturally suggest other ideas akin to those found to pertain to the deceased poet. A writer in the *Daily News* says—"We have seen Moore die in decrepid old age; yet did Moore, in his boyhood (when he was fourteen), delight in Roger's 'Pleasures of Memory.' When young Horner came to London to begin his career, he found Rogers a member of the King of Clubs, the intimate of Mackintosh (who was his junior), Scarlett, Sharpe, and others, long gone to the grave as old men—and one, Maltby, who was a twin wonder with himself as to years. The last evening that Mackintosh spent in London before his departure for India was at Rogers's. It was Rogers who 'blabbed' about the duel between Jeffrey and Moore, and was the cause of their folly being rendered harmless; and it was he who bailed Moore; it was he who negotiated a treaty of peace between them; and it was at his house that they met and became friends. Moore names him as one 'of those agreeable rattles who seem to think life such a treat that they never can get enough of it.' There was much to render life agreeable to a man of Rogers's tastes, it must be owned. He saw Garrick, and watched the entire career of every good actor since.

All the Kembles fell within his span. He heard the first remarks on the 'Vicar of Wakefield,' and read, damp from the press, all the fiction that has appeared since, from the Burneys, the Edgeworths, the Scotts, the Dickenses, and the Thackerays. As for the poetry, he was aghast at the rapidity with which the Scotts, Byrons, and Moores poured out their works; and even Campbell was too quick for him—he, with all his leisure, and being always at it, producing to the amount of two octavo volumes in his whole life. Somebody asked, one day, whether Rogers had written anything lately. Only a couplet, was the reply—(the couplet being his celebrated epigram on Lord Dudley). '*Only* a couplet?' exclaimed Sydney Smith. 'Why, what would you have? When Rogers produces a couplet, he goes to bed, and the knocker is tied, and straw is laid down, and caudle is made, and the answer to inquiries is that Mr Rogers is as well as can be expected.' Meantime, he was always substantially helping poor poets. His aids to Moore have been recently made known by the publication of Moore's Diaries. It was Rogers who secured to Crabbe the £3,000 from Murray, which were in jeopardy before. He advanced £500 to Campbell to purchase a share of the *Metropolitan Magazine*, and refused security. And he gave thought, took trouble, used influence, and adventured advice. This was the conduct and the method of the last of the patrons of literature in England."

"For half a century," says the *Times*, "his house was the centre of literary society; and the chief pride of Mr Rogers lay not so much in gathering round his table men who had already achieved eminence as in stretching forth a helping hand to friendless merit. Wherever he discerned ability and power in a youth new to the turmoils and struggles of London life, it was his delight to introduce his young client to those whom he might one day hope to equal."

If we turn for a moment from the congenial arena of literary life to the scene of noise and strife which the politics of the early years of the reign of George III. present, we find the poet already enlisted on the side of progress, and associating with men whose names are foremost on the pages of British history in that eventful age, when the foundations of empire were laid on this continent by the colonists who then dictated terms to the mother country. "Let us carry back our minds," says the biographer last quoted, "to the days of Wilkes and the Duke of Grafton, and remember but the mere names of the statesmen who have administered the affairs of the country from that time to the present, and we will have present to our recollection a list of the associates and friends of Rogers. It is, however, to the literary history of the century we must mainly look for a correct appreciation of Rogers's career. He not only outlived two or three generations of men, but two or three literary styles. The Poet of Memory, as he has been called, must not be rashly judged by the modern student, whose taste has been partly exalted, partly vulgarized, by the performances of later writers—we are speaking of a cotemporary of Dr. Johnson. Rogers must have been a young man some 20 years old when the great lexicographer died, and, therefore, a great portion of Johnson's writings must have been to him cotemporary literature. Let those who are inclined to cavil at the gentler inspirations of Rogers think for a moment what English poetry was between the deaths of Goldsmith and Johnson and the appearance of Walter Scott's first great poem. Cowper redeems the solitary waste from absolute condemnation at the most unfortunate epoch in our literature. Rogers no doubt formed his style upon earlier models, but he was no servile copyist; he could feel, without any tendency to apish imitation, the beauties of such authors as

Dryden and Pope. The poem by which his name is principally known to the public will always remain among the classical pieces of English literature, while some of his smaller poems will never cease to hang in the memory of men while the English language is understood. It must have been by an extraordinary combination of position, of intellectual and social qualities, of prudence and of wisdom, that the same man who was the friendly rival of Byron, Wordsworth, and Scott, talked finance with Huskisson and Peel upon equal terms, exchanged *bon mots* with Talleyrand, and was the friend of all the eminent men and of many of the indigent and miserable who flourished and suffered during three parts of a century."

COUNT VALERIAN KRASINSKI.

The Edinburgh papers announce the death of this venerable and distinguished foreigner, which took place on the 22d December. He has resided in Edinburgh for the last eight years, and was familiarly known to its literary circles, where his singularly comprehensive stores of historic knowledge, his extraordinary memory, and his pleasing and courteous manners, ever made him a welcome guest. He belonged to one of the noblest of Polish families, was a native of the ancient Polish province of White Russia, and took a leading part in the Revolution of 1830. On the termination of the struggle, the Count came in 1831, among the crowd of exiles who sought refuge in Britain, and the last work which occupied him was the preparation of a final appeal to the British nation on the subject of Poland. His advocacy of Polish restoration, however, was not revolutionary, but conservative. His first literary production during his exile was a translation of Borolowski's "Court of Sigismund Augustus," an historical romance. Next appeared his "History of the Polish Reformation,"— a work which at once established Count Krasinski's reputation as one of the most eminent historical writers of the day, and which having subsequently been translated into German and French, acquired for him European renown, and won for him flattering notices from the most distinguished men of letters in all countries, as well as from crowned heads, among whom was the late King of Prussia, who bestowed upon him the gold medal for literary merit. In 1847 he delivered in Edinburgh a course of lectures on "Panslavism and Germanism," which were shortly afterwards published. His "Religious History of the Slavonic Nations" appeared in 1853. Early last year he commenced the publication, in parts, of a "History of Poland," the materials for which he had long had in preparation. Besides the works now mentioned, Count Krasinski contributed occasionally to some leading periodicals. Though often subjected to great privations, he ever resolutely rejected the most brilliant offers made to him by Russia, and even declined the more flattering and honorable overtures made to him by the King of Prussia, preferring a life of honest, though not painless, independence in a free country to the golden chains of the destroyer of his native land, or even the service of a monarch whose country has borne an unenviable part in the history of that destruction.

SIR GEORGE BALLINGALL.

The death of Sir George Ballingall, M. D., Professor of Military Surgery in the University of Edinburgh, took place on the 4th of December last, at his country residence, Altamount, near Blairgowrie. He had filled the chair of Military Surgery in the University for thirty-two years, his appointment dating from 1823. He was a Fellow of the Royal College of Surgeons, Edinburgh; a Fellow of the Royal Society; an Honorary Member of the Royal College of Surgeons, Ireland; and a member of the Medical Societies of Paris, Vienna, St. Petersburg, and Berlin. Sir George began his career in the army, and was for some years Surgeon to the 33d Regiment of Foot. The profession is indebted to him for several valuable contributions to medical literature, the chief of which are: "Observations on the Diseases of the European Troops in India;" "Observations on the Site and Construction of Military Hospitals;" and "Outline of Military Surgery."

ROBERT MONTGOMERY.

English papers record the death of the Rev. Robert Montgomery as one of the events of the closing year. If popularity, as proved by the sale of numerous successive editions, could have proved the author of "The Omnipresence of the Deity," "Satan," &c., to be a poet, this writer had abundant credentials, some of his volumes having gone through fourteen editions. Long since, however, Wilson, in Blackwood, exposed his vapid and hollow pretensions, and Macaulay in the Edinburgh Review, anatomized him with his keen critical scalpel. To the latter notice of him, included in the collected Essays of the historian, we may possibly owe some remembrance of him by posterity, such as his own turgid verse could not secure for him.

AMERICAN SCULPTRESS.

The correspondent of the *Toronto Leader*, writing from Rome, November 5th, remarks:—"What prevents a woman from being a sculptor*ess?* One of Mr. Gibson's students is a young lady, from Boston Mass., of the name of Hosman. This Miss Hosman promises to rival her countryman, Powers. She is not a mere chiseller: she is a woman of original ideas and uncommon energy of execution. The greatest sculptor of the age speaks of her talents in a very flattering way. She has in hand a model of the Cenci, the young lady who is the victim of Shelly's powerful tragedy of the Cenci. There was hardly any object in Rome that I so much wished to see as the Palace of the Cenci, if it still existed, or anything relating to it, if it existed no more; and here I find a young American lady carrying into effect her own original idea of treating this subject in sculpture. It has never before been so treated. Portraits of the youthful victim there have been. I saw one this morning, taken by Guido, the morning before her execution. It was in the studio of Ratti, an Italian artist. Ratti has not merely given the portrait, but the whole scene; the judge, the victim, and Guido taking her portrait. Hon. Mr. Ross has purchased this picture. The model which Miss Hosman is making represents the victim lying in prison before her execution. She lies on her left cheek, with her right arm folded round her head, and her left arm hanging down. Mr. Gibson says, there is a month's work on this model still to be done. I also saw a finished statue by Miss Hosman. It was Œnone, the sheperdess. The execution was very good."

It is scarcely necessary to remark that this is by no means the first example of the successful practice of the sculptor's art by a lady; though the "Beatrice" of Shelly's "Cenci" is a subject of rather singular choice for a lady artist. The works of the Hon. Mrs. Damer's chisel are well known in England; the more recent Joan of Arc, of the French d'Orleans Princess, is familiar to us all, at least by statuette copies; and Properzia Rossi, the celebrated female sculptor of Bologna, has had her artistic achievements recorded, both in prose and verse.

MONUMENT TO THE SCOTTISH POET NICOLL.

An appeal has lately been made to the friends and admirers of the poet Nicoll for subscriptions to erect a monument to his memory, which is being favourably responded to. It is proposed to place the monument on a piece of ground granted by Colonel Richardson Robertson, of Tulliebelton, on Ordie Braes, near the poet's birthplace. Nicoll's remains lie in Leith kirkyard, and are still without a stone to mark the spot.

MEMORIAL TO LIEUTENANT BELLOT.

A monument to the memory of the late Lieutenant Bellot, of the French navy, who perished in the last Arctic expedition, has been erected on the west wharf of Greenwich Hospital. It is a very prominent object from the river, and consists of an obelisk of Aberdeen red granite, highly polished.

BRITISH OBITUARY OF 1855.

Within the last twelve months what a gap has been made in the memorable roll! The sagacious and indefatigable Truro,—the earnest and philosophic Molesworth,—the enterprising Parry,—the warm-hearted and upright Inglis,—the scientific De la Beche,—the learned Gaisford,—the reforming Hume,—the harmonious Bishop,—the financial Herries,—the diplomatic Adair,—the poetical Strangford, also a diplomatist, with Ellis and Ponsonby, his fellow-labourers in the last-named category,—the gifted Lockhart,—Miss Ferrier and Adam Ferguson, connected, too, with Sir Walter Scott,—Lord Robertson, the convivial Judge,—Lord Rutherfurd, his acute compeer,—Miss Mitford and strong-hearted Currer Bell,—Colburn, the godfather to half the novels of the last half century,—Sibthorp the eccentric,—the travelled Buckingham,—Park the sculptor,—Gurney the short hand writer,—J. Smith, the preternatural,—the centenarian Rogers,—Black of the *Morning Chronicle*,—the life-preserving Captain Manby,—Archdeacon Hare,—Jessie Lewars, the friend of Burns,—the injured Baron de Bode,—and a long file of titled names distinguished in all the pursuits of life.—*Bentley's Miscellany.*

LITERARY GOSSIP.

Lady Emmeline Stuart Wortley, daughter of the Duke of Rutland, may be mentioned among the popular verse-writers recently deceased.

Sidney Dobell, the author of "Balder," and better known by his *nomme de plume* of Sidney Yendis, is reported to be engaged on a series of Lyrics suggested by the incidents of the war. His share in the "War Sonnets" produced by the joint labors of Alexander Smith and himself may be accepted as a good foretaste of what may be expected from him.

Longfellow is engaged, it is said, on a translation of Dante, which is already so far advanced that it is expected to be ready for the press some time during the present year.

Mrs. Oliphant, the authoress of "Passages in the Life of Mrs. Margaret Maitland, of Sunnyside," which won such high and well-merited praise from Lord Jeffrey, has produced a continuation of that work under the name of "Lilliesleaf," which is spoken of by English critics as fully equal to the first. It is not generally known that this talented Scottish authoress was only in her nineteenth year (then Miss Margaret Wilson) when she produced the work which won the plaudits of the veteran critic.

Mr. Robert Chambers is now engaged on a narrative of his visit during the past summer to Iceland and the Faroe Islands. Some interesting geological observations may be anticipated from it.

Mrs. Gaskell has undertaken to prepare for the press a biography of Charlotte Bronte, the lamented authoress of "Jane Eyre."

The Rev. Dr. W. L. Alexander, of Edinburgh, has nearly ready for the press a Life of the late Dr. Wardlaw.

The *Dublin University Magazine* has been purchased for £750 by Messrs. Hurst and Blackett of London. It will henceforth be published there. Our readers are probably aware that the *Edinburgh Review* is in like manner a Cockney, having been for years Edinburgh only in name; but its place is well supplied by the native *North British Review.*

The *Piedmontese Gazette* announces that Silvio Pellico's correspondence will shortly be published, and invites all those who are in possession of letters of that eminent writer, and wish them to appear in the collection, to send them to M. G. Stefani, at Turin.

The oldest work in the Russian language, says a writer in the *Literary Gazette*, was produced in 863, and was a translation from the Greek of the Holy Scriptures. The Russian language is allied to the Sanscrit, but the old Sclavonian dialect—that which is used in the offices of the Church—approaches it more closely than the modern tongue. The latter is overladen with Tartar, Mongol, Turkish, Polish, and German words.

The news of Macaulay's resignation of his seat in Parliament, while it affords abundant excitement in the arena of politics, has its full interest in a literary point of view. Already one of the Scottish papers rumors the fifth volume of his history completed in MS., and further portions of the work far advanced.

MILTON AND NAPOLEON.

A correspondent communicates the following curious statement to the Notes and Queries:—"Among some books purchased at Puttick & Simpson's two years since, was a copy of Symmons' 'Life of Milton.' Having lately occasion to examine it more than I had hitherto done, I found it contained many notes and remarks in the handwriting of a former possessor, J. Brown. Who this gentleman was I know not, and the following note must be taken on *his* authority, not mine:—

"In this 'Life of Milton,' by Dr. Symmons, p. 551, is a note to which this notice may be appended:—

"Napoleon Bonaparte declared to Sir Colin Campbell, who had charge of his person at the Isle of Elba, that he was a great admirer of our Milton's 'Paradise Lost,' and that he had read it to some purpose, for that the plan of the battle of Austerlitz he borrowed from the sixth book of that work, where Satan brings his artillery to bear upon Michael and his angelic host with such direful effect:—

'Training his devilish enginery, impal'd
On every side with shadowing squadrons deep,
To *hide the fraud.*'

"This new mode of warfare appeared to Bonaparte so likely to succeed, if applied to actual use, that he determined upon its adoption, and succeeded beyond expectation. A reference to the details of that battle will be found to assimilate so completely with Milton's imaginary fight as to leave no doubt of the assertion.

"I had this fact from Colonel Stanhope, who had just heard it related by Colonel Campbell himself. Colonel Stanhope was then at Stowe, the Marquis of Buckingham's, where I heard it repeated. It has never to my knowledge been in print, nor have I ever heard the circumstance repeated. Colonels Stanhope and Campbell have been long dead. The time of my hearing the above was 1815."

D. W.

MISCELLANEOUS.

MATERIALS FOR TEXTILE FABRICS.

The late Paris Exhibition contained ample proof that the colonies of Great Britain could produce an inexhaustible supply of vegetable fibres adequate to all the requirements of our textile manufactures in lieu of the flax and hemp of Russia of which the war is to a large extent depriving us. When the supply of rags fell short of the demand for paper making, attention was turned to the vegetable kingdom for a substitute, and not one, but many ligneous fibres were speedily discovered, of acknowledged suitableness for the purpose. The paper-makers, however, found that, in order to take advantage of these discoveries, expensive alterations would be required in their existing machinery; and in the meantime. the supply of rags, which had been kept up on the Continent in the expectation of increased prices from the demand for cheap newspapers, has become sufficient for ordinary wants; although newspaper proprietors have not been relieved of the extra price laid upon their paper during the scarcity of rags. The capability of India to supply this country with substitutes for Russian flax and hemp, was demonstrated in the collection of products exhibited at Paris by Dr. Royle; and a corresponding collection from Jamaica, prepared by Mr. N. Wilson, of the Botanic Garden in that island, exhibited an equal capability on the part of our colonies in the West Indies. There is now a reasonable prospect that sugar, their staple product, will no longer be an unremunerative article of produce. But with the revival, as we fondly trust, of the prosperity of these fine colonies, the proprietors have an opportunity of pushing their enterprise into other and more lucrative fields of production. The *Kew Garden Miscellany* for November, edited by Sir W. J. Hooker, contains extracts from a report on the Jamaica Botanic Garden, deserving the careful consideration of proprietors in that island. The report bears testimony to the increasing desire for growing new plants and adopting new staples in Jamaica, as well as for a more extended and varied cultivation of the island. in order to meet the exigencies of its altered condition. Numerous plants have been introduced by Mr. Wilson, who has tested their fitness for the soil and climate, and who finds that the island now "possesses the finest fibres and the greatest number of textile plants in the world, hitherto of no avail in the country in general, and held of little value by individuals, but which may now be turned to the greatest account in a national point of view." No fewer than *fifty-one* of the samples of fibres shown at Paris from Jamaica were the products of plants indigenous to the island, and all suited more or less for textile purposes, from the coarse cocoa-nut coir to filaments rich as those of the finest silk. We subjoin an extract from this important and seasonable report:—

For the Plantain, Pinguin, and all similar herbaceous plants, machinery is absolutely necessary to separate and clean the fibre advantageously; when this desideratum is accomplished, and with one or two years' practice, there is nothing to prevent Jamaica competing with any part of the world of ten times the same extent. The inducement to do so cannot be much greater than it is at present. I find, by a statistical account, that the imports of flax into the United Kingdom during 1853, amounted to 94,163 tons, 14 cwt., and, at the exhorbitant price of £110 per ton, to which the average price of foreign flax has already risen, it shows a sum of £10,358,007, which has been paid in cash for foreign flax fibre last year; and since the prohibition of Russian hemp into European markets, prices and demand are increasing daily.

"My motive for laying before you my views on this subject, and preparing the samples of fibre for your inspection, is, that I am anxious to submit to you, and through you to the agriculturists and people in general of this island, the desirability and advantages in an individual and national point of view to be derived from the adoption and extensive cultivation of fibrous plants. As I have already mentioned, the great scarcity, exhorbitant price, and widely-spreading demand for fibre throughout the world, render the materials of which it is manufactured of much importance, particularly in this country, where labour is scarce and dear, and agriculture at its lowest ebb. Many of these fibres will be found of superior quality, and produced in greater abundance than any grown in temperate regions.

"I have made a very moderate calculation of the produce of an established field with Plantains, which I find to be as follows:—

	£	s.	d.
An acre planted with suckers, at ten feet apart, will contain 435 plants, and the first year will produce as many bunches of fruit worth 6d.	£10	17	6
Each stem will yield 1 lb. of finely-dressed fibre, worth 6d.	10	17	6
Amounting in sterling money in all to....	£21	15	0

METEOROLOGICAL OBSERVATIONS.

The present number contains the Monthly Meteorological Reports for November 1855, in continuation of the series hitherto published in the Canadian Journal; and those for December, along with the abstracts of the various observations for the past year would also have been included, but for unavoidable impediments incident to the starting of the new series, with a different size of page, which render the materials formerly used for setting up the Monthly Meteorological Registers of the various Canadian observers no longer available.

The December number of the Journal contains three papers on the subject of Meteorological Observations in Canada, from which it will be seen that a very little time must elapse before a greatly extended staff of observers will be in full operation throughout all the settled districts of Upper Canada; and the impetus thus given to such labors in this important department of science, cannot fail to be productive of valuable results. The example set by the Upper Province, will, it may be confidently anticipated, stimulate those at the head of the scientific and educational institutions throughout British North America to follow its example, and thus contribute some of the links in the great chain of philosophical researches in Physical Geography and Magnetism, now embracing so widely extended an area of the globe.

Already symptoms of an intelligent and increasing interest in this subject are apparent. Professor Williamson, of the University of Queen's College, Kingston, has intimated to the editor his intention of enlisting as one of the contributors to this branch of scientific observation, and furnishing to the Canadian Journal monthly tables from Kingston, corresponding with those already due to the Meteorological and Magnetic observations made at the Provincial Observatory of Toronto University, and to the indefatigable labors of Dr. Smallwood, at St. Martin's, Isle Jesus, Capt. Noble, and Mr. W. D. C. Campbell, at Quebec, and Dr. Craigie, at Hamilton. It has been resolved by the Canadian Institute, after mature deliberation, that its duties in relation to this department of science shall be strictly limited to publishing the observations supplied by the various scientific laborers throughout the Province; but even this, it is obvious, must speedily become both an onerous and very responsible duty, as the stations multiply through the Province, and the number of volunteer observers increase. Meanwhile the work is not incompatible with the general features of this Journal, but the period is probably not far distant when the Institute may find it advisable to publish in a distinct and independent form the Meteorological and Magnetic Journal of British North America.

MONTHLY METEOROLOGICAL REGISTER, AT THE PROVINCIAL MAGNETIC OBSERVATORY, TORONTO, CANADA WEST.—NOVEMBER, 1855.

Latitude, 43 deg. 39·4 min. North. Longitude, 79 deg. 21 min. West. Elevation above Lake Ontario, 108 feet.

DAY.	BAROMETER AT TEM. OF 32 DEG.				TEMPERATURE OF THE AIR.				Mean Temp. +or− of the Average.	TENSION OF VAPOUR.				HUMIDITY OF THE AIR.				DIRECTION OF THE WIND.				VELOCITY OF THE WIND.				RAIN IN INCH.	SNOW IN INCH.
	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.	MEAN.	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.	MEAN.		
	°	°	°	°	°	°	°	°	°					°	°	°	°										
1	29·476	29·600	27·725	29·616	49·2	51·8	39·5	45·9	+6·5	0·316	0·226	0·161	·237	·92	·60	·67	·73	S W b W	N W b N	N	N 14 W	7·0	11·2	11·2	10·24	Inap.	...
2	·770	·794	·838	·805	37·4	45·3	37·3	40·0	0·2	·177	·167	·156	·163	·79	·56	·71	·67	N N E	E b N	N N E	N 39 E	8·8	6·2	8·6	7·24	...	...
3	·852	·804	·831	·829	31·2	42·4	32·8	35·4	−4·6	·140	·175	·150	·157	·84	·65	·80	·77	N	E N E	N	N 21 E	4·4	5·8	8·8	7·28	...	...
4	·934	·924	...	...	29·1	41·8	...	...	...	·127	·158	...	...	·78	·60	...	...	N	S b E	E N E	E 20 N	8·2	4·2	5·4	5·60	...	...
5	·875	·760	·665	·760	42·7	59·7	46·8	46·6	+ 7·1	·226	·275	·265	·256	·82	·76	·84	·82	E	E b N	E	E 12 N	9·4	14·4	11·0	11·88	...	...
6	·627	·610	·569	·602	47·0	52·7	49·8	49·6	+10·5	·257	·277	·311	·295	·84	·71	·88	·84	E	E	E 6 S	E 2 S	9·4	9·1	6·5	7·84	1·030	...
7	·498	·503	·612	·536	48·8	53·1	47·4	49·6	+10·6	·330	·375	·290	·328	·97	·95	·90	·93	E	S S W	N W b N	N 20 W	6·4	2·0	4·2	6·01	1·005	...
8	·806	·866	·978	·891	57·8	49·3	43·6	43·1	+ 4·5	·197	·245	·204	·214	·87	·71	·73	·77	W b N	S S W	N N W	W 2 S	9·0	5·4	9·6	6·02	...	...
9	30·089	30·100	·997	30·053	35·5	45·2	41·7	40·9	+ 2·5	·175	·202	·214	·195	·82	·68	·82	·76	N N W	E S E	S E b E	East.	5·4	5·5	7·8	6·35	...	...
10	29·881	29·744	·752	29·730	39·3	47·7	45·3	44·5	+ 6·5	·195	·235	·248	·233	·82	·72	·80	·80	E N E	E b S	E b N	E 4 N	4·5	5·8	2·0	4·53	...	...
11	·775	·742	...	...	47·0	48·9	...	...	...	·257	·280	...	...	·84	·82	...	...	E b N	E	E N E	E 13 N	5·0	16·2	16·2	13·89	1·020	...
12	·625	·491	·648	·590	51·3	52·8	48·1	50·1	+12·6	·355	·374	·328	·341	·96	·96	·99	·95	E	E	S W	S 16 E	11·1	5·5	10·6	8·87	1·120	...
13	·795	·817	·854	·828	42·5	54·1	42·0	45·8	+ 8·6	·221	·178	·196	·205	·82	·43	·74	·68	S W b W	W S W	W b S	W 36 S	10·0	16·0	6·0	9·07	...	...
14	·887	·874	·882	·872	33·7	53·3	44·1	44·0	+ 7·4	·164	·246	·176	·196	·84	·61	·62	·68	W N W	S W b S	N W	S 37 W	1·2	11·8	0·4	3·15	...	...
15	·824	·615	·132	·610	43·4	47·7	48·3	47·0	+10·5	·190	·272	·317	·259	·68	·84	·95	·84	Calm	E b S	Calm	S 44 E	0·8	6·2	0·5	3·97	0·130	...
16	·295	·628	·866	·634	53·6	58·1	30·2	38·4	+ 2·1	·345	·133	·124	·181	·86	·58	·74	·74	N N W	N N W	N	N 32 W	20·0	26·0	5·8	16·07	...	...
17	·882	·523	·334	·577	25·9	33·3	33·3	30·7	− 5·1	·103	·136	·213	·147	·71	·71	100	·84	N E	E	E b S	E 20 N	12·8	33·2	4·5	17·08	0·180	0·5
18	·685	·729	...	...	29·1	34·6	...	...	...	·140	·152	...	...	·85	·71	...	...	W	W b S	W N W	W 3 N	7·2	14·2	19·2	15·71	...	0·5
19	·792	·833	·955	·887	29·4	32·0	26·9	28·9	− 6·2	·115	·156	·094	·130	·89	·75	·63	·80	W b S	W	W	W 8 N	12·2	21·7	10·0	12·91	...	Inap.
20	30·001	·973	·775	·903	23·7	31·2	32·7	29·2	− 5·6	·115	·158	·172	·140	·86	·91	·93	·89	N N W	E S E	S E	S 44 E	4·5	3·0	12·0	6·88	...	2·0
21	29·394	·402	·657	·503	39·2	35·7	29·4	34·5	+ 0·0	·211	·135	·096	·152	·89	·66	·58	·73	S S W	W b S	N W b N	W 26 N	10·4	18·4	36·5	19·88	...	Inap.
22	30·001	·989	·856	·945	23·7	29·8	29·1	27·5	− 6·6	·109	·128	·123	·120	·83	·78	·76	·79	N b W	W b N	W S W	W 2 S	10·6	12·2	7·7	9·70	...	...
23	29·502	·141	·280	·321	37·2	42·0	37·0	37·8	+ 4·1	·149	·174	·160	·163	·67	·65	·72	·72	S W b S	W S W	W	W 6 S	21·8	20·5	22·0	23·21	0·005	...
24	·752	·843	·775	·793	23·0	31·3	32·7	28·7	− 4·9	·101	·121	·168	·120	·81	·71	·92	·80	N W	W b N	S W b W	W 18 N	25·9	16·0	10·0	10·27	...	...
25	·552	·204	...	...	36·3	40·8	...	...	...	·131	·240	...	...	·62	·95	...	...	S S E	S W	W b N	W 39 S	8·8	7·2	15·2	11·93	0·100	...
26	·312	·318	·614	·425	34·6	40·2	32·3	35·9	+ 3·4	·155	·172	·157	·160	·77	·70	·75	·76	S W b W	W b N	W b N	W 7 N	14·2	23·1	10·5	14·61	Inap.	...
27	·550	·147	·029	·226	32·7	45·5	40·9	39·5	+ 7·3	·139	·163	·162	·157	·74	·54	·64	·65	S W b W	W S W	S W b W	W 31 S	13·2	13·6	15·0	13·83	...	Inap.
28	28·985	·085	·283	·137	38·8	37·6	20·8	31·1	− 0·7	·156	·148	·074	·125	·66	·66	·63	·68	W S W	N b W	N N W	N 50 W	14·7	20·6	20·5	18·10	...	...
29	29·419	·490	·623	·52	19·5	28·9	25·9	24·8	− 6·7	·090	·087	·126	·10	·82	·54	·85	·77	N W b W	W	W b S	W 20 N	10·6	19·5	8·0	10·93	...	...
30	·711	·595	·484	·586	23·3	38·4	36·3	32·7	+ 1·6	·109	·151	·168	·137	·84	·66	·79	·73	W b W	S W b S	S W b W	S 44 W	4·6	18·0	10·5	11·38	...	...
	29·677	29·637	29·667	29·661	36·3	42·7	37·7	38·6	+ 2·1	0·188	0·196	0·186	0·190	·82	·69	·78	·74				W 24 N	9·74	13·08	10·54	10·81	4·590	3·0

Highest Barometer.........30·131. at 8 A. M. on 9th } Monthly range :=1·148 in.
Lowest Barometer ....28·983, at 6 A. M. on 28th }
Highest registered temperature, 59° 2 at P. M. on 15th } Monthly range :=43·7.
Lowest registered temperature, 15° 5 at A. M. on 29th }
Mean maximum Thermometer, 45° 50 } Mean daily range: = 16° 76.
Mean minimum Thermometer, 28 74 }
Greatest daily range 26° 5 from P. M. of 28th to A. M. of 29th.
Least daily range ... 7° 6 from P. M. of 30th to A. M. of 1st December.
Warmest day...12th...Mean temperature : = 50° 13 | Difference: 25° 33.
Coldest day..... 29th...Mean temperature : = 24° 80 |
Greatest intensity of Solar radiation = 67° 0 on P. M. of 14th.
Lowest point of Terrestrial radiation = 12° 0 on A. M. of 20th.

Monthly range......... 55° 0

Aurora observed on 5 nights, viz.. 3d, 5th, 12th, 16th and 18th.
Possible to see Aurora on 19 nights.
Impossible to see Aurora on 11 nights.
Raining on 8 days, raining 57·2 hours, depth 4·590 inches.
Snowing on 6 days, snowing 11·0 hours, depth 3·0 inches.
No thunder or lightning recorded this month.
Mean of Cloudiness, 0·60.

SUM OF THE ATMOSPHERIC CURRENT, IN MILES RESOLVED INTO THE FOUR CARDINAL DIRECTIONS.

North.	West.	South.	East.
2376·86	4009·65	1454·73	1911·88

Mean direction of the wind W 24 N.
Mean velocity of the wind ...... 10·81 miles per hour.
Maximum velocity .... 36·5 miles per hour from 9·30 to 10·30 P.M. on 21st.
Most windy day .... 23d, mean velocity: 23·21 miles per hour.
Least windy day .... 14th, mean velocity : 3·15 do
Most windy hour .... 2 to 3 P. M., mean velocity: 13·11 per hour.
Least windy hour .... 2 to 3 A. M.. mean velocity : 8·62
Mean diurnal variation .... 4·49 miles.

The mean temperature of November 1855 was 1° 8 above the average of the last 16 years, and the depth of rain that fell 1·564 inches above the mean.

The mean velocity of the wind was 4·56 miles per hour above the average of the last 8 years, and is the greatest for any month yet recorded in the observatory.

In looking out for the periodic display of meteors, from the 11th to the 14th, about 30 were observed on the 12th, between 10h and 15h; and 17 on the 13th between 8h and 14h. At 14h 49m of the 12th a brilliant meteor 3′ in diameter appeared in the west at a point 45° above the horizon, from whence it descended vertically. Its course was marked by a belt of light, 3′ in diameter, whose color changed from deep red to green and white, and which lasted 10s with undiminished splendor; the luminous path continued visible at least 1m 30s.

YEAR.	TEMPERATURE.					RAIN.		SNOW.		WIND.	
	Mean.	Diff. from Aver.	Max. obs'd	Min. obs'd.	Range	Days.	Inches	Days.	Inches.	Mean Division	Mean force or Velocity.
	°		°	°	°						
1840	35·9	—0·9	54·4	20·5	33·9	5	1·220	8	...	......	......
1841	35·0	—1·8	63·2	7·6	55·6	8	2·450	5	...	......	0·91 lb.
1842	33·3	—3·5	50·6	7·6	43·0	9	5·310	10	...	......	1·22 "
1843	33·5	—3·3	51·2	14·4	36·8	10	4·765	7	1·2	......	0·59 "
1844	34·9	—1·9	49·8	12·0	37·8	8	imp't.	4	8·0	......	0·48 "
1845	36·8	0·0	58·8	7·6	51·2	7	1·105	4	5·0	......	0·53 "
1846	41·3	+4·5	55·5	8·2	37·3	12	5·805	2	0·4	......	0·64 "
1847	38·6	+1·8	58·2	7·8	50·4	14	3·155	3	Inap.	......	0·36 "
1848	34·5	—2·3	49·3	16·5	32·8	9	2·020	3	1·4	W9°N	4·81 miles
1849	42·6	+5·8	56·7	28·4	28·3	10	2·815	2	1·0	N39W	4·78 "
1850	38·8	+2·0	62·3	18·1	44·2	7	2·955	1	Inap	N42W	5·27 "
1851	32·9	—3·9	50·1	16·5	33·6	5	3·885	6	6·7	W39°N	4·70 "
1852	36·0	—0·8	50·4	18·7	31·7	7	1·775	3	2·0	W31°N	6·50 "
1853	38.7	+1·9	54·1	14·4	39·7	15	2·425	6	2·7	N1°E	5·52 "
1854	36·8	0·0	51·9	15·1	36·8	13	1·115	4	1·3	W1°S	7·58 "
1855	38·6	+1·8	54·1	18·7	35·4	8	4·590	6	3·0	W24°N	10·81 "
Mean	36·76		54·00	15·13	39·47	9·2	3·025	4·6	2·5		0·67 lbs. / 6·25 miles

MONTHLY METEOROLOGICAL REGISTER, ST. MARTIN, ISLE JESUS, CANADA EAST—NOVEMBER, 1855.

(NINE MILES WEST OF MONTREAL.)

BY CHARLES SMALLWOOD, M. D.

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

Day.	Barom. corrected and reduced to 32° Fahr. 6 A.M.	2 P.M.	10 P.M.	Temp. of the Air. 6 A.M.	2 P.M.	10 P.M.	Tension of Vapor. 6 A.M.	2 P.M.	10 P.M.	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	Direction of Wind. 6 A.M.	2 P.M.	10 P.M.	Velocity in miles per hour. 6 A.M.	2 P.M.	10 P.M.	Rain in Inches.	Snow in Inches.	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0. 6 A.M.	2 P.M.	10 P.M.
1	29.696	29.680	29.857	39.7	48.4	41.1	.245	.349	.257	.94	.96	.95	S S E	S S W	N N W	2.52	3.52	1.66	0.306	...	Rain.	Rain.	Clear.
2	.990	.978	994	31.5	44.5	33.0	190	310	187	96	74	90	N N E	E N E	N N E	3 00	13.21	9.33	...	...	Clear.	Cum. St. 9.	Clear, Aur. Bor.
3	30.009	30.042	30.048	30.1	41.6	29.0	168	207	161	90	74	89	N E by N	N E by N	N E by N	8.40	9.01	3.51	...	...	Str. 4.	Do. 4.	Do.
4	.094	.047	.190	28.1	43.8	30.0	166	209	169	90	69	90	N E by N	N E by N	E	7.45	4.40	0.12	...	...	Clear.	Clear.	Do.
5	.209	.174	.100	26.2	39.1	35.0	156	181	206	96	73	92	E N E	E S E	E by N	1 46	1 80	3.16	...	...	Do.	Do.	Do. Aur. Bor.
6	29.991	29.906	29.906	31.6	51 1	41.0	185	274	253	95	70	90	SE by E	SE by E	SE by E	5.93	7.63	9.91	...	...	Do.	Do.	Do. Do.
7	.857	.704	.730	40.1	57.0	49.5	245	385	350	91	81	93	S E	SE by E	N by W	4.12	1.55	0.41	Inapp	...	Cir. Cum. Str. 5.	Cir. Cum. Str. 8.	Str. 10.
8	.784	.921	30.010	47.1	51.2	39.1	323	279	234	94	71	91	W by N	W by N	W S W	5.18	14 30	1 13	0.396	...	Str. 10.	Cir. 1.	Clear.
9	30.198	30.231	.265	32.7	47.0	32.5	197	277	191	95	80	95	W by N	S W	S W	4 97	3.11	0.36	...	...	Clear.	Clear.	Do.
10	.121	29.987	29.964	30.0	48.2	39.0	176	261	224	94	74	89	N E by N	S S E	S	0.14	0.80	1.01	...	...	Do.	Cir. Str. 10.	Str. 10.
11	.081	30.103	30.192	38.2	48.6	40.2	226	281	227	91	80	85	N E by N	N E	N E by N	0.00	5.51	10.51	...	...	Cir. Str. 8.	Cir. Cum. Str. 4.	Clear.
12	.154	.044	29.914	36.8	43.4	42.4	214	252	263	99	85	92	NE by E	NE by E	NE by E	19.92	9.32	12.11	...	...	Do. 6.	Cir. Str. 10.	Rain.
13	29.817	29.900	.939	41.0	53.2	42.5	263	323	235	99	79	85	S	W S W	W S W	11.70	11.50	8.10	1.751	...	Rain.	Cum. 4.	Clear.
14	.964	.845	.909	39.6	55.7	43.7	234	331	252	95	72	85	S W	S W	S W	10.63	8.58	5.70	...	...	Light Cum. 4.	Clear.	Do.
15	30.045	.965	.775	31.6	46.1	37.0	185	246	179	96	75	76	N W	E by N	NE by E	1.45	0 67	4.00	Inapp	...	Clear.	Cir. Str. 9.	Str. 10.
16	29.284	.498	.901	36.0	41.0	26.5	221	191	165	99	70	90	E S E	W N W	W N W	6.60	13.30	23.64	0.995	...	Rain.	Do. 6.	Do. 4.
17	30.120	30.044	.874	29.2	25.0	23.1	114	123	106	87	79	76	N by W	NE by E	E N E	11.23	6.31	13.65	...	2 74	Clear.	Str. 10.	Snow.
18	29.629	29.784	.752	21.0	26.7	26.1	126	157	156	93	91	96	N	W S W	SE by E	11.69	6.41	5.37	...	...	Cum. Str. 4.	Cir. Str. 10.	Cir. Str 8.
19	.795	.842	.984	22.0	25.0	13.1	131	123	083	94	79	82	W	W by N	W by N	14.75	13.90	16.36	...	...	Do. 6.	Str. 10.	Clear, Aur. Bor.
20	30.173	30.153	30,170	1.0	19.2	8.8	048	080	066	95	64	93	W S W	W	W by N	8.00	4.23	5.08	...	...	Clear.	Clear.	Do.
21	29.847	29.590	29.521	12.0	18.1	18.0	085	106	124	88	87	99	NE by E	NE by E	N E by N	2.54	10.40	18.51	...	3.40	Cir. Str. 10.	Snow.	Snow.
22	30.051	30.069	30.070	5.4	20.1	15.6	058	103	108	92	87	94	W by N	W by N	S W by W	5.57	11 36	5.05	...	1.20	Clear.	Clear.	Cir. Cum. 5.
23	29 802	29.296	29.140	20.0	32.6	34.0	121	199	210	93	94	98	S	S S E	S W by W	9.85	7.76	8.50	0.100	...	Cir. Str. 10.	Cum. Str. 10.	Rain.
24	29.661	30.124	30.081	9.0	24.1	13.2	064	103	083	90	68	82	N W	W S W	W S W	35.00	29.71	8.48	...	...	Clear.	Clear.	Cir. Str. 10.
25	29.827	29,552	29.279	21.0	28.9	34.1	118	179	192	88	95	99	S E	SE by S	S S E	5.05	4.00	10.52	...	1.00	Cir. Cum. Str. 8.	Snow.	Rain.
26	.271	.341	.886	36.0	34.2	30 1	220	195	177	99	91	94	W S W	W S W	N W	18.00	0.51	6.30	0.377	...	Rain.	Sleet.	Cir. Str. 3.
27	.606	.421	.210	21.8	31.8	32.5	134	214	195	95	92	95	S W by W	N E	S S E	23.18	0.42	4.39	Inapp	...	Cir. Str. 10.	Cir. Str. 4.	Do. 10.
28	29 010	29.025	.285	36.0	37.8	21.3	230	218	092	97	71	91	S W	S W	N W	8.44	5.17	17.00	Inapp	...	Do. 10.	Do. 8.	Do. 10.
29	29.469	.457	.612	8.1	17.0	12.7	065	084	096	93	73	82	W by S	W N W	W N W	10 08	11.67	17.70	...	...	Do. 10.	Clear.	Clear, Aur. Bor.
30	.857	.862	.772	12.2	27.7	26.7	094	137	161	88	82	91	W S W	W S W	S by E	10.00	7.82	4.05	...	...	Clear.	Cir. Str. 10.	Cir. Str. 6.

MONTHLY METEOROLOGICAL REGISTER, QUEBEC, CANADA EAST, NOVEMBER, 1855.

BY CAPT. A. NOBLE, R.A., F.R.S., AND MR. WM. D. C. CAMPBELL.

Latitude, 46 *deg.* 49.2 *min. North*; *Longitude*, 71 *deg.* 16 *min. West.* *Elevation above the level of the Sea*, 200 *Feet.*

Date.	Barometer corrected and reduced to 32 degrees, Fahr.				Temperature of Air.				Tension of Vapor.				Humid'y of Air.				Direction of Wind.			Velocity of Wind.			Rain in Inch.	Snow in Inch.	REMARKS.
	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M.	2 P.M.	10 P.M.	Mn.	6 A.M.	2 P.M.	10 P.M.	MN.	6 A.M.	2 P.M.	10 P.M.	MN.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.			
1	29.657	29.592	29.790	29.680	37.5°	42.5°	40.0°	40.2°	.188	.267	.210	.222	.84	.99	.86	.90	Calm.	Calm.	W	0.0	0.0	7.2	.620	...	
2	.933	.909	.976	.939	32.7	38.0	34.8	35.2	.166	.267	.137	.190	.89	.89	.68	.82	Calm.	E	N W	0.0	15.2	10.0	...	...	2nd. At 2 a.m. Auror visible thro'h a break in the clouds.
3	30.037	.935	.935	.969	31.1	34.1	30.1	31.8	.119	.101	.120	.113	.68	.51	.72	.64	E	E	Calm.	8.0	5.2	0.0	...	...	
4	29.992	30.032	30.114	30.046	27.0	37.3	32.4	32.2	.127	.170	.167	.155	.85	.77	.91	.84	Calm.	W	Calm.	0.0	3.8	0.0	...	...	
5	30.158	.114	.116	.129	29.6	45.1	37.9	37.5	.144	.155	.202	.167	.87	.53	.89	.76	W b N	Calm.	N W	2.0	0.0	2.0	...	...	
6	.061	29.889	29.944	29.965	34.8	47.0	39.2	40.3	.182	.166	.173	.174	.90	.51	.72	.71	E	S E	S E	2.0	2.0	3.8	...	...	
7	29.875	.660	.634	.723	35.3	47.3	48.0	43.5	.184	.250	.213	.219	.90	.72	.74	.79	Calm.	Calm.	Calm.	0.0	0.0	0.0	.303	...	
8	.594	.957	.894	.815	47.3	46.5	38.0	43.9	.311	.256	.210	.259	.97	.82	.92	.90	Calm.	N W	N W	0.0	8.0	7.2	.079	...	
9	30.056	30.099	30.176	30.110	33.1	41.8	32.0	35.6	.154	.121	.132	.135	.82	.48	.73	.68	N W	N	Calm.	3.8	10.0	0.0	...	...	
10	1.67	29.977	29.868	.004	31.1	39.2	37.7	36.0	.127	.155	.169	.150	.73	.65	.77	.72	Calm.	N N W	Calm.	0.0	2.0	0.0	...	...	
11	29.973	30.074	30.215	.087	37.7	44.4	38.2	40.1	.186	.184	.160	.177	.83	.64	.70	.72	W b N	E	E b N	3.8	11.3	17.9	...	...	
12	30.308	.230	.066	.201	31.9	35.3	37.1	34.8	.138	.138	.165	.147	.77	.67	.75	.73	E N E	E N E	E N E	21.3	27.8	25.4	...	...	
13	29.917	29.755	29.756	29.809	34.8	39.0	38.8	37.5	.202	.236	.226	.221	1.00	1.00	.96	.99	E N E	Calm.	W	21.6	0.0	2.0	1.118	...	
14	.782	.670	.775	.744	34.5	48.0	37.0	39.8	.200	.206	.173	.193	1.00	.62	.79	.89	Calm.	W N W	N W	0.0	5.2	12.4	.102	...	
15	.926	.900	.753	.860	31.7	38.0	35.2	35.0	.133	.115	.149	.132	.75	.51	.72	.66	N W	W N W	E N E	7.2	8.0	13.4	...	...	
16	.298	.220	.717	.412	33.2	40.3	25.1	32.9	.173	.190	.091	.151	.91	.77	.66	.78	E S E	W N W	N W	9.3	12.9	9.3	.304	...	
17	.898	.943	.864	.902	20.5	25.1	20.4	22.0	.062	.062	.065	.063	.54	.45	.57	.52	N W	N W	E N E	3.8	5.2	14.3	.066	2.0	
18	.649	.623	.675	.649	19.0	21.0	24.3	21.4	.087	.115	.125	.109	.81	.99	.94	.91	E N E	E N E	Calm.	25.0	3.8	0.0	...	3.8	
19	.527	.644	.835	.669	24.8	20.1	10.5	18.5	.123	.058	.047	.076	.93	.51	.63	.69	N N W	N N W	N N W	2.0	15.6	10.0	...	...	
20	.954	.989	.991	.978	6.4	18.1	12.4	12.3	.045	.060	.074	.060	.71	.58	.90	.73	W N W	W	Calm.	6.2	5.2	0.0	...	...	20th. A good Auroral arch, 20°.
21	.876	.758	.522	.719	7.8	19.8	21.0	16.2	.066	.085	.112	.088	.98	.75	.06	.90	Calm.	E N E	E N E	0.0	7.2	15.2	...	2.0	
22	.733	.728	.842	.768	17.2	22.7	15.4	18.4	.076	.070	.066	.071	.77	.55	.72	.68	W S W	W S W	W S W	5.2	5.2	3.8	...	...	22nd. At 10 p.m. a colored circle 24° in diameter round the moon, colors very brilliant.
23	.643	.215	28.875	.244	19.6	25.1	31.7	25.5	.092	.113	.166	.124	.83	.82	1.00	.88	W S W	Calm.	Calm.	2.0	0.0	0.0	...	3.0	
24	.258	.635	29.812	.568	13.4	10.1	5.2	9.6	.060	.041	.037	.046	.71	.55	61	.62	W N W	W N W	Calm.	32.2	15.6	0.0	...	1.5	
25	.758	.579	.215	.517	12.6	21.0	26.8	20.1	.065	.099	.148	.104	.78	.85	1.00	.88	Calm.	Calm.	E	0.0	0.0	7.2	...	3.5	
26	.088	.120	.207	.138	30.3	34.6	26.0	30.3	.169	.144	.090	.134	1.00	.72	63	.78	Calm.	W	N W	0.0	5.2	11.5	...	...	
27	.407	.331	.092	.277	13.1	17.8	19.0	16.6	.059	.058	.087	.068	.70	.57	81	.69	W N W	W N W	E N E	8.8	3.8	7.2	...	3.0	
28	28.990	28.946	.079	.005	23.0	24.6	23.4	23.7	.123	.135	.128	.129	.98	1.00	1.00	.99	E N E	E	Calm.	11.3	3.8	0.0	...	6.0	
29	29.194	29.208	29.436	.279	14.2	15.2	14.3	14.6	.068	.064	.061	.064	.77	.70	.69	.72	W	N W	N W	11.5	3.8	13.9	...	...	
30	.599	.684	.614	.632	10.5	19.4	21.7	17.2	.062	.070	.095	.076	.83	.64	.80	.76	N W	W N W	Calm.	13.9	10.0	0.0	...	...	
M	29.7443	29.7139	29.7269	29.7284	25.86	31.95	28.45	28.75	.1297	.1377	.1343	.1339	.835	.692	.796	.774				6.6	6.5	6.5	2.892	24.8	

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

Barometer	Highest, the 9th day	30.265
	Lowest, the 28th day	29.007
	Monthly Mean	29.833
	Monthly Range	1.258
Thermometer	Highest, the 7th day	59°.
	Lowest, the 20th day	1°.8
	Monthly Mean	31°.58
	Monthly Range	57°.2
Greatest Intensity of the Sun's Rays		105°.7
Lowest Point of Terrestrial Radiation		2°.1
Mean of Humidity		.884

Rain fell on 10 days, amounting to 3.926 inches; it was raining 50 hours 30 minutes.

Snow fell on 4 days, amounting to 8.34 inches; it was snowing 30 hours 10 minutes.

The most prevalent Wind was W N W—704.10 miles.

The least prevalent Wind was East—5.00 miles.

The most windy day was the 24th; mean miles per hour, 24.37.

The least windy day was the 10th; mean miles per hour, 0.65.

Most windy hour, from 7 till 8. a. m.. on the 24th—38.10 miles.

The total distance traversed by the Wind was 5794.10 miles; resolved in the Four Cardinal Points, gives N 1389.80 miles, S 667,90 miles, E 834.80 miles, W 2901.60 miles.

Aurora Borealis visible on 6 nights—might have been seen on 13 nights.

Zodiacal Light visible, but fainter than in October; its elongation on the 6th day did not exceed 50°.

The electrical state of the atmosphere has been marked *generally* by moderate intensity, and the 1st, 19th, 25th and 25th days, indicated a high tension of a negative character.

OZONE—was in moderate quantity.

REMARKS ON THE QUEBEC METEOROLOGICAL REGISTER FOR NOVEMBER.

Maximum Barometer, 6 a.m. on the 12th	30.308
Minimum Barometer, 10 p.m. on the 23rd	28.875
Monthly Range	1.433
Monthly Mean	29.7284
Maximum Thermometer on the 7th	48°.8
Minimum Thermometer on the 12th	5.0
Monthly Range	43.8
Mean Maximum Thermometer	34.38
Mean Minimum Thermometer	21.81
Mean Daily Range	12.57
Mean Monthly Temperature	28.75
Greatest Daily Range of Thermometer on 16th	22°.5
Least Daily Range of Thermometer on 29th	5°.6
Warmest Day, 8th. Mean Temperature	43.9
Coldest Day, 24th. Mean Temperature	9.6
Climatic Differences	34.3

Possible to see Aurora on 14 Nights.

Aurora visiole on 14 Nights.

Total quantity of Rain, 2.892 inches.

Total quantity of Snow, 24.8 inches.

Rain fell on 7 Days.

Snow fell on 8 Days.

NOTE.—The columns Tension and Humidity in this Table are derived from observations with Regnault's Hygrometer.

THE

CANADIAN JOURNAL

OF

INDUSTRY, SCIENCE, AND ART:

CONDUCTED BY

THE EDITING COMMITTEE OF THE CANADIAN INSTITUTE.

NEW SERIES. NUMBER II.

MARCH, 1856.

TORONTO:
PRINTED FOR THE CANADIAN INSTITUTE,
BY LOVELL AND GIBSON, YONGE STREET.

CANADIAN INSTITUTE.

The Canadian Journal is printed exclusively for gratuitous distribution among the Members of the Canadian Institute, and such Institutions and Societies as the Council may determine; but Members may purchase extra copies at 2s. 6d. per number, and Provincial Literary and Scientific Societies may obtain the Journal at the same rate, by an annual payment in advance.

*** *Communications for the Journal to be addressed to the General Editor*, Dr. Wilson, *University College, Toronto.*

THE CANADIAN JOURNAL.

NEW SERIES.

No. II.—FEBRUARY, 1856.

THE PRESIDENT'S ADDRESS.

BY GEORGE WILLIAM ALLAN, PRESIDENT.

Read before the Canadian Institute, 19th January, 1856.

In fulfilling the duty which devolves upon me as President, of addressing you upon the present condition and future prospects of the Institute, I have reason to congratulate both myself and my brother members, that the prosperous state of the Society is such as to render a review of its past history and proceedings, and a comparison between the first struggling years of its existence, and its present efficient organization, not only an agreeable task, but one full of hope and encouragement for the future.

Established at first under circumstances of great difficulty and discouragement, the Institute has, through the zealous efforts of its friends and supporters, been gradually increasing in efficiency and usefulness, until it has at length attained a standing, and attracted to itself a degree of sympathy and support, which warrant us in entertaining the most favorable anticipations as to its future progress.

If, then, I venture to occupy your time for a few moments, to advert to some of the circumstances connected with its early career: it is with the hope that *past* success may excite to increased exertion, and that a review of what has been already accomplished, may induce us to take the greater heed, that the vantage ground the Institute has gained may never be lost through supineness or indifference on the part of its members.

Of the difficulties and discouragements with which the first promoters of the Society had to contend, some idea may be formed from a sketch given in one of the early numbers of the Journal, of the history of the Association, in which the writer, after alluding to the various disheartening circumstances attending their first efforts, goes on to describe the attendance at the monthly meetings, as having at last "dwindled down to *two*," and " the prospects of the young Institute as being gloomy in the extreme."

How these prospects have brightened since that period of despondency, is, perhaps, best attested by the numerous assemblage we now see drawn together here at every weekly meeting, and amongst them I trust are still to be found the never-to-be-forgotten *Two*, whose names ought certainly to be had in honor by all who wish well to our Society.

The year 1851 may properly be looked upon as the period from which the Canadian Institute, as at present constituted, dates the commencement of its existence.

It was in that year that the first steps were taken to divest the Society of the strictly professional character it had assumed on its first establishment, and which, by giving a wider scope to its operations, and inviting the co-operation of all interested in scientific and literary pursuits, secured an amount of support and sympathy it could never otherwise have obtained.

In May, of the same year, the first Conversazione was held, and in the following November the Royal Charter of Incorporation was granted: and by it the gentleman whose scientific labors, more especially upon a very recent occasion, have contributed to make Canada most widely and favorably known—W. E. Logan, Esq.—was appointed first President of the incorporated body. But the Society, although thus regularly organized, was still, as it were, without a mouth-piece. It possessed no accredited organ to record its proceedings, or serve as the medium of publication for those papers which were read before the Society from time to time. In August, 1852, that want was supplied by the issue of the first number of the Canadian Journal, a publication which, it may be safely averred, has assisted most materially to keep alive an interest in the Society's proceedings, contributed to make it widely and favorably known throughout the Province, and attracted the support of many living at a distance, who, but for it, would in all probability never have become members of the Institute.

Indeed from the period of the re-establishment of the Journal may be dated the rapid progress in the numbers of the Society, which have since that year increased from 112 to 420.

The Journal established, the number of its members steadily increasing, and the weekly meetings during the session fully attended: the Society has continued to progress without any very marked or interesting occurrence until the past year, during which two events have taken place, both of much importance, and both likely to exercise considerable influence upon the future prospects of the Institute. I allude to the completion of the union with the Toronto Athenæum, and the commencement of the new building destined to become the future permanent home of the amalgamated body. The union with the Athenæum cannot fail to be productive of the most beneficial results, by securing the combined support of so many persons interested in the pursuits of literature and science, instead of that support being divided, as heretofore, between two bodies, both having kindred objects in view.

Nor need we fear that by this arrangement we have narrowed the field of usefulness, or circumscribed the bounds within which all may find full employment who are able and willing to make their talents or acquirements subservient to the advancement of knowledge in any of its departments.

The Institute has been well described as "an attempt to unite under one roof, and in one organization, a full representation of the active mind of the community." And there is surely ample scope afforded by the wide range of subjects embraced within the sphere of the Society's objects, for "*the active mind*" to find full employment. Whether its "*representation*" be "*full*" and complete, must ever depend upon the readiness of each individual member to communicate the results of his observations or researches, in that department of literature or science which he may have made the object of his more special study or pursuit.

But through our union with the Athenæum we have also gained a most valuable addition to our library and museum, and if the condition attached to this acquisition be faithfully carried out, the beneficial effects of the arrangement upon the future welfare and prosperity of the Institute can hardly be overrated.

It is stated in the report which was laid before you the other evening, "that 850 volumes, including the transactions of the leading scientific and literary societies of Great Britain, as well as other works of a strictly literary and scientific character," have been added to our library. By the terms of our amalgamation, the joint library is to be thrown open to the public, under certain restrictions; and if in addition to this, our museum, when properly arranged, and so far increased as to render it one of general interest, is also thrown open, we shall have effected an arrangement which will make the Institute essentially a *Provincial* Institution, and establish for it the strongest possible claims for the sympathy and support of every Canadian.

I may be thought, perhaps, by some, rather to overrate the importance of this matter, but we should recollect that Upper Canada at all events does not boast of a single *public* library, in the strict sense of the term, or of any thing that can be called a Provincial Museum. True it is that the universities of University and Trinity Colleges possess valuable libraries; and University College being a provincial institution, and having ample funds at its command, its library and museum will no doubt continue to receive important additions every year, which must ultimately render them very complete and valuable collections.

But, although these institutions are most liberal in affording every facility to strangers who may be desirous of visiting either their libraries or their museums, the practical benefits to be derived from either the one or the other must necessarily be almost entirely confined to those more immediately connected with the Universities themselves.

Under these circumstances, therefore, it cannot but be a matter of rejoicing, to all who are interested in the intellectual progress of the people of this country, that a most favorable opportunity is now afforded to us of supplying a great public want, and more especially have we, as Members of the Institute, reason to congratulate ourselves that this is likely to be effected through the instrumentality of this Society.

That the Institute, from its very nature and constitution, uniting as it does all parties in its pale, is peculiarly fitted for being the medium for carrying out this undertaking, cannot, I think, admit of question. For it is undoubtedly one of the unfortunate results consequent upon the divided state of public opinion on educational questions in this country, that our efforts in the cause of knowledge have in many cases been rendered less effective by the different views entertained as to the best mode of imparting it; and the means and energies of those most anxious for its advancement, which, if united, would produce the most splendid results, are by their division weakened and impaired.

Much as this is to be lamented, it was perhaps impossible that it could have been otherwise, and I only allude to this subject now, for the purpose of bringing more forcibly before you the immense advantages which the Institute possesses in presenting, as it does, a *com-*

mon ground on which all can meet, and the golden opportunity now presented, if we would but avail ourselves of it, of enlisting all classes and parties in the support of *one great institution*, in contributing to whose library and museum, all may feel that they are not assisting to build up a collection belonging to any one section or party in the community, but that in adding to the contents of the one, and aiding to make the other the depository of all that is interesting in the natural history, mineral productions, and historical antiquities of the country, they are assisting to form a collection which will ever be regarded with feelings of common interest and pride by every Canadian.

But these bright anticipations could hardly be realized, unless the want which we have long felt, of a convenient and permanent home, of such a character as would meet the necessary requirements of the society, was also about to be provided for, and we have therefore scarcely less reason to congratulate ourselves upon another event which has occurred during the past year, viz. the commencement of our new building, which I trust the liberality of the members will enable the Council to push forward to completion, with as little delay as possible. We have only to look round upon the limited space afforded by our present rooms, to feel convinced that, with such an increase as may reasonably be looked for in the number of our members, and in the extent of our collections both of books and specimens, the means of accommodation here would soon be found wholly inadequate, and I do regard it as a fortunate circumstance for the Institute, that the proposed arrangements with respect to the Library, to which I have before alluded, will undoubtedly give us a strong claim upon the public for pecuniary aid towards the erection of a building, in which they will in many respects have a common interest with ourselves.

The time which we have chosen for this undertaking is, in many respects, a most favorable one. The Government, whose liberality we have upon many occasions already experienced, is now established here. Its removal hither has brought amongst us many gentlemen who take a lively interest in those pursuits, for the furtherance and management of which this Institute was founded; and we may reasonably hope that our hands will be strengthened by the active sympathy and support of many whom distance before precluded from taking an active part in the proceedings of our Society. Indeed, that we are already gainers by the change is evinced by the fact, that we have this year the pleasure of numbering amongst our vice-presidents one whose name has long been familiar to us as an active and efficient officer of one of the learned societies of the Sister Province.

The meeting of the Legislature will also bring together many who have taken a warm interest in the advancement of this Association, and who have given the most substantial proofs of that interest, in the aid and support which they have uniformly extended to us, whenever the question of pecuniary assistance to the Institute has been brought before them in their places in parliament.

All these are considerations, which supply the strongest possible motives to renewed exertion on our part, and we should endeavor to shew that the countenance and support which have been extended to us, have not been bestowed in vain, or without producing corresponding fruit.

And this naturally leads me to the consideration of another subject, which from its importance deserves to be specially alluded to on an occasion like the present. I mean the number and character of the papers which have been read before the Institute during the past session, as this must, after all, afford the surest index of the vitality and energy of the Society itself.

A glance at the list contained in the report will satisfy us, I think, that both in point of numbers and interest they will bear a favorable comparison with those of former years, and what is also *very desirable*, a large proportion were upon subjects connected with the natural history, and the history of the aboriginal races of this country, and the public works of the Province. But there is nevertheless, I fear ground for the complaint made in the report, of "*apparent supineness*' on the part of the members, as shewn in the fact that the labor has been borne by comparatively few, and that to the members of the Council is due the credit of having furnished by far the largest proportion of the papers of the session.

The members of the Institute should never forget that in the words of one of our first Presidents—"it is not organization which makes the difference between things animate and inanimate, but life. Stone walls do not a prison make—nor do apartments and paraphernalia make the learned society, but learning. It is not enough for us to have combined ourselves to effect certain useful objects, if having done so we, *individually*, leave those objects to take care of themselves."

Composed, as an association of this kind must always be, of very many whose occupations do not admit of their devoting any considerable portion of their time to the pursuits of literature or science, and who have joined the Society more for the sake of acquiring information and instruction, than with any expectation of being able to contribute to the general stock of knowledge themselves: we should, nevertheless, remember that it is not *only* to those amongst us whose scientific attainments and extensive learning pre-eminently fit them for the task of sustaining the character of the Society, and carrying out its objects, that we look for assistance and support. There are many subjects of enquiry and observation which come within the reach of every intelligent person. Subjects connected with the peculiarities of our climate and soil, and the geology and natural history of the country, upon all of which much valuable information might be collected at the cost of a comparatively small expenditure of time and trouble on the part of individual observers, while many important facts might be thus elicited which might form the basis for future enquiry and research, on the part of those whose talents and acquirements more peculiarly fit them for the task.

Upon the individual exertions then of the members of the Institute, and their hearty co-operation in the furtherance of its objects, must we depend for that degree of life and vigor in this Association which alone can enable it to take rank worthily among the scientific societies of the world.

The inducements to the prosecution of scientific enquiries are as great here as in any other part of the world—indeed it may be said that there are peculiar reasons why those who desire to promote the best interests of our country, should exert themselves in the prosecution of such studies.

Canada has lately made herself most favorably known through her products and manufactures, at the great exhibitions of 1851 and 1855.

Now, I think it will be readily admitted that the results of these exhibitions have clearly proved that, in the present advanced state of civilization, "*a competition in industry must be a competition of intellect*," and that the material greatness and prosperity of individual countries must largely depend upon their advancement in science.

Possessing, as we undoubtedly do, many advantages over other countries, in the fertility of our soil, and the extent and excellence of our mineral productions, still, if we neglect or overlook the cultivation and promotion of those scientific enquiries which tend to the effective application of increased power, be it in agriculture or manufactures, both with regard to the economy of labor and of time—

the increasing wants of civilization, and the effects of competition, will undoubtedly leave us far behind in the race of progress.

We should do well ever to bear in mind the words of one well qualified to speak on such a subject:—" The progress of science and industry in countries which have reached a certain stage of civilization, ought actually to be synonymous expressions; and hence it follows, that it is essentially the policy of a nation to promote the one which forms the springs for the action of the other."

If, then, we desire to see our country attain that position, which its boundless natural advantages, if properly turned to account, entitle it to assume, let us use our best exertions that this Institute may become the channel for the diffusion of the fullest information as to our peculiarities of soil and climate, our agricultural and mineral productions, and our means of internal communication and improvement; and, while uniting together in a common bond all who possess a taste for literature or science, may more especially prove the means of fostering those studies and enquiries which are not only of vital importance in enlarging and strengthening the mental powers of those who engage in them, but must also have a directly practical effect upon the progress and advancement of the country to which we belong.

And now, gentlemen, allow me, in conclusion, to thank you for the honor you have conferred upon me, in electing me as your President. The only drawback to the pleasure and gratification which I feel in having been honored by your choice on this occasion, is the consciousness of my want of ability, as compared with those who have preceded me in the occupation of this chair, worthily to fill so honorable a post, and I can only suppose that a deep interest in the welfare of the Society, and an earnest desire (which I trust I have always exhibited) to further its objects and promote its advancement, have been kindly accepted by you in lieu of many higher qualifications which I feel to be wanting in me for this important office.

I have reason to congratulate the Institute that its Vice Presidents and the members of the Council are gentlemen whose talents and acquirements well qualify them for sustaining the reputation of the Society, and I trust that under their able direction the Institute may continue to make as rapid progress as it has hitherto done, and attracting to itself the undivided support of the learning and science of the Province, may continue to attest that the intellectual progress of Canada is ever keeping pace with her rapid advancement in material prosperity.

AN EXAMINATION OF PROFESSOR FERRIER'S THEORY OF KNOWING AND BEING.

BY THE REV. GEORGE PAXTON YOUNG, A. M.

PROFESSOR OF LOGIC AND METAPHYSICS, KNOX'S COLLEGE, TORONTO.

Read before the Canadian Institute, January 26*th*, 1856.

In the Institutes of Methaphysic, or Theory of Knowing and Being, by Professor Ferrier of St. Andrews, we have an investigation of the question : What exists ? And the conclusion which the author comes to, is, that "Absolute Existence is the synthesis of subject and object." In other words, to constitute Absolute (that is, real and independent) Being, two factors are requisite : a conscious subject, and an object apprehended by it.

The doctrine that Mind is an invariable factor of Being, is, I need not say, altogether opposed to the common view, which attributes to Matter an absolute existence apart from mind. While it is obvious, for example, that the hues of a rainbow do not absolutely exist, but exist only as perceived ; the raindrop which produces the phenomenon by its refraction of the sun's light, is regarded, not only by the vulgar, but by the majority of philosophers, as a thing of which existence can be affirmed, without taking into view any other thing whatsoever ; a thing which exists as well when no mind is employed about it, as when it is the object of intelligent apprehension, and whose existence would not be a contradiction, even on the supposition of all intelligent minds being annihilated. But to this Professor Ferrier gives a direct denial. No such thing, he holds, as matter any where exists, or can exist, save in synthesis with a mind apprehending it. Matter is merely a contingent factor of existence ; *per se* it is a contradiction. Our author's theory, however, is no less opposed to the idea that Mind has an absolute existence. Even those who hold the view against which Locke argues so strenuously, that the mind always thinks, are for the most part ready to allow that the case might have been otherwise, and that the supposition of there being no object present to the mind—no thing or thought apprehended by it—does not involve a contradiction. But this is not the opinion of Professor Ferrier. Mind *per se*, like matter *per se*, he relentlessly brands as nonsense. Mind according to him, is merely one of the factors necessary to existence : *per se* it is a contradiction. Existence is constituted by the union of mind (the Ego), a factor which must be invariably present, with objects, which may contingently be either matter (the Non-ego) or states of the Ego —either things (elements contradistinguished from the mind), or thoughts (modifications of the mind.) Let it be particularly observed that the doctrine of the Institutes is not that the existing thing called matter is incapable of existing, except as apprehended by the existing thing called mind, and that the existing thing called mind is incapable of existing, except as apprehending an existing object. Matter is not viewed as one existing thing, and mind as another existing thing at all. Mind and its object are considered to be two factors, each of which is indispensable to existence; and the only things which really and independently exist are Minds-in-union-with-Somewhat.

It is apparent that this doctrine cannot be established empirically; for even should all the things whose existence is discovered to us by experience be Minds-in-union-with-Somewhat, it would not follow that these are the only existences possible. Professor Ferrier accordingly disdains the aid of empiricism. Throughout the Institutes he makes not a single appeal, for the purpose of proving the main doctrine of the work, to contingent facts; but starting from what is regarded as a position of necessary truth, he essays to work out his system by a chain of strictly demonstrative reasoning.

His conclusions with respect to Being are based upon a peculiar theory of Knowing. His Ontology has an Epistemology for its forerunner; and, as the doctrine of the former is, that what *exists* is the synthesis of subject and object; so that of the latter, in which the way is paved for the Ontology, is, that what is *known* is the synthesis of subject and object. It will of course be understood, after what is stated in the preceding paragraph, that the Epistemology of the Institutes is a theory, not of the contingent structure of our cognitions, but of the necessary structure of all cognitions. A subject (self) cannot be known *per se* by any intelligence; neither can objects (things or thoughts) be known *per se* by any intelligence. The object (properly so called) which any intelligence apprehends, is constituted by the union of two factors, the object (popularly so called), and the apprehending mind. The result of the whole investigation may be summed up in a quasi-algebraical formula, which we may call, in Professor Ferrier's own phraseology, "the equation of the "known and the existent." Let k be what is known; and e, what exists; then k=e=self-cum-alio.

As a condition of the possibility of demonstrating that what any intelligence knows is a synthesis of subject and object, we must at the very outset have a definition of knowledge; for, from the nature of the case, no necessary conclusions can be established regarding that of which a definition has not been laid down. Should any one say that we are unable to render an account of what knowledge is, then (I answer) the attempt of the Institutes must be abandoned as hopeless; just as it would have been hopeless for Euclid to attempt to make out a single necessary proposition respecting the circle, if he had not first fixed what a circle is. One would stare who should be asked to demonstrate that the object of X Y Z must always be self-cum-alio: but it would not be more unreasonable to demand this of him, than to ask him to prove that the object of knowledge must be self-cum-alio, the nature of knowledge being undetermined.

Professor Ferrier was thoroughly aware of this. He saw that a solution of the question: What is knowledge? is the prime condition of a system of necessary propositions respecting knowledge, and indeed must contain in itself the whole concentrated essence of an Epistemology. Has he then answered the question? He thinks that he has. But his answer is in reality none. It is not a definition of the matter needing to be defined, but a statement regarding a different point altogether. Let us consider what is implied in a definition of knowledge. This is brought out with great clearness in the Theætetus, a dialogue of Plato, which our author quotes and comments upon very felicitously. The interlocutors are Socrates, and a young man called Theætetus. Socrates puts the question: "What "does science (knowledge) appear to you to be"? Theætetus answers, "It appears to me that sciences are such things as one may "learn from Theodorus: geometry, and the others which you just "now enumerated." To which Socrates with exquisite raillery rejoins, "Nobly and munificently, answered my friend, when asked for one thing, "you give many:" adding, "The question asked was not "this: of what things there is science; for we did not enquire with a "view to enumerate them, but to know what science itself is." He illustrates his meaning by supposing a person to be asked, What is clay? The person would answer, not by enumerating the different kinds of clay: potters' clay, ovenbuilders' clay, brickmakers' clay, and the like, but by stating what is common to all clay—that it is earth mixed with water. In like manner, it is no reply to the question, What is knowledge, to specify various kinds of knowledge, the knowledge of geometry, the knowledge of music, &c.; but the thing on which information is desired, is: What common element belongs to all cognition?—"Come," said Socrates to his young friend, "endeavour "to designate many sciences (kinds of knowledge) by one notion" He therefore who would explain what knowledge is, must, if Plato has reasoned well, show us the one notion designative of the many varieties of knowledge. Has Professor Ferrier done this? He has not. He thinks that he has. In the opening proposition of the

Institutes, it is affirmed that, along with whatever any intelligence knows, it must have some cognisance of itself. This is made the basis of our Author's Epistemology, and it is in this proposition that his answer to the question, What is knowledge, is embodied. He fancies that by indicating the Ego as an object known in all cognition, he has set before us "the common point in which all our cognitions unite "and agree." "The Ego," he says, "is this feature, point or element; "it is the common centre which is at all times known, and in which "all our cognitions, however diverse they may be in other respects, "are known as uniting and agreeing; and besides the Ego or one's self, "there is no other identical quality in our cognitions." But is it not plain that the Professor is here labouring under a delusion? To say, that, along with whatever any intelligence knows, it knows itself, is not informing us what knowledge is. Mr. Ferrier may have succeeded in pointing out an object which is apprehended in every cognitive act; but this is not tantamount to pointing out an element common to all cognition: it is not designating the many varieties of knowledge by one notion: it is saying nothing about knowledge, but only something about its object. Our author has lost himself, therefore, at the very outset of his course; and has failed to secure the basis indispensable for the structure which he proposes to erect.

The force of these strictures will be still more apparent, if, admiting Professor Ferrier's starting position, that the Ego must know itself in all cognition, and accepting this as an explanation of what knowledge is, we proceed to examine the conclusion deduced. He argues that because an intelligence must, along with whatever it cognizes, have some cognizance of itself, the object (properly so called) —the perfect object—of cognition, is not self simply, nor the thing or thought simply which in ordinary thinking is viewed as the object; but that it is self-cum-alio—self *plus* the object (popularly so called) —that, in short, it is Mind-in-union-with-Somewhat, or the synthesis of subject and object. Now is such an inference legitimate? Assuredly not. At least the conclusion cannot be deduced from the premises by a purely logical process. For what is there, as far as has yet been shewn, to hinder a person who admits that the Ego is known in all cognition, from holding that a knowledge of self may accompany a knowledge of whatever things or thoughts the mind apprehends; yet not so as that self, and the thing or thought apprehended along with it, form by their synthesis a single object of cognition, but so as that self forms one complete object of cognition, and the thing or thought apprehended along with it forms another complete object of cognition? There is no absurdity, as far as the form of

Professor Ferrier's argument goes, in maintaining that the Ego is known, and that the Non-ego, or some state of the Ego, is also known, the two cognitions taking place simultaneously. Perhaps the one position, that the Ego knows itself along with whatever it cognises, does imply the other: that what is known is the synthesis of subject and object; but the latter cannot be evolved out of the former by a barely logical process; and the validity of the inference (if it possess validity) can be made apparent only by an exposition of what is meant by the Ego knowing itself in all cognition; in other words, by a definition of knowledge, not in respect of its object, but in respect of its essential nature. Such a definition requires, in fact, to be given, before we are entitled to speak of an *object known* at all. Professor Ferrier appears to have had no qualms of conscience in introducing his readers, at the very beginning of his Institutes, to what he calls the *object of cognition*—defining cognition by means of its object; but he ought to have reflected that, until we have determined what cognition itself is, we cannot so much as form an idea of what the words, *object of cognition*, signify.

It will be observed that Professor Ferrier's Epistemology being a theory of the necessary structure of all knowledge, his answer to the question: What is knowledge? must hold good not only for the cognitions of finite minds, but for the divine knowledge likewise. Now, even if all the cognitions of finite minds could be supposed to have certain common characteristics, in virtue of which they might be designated by one notion, can it be legitimately taken for granted that there is anything whatsoever in common between knowledge in God, and knowledge in his creatures? From the poverty of language, we are compelled to use the same term *knowledge*, to describe the exercise of intelligence by God, which we employ to describe the exercise of our own intelligence; but that the knowledge of God has anything whatsoever in common with the knowledge of created beings—that there are any necessary laws of cognition to which the divine knowledge, and ours, and that of all other creatures, are alike subject—is certainly not a thing to be lightly assumed. Must not God, (Professor Ferrier will ask), know himself in every exercise of his infinite intelligence? And this is the sole respect in which it is contended that knowledge in God and knowledge in us are governed by a common law. (It is difficult to conduct such discussions in a becoming manner; and there is nothing which I am more anxious to avoid, than the appearance of employing the name of God as though it were an unmeaning symbol. But the point under consideration, and others that will arise before the close of the paper, have so vital a connection with the highest moral and religious interests, that it is indispensable to speak in terms which, without sufficient cause, might be open to the charge of irreverent familiarity). Must not God, then, know himself—it will be said—along with all that he knows? Undoubtedly, *in some sense;* but the question that must be determined before this admission can serve Professor Ferrier's purpose, is: In what sense? If God's knowledge of himself should be altogether of a different kind from our knowledge of ourselves—which I believe it to be—and which at all events, Professor Ferrier has not disproved —is it designating the divine knowledge and ours by one notion; is it reducing them under the dominion of a common law; is it laying a foundation for a series of propositions applicable to both alike: to tell us that God knows himself in all the acts of his understanding, and that we know ourselves in all the acts of our understanding? Let it be shewn that the word *know* means the same thing in both cases, and let its import be pointed out, and then Professor Ferrier will be in a position to commence his argument. He will have got a fixed nail on which to hang his chain.

In the following passage our author replies to the charge of presumption which he anticipates that some will bring against him for endeavoring to reduce all intelligence, whether divine or human, under the dominion of necessary laws. "It may seem to adopt a "somewhat presumptuous line of exposition in undertaking to lay "down the laws, not only of *our* thinking and knowing, but of *all* "possible thinking and knowing. This charge is answered simply by "the remark that it would be still more presumptuous to exclude "any possible thinking, any possible knowing, any possible intel-"ligence, from the operation of these laws—for the laws here refer-"red to are necessary truths—their opposites involve contradictions "and therefore the supposition that any intelligence can be exempt, "from them is simply nonsense." And with reference to a supposed enquiry on the part of a reader, whether it might not have been sufficient to lay down the alleged necessary laws of cognition as absolutely authoritative over human intelligence only, he goes on to say; "Good reader, this is not sufficient. It is absolutely indispensable, "(this must be confessed in the plainest terms)—it is absolutely in-"dispensable for the salvation of our argument, from beginning to "end, that these necessary laws should be fixed as authoritative, not "over human reason only, but as binding on all possible intelligence. "It is not possible, therefore, for the system to adopt any such sug-"gestion as that thrown out. And if the reader had any further "misgivings as to the propriety of our course, we would recommend "him to consider whether *he* does not hold that *all* reason is bound "by the law of contradiction as expounded in sec. 28. Of course, if "we may assign to intelligence universally *any one* necessary condi- "tion of thought and knowledge, the whole question is at an end, "and must be held to be decided in favor of the views of this sys- "tem." As this is the only passage in the Institutes where any thing having the semblance of argument is advanced in support of the principle that all intelligence is governed by certain necessary laws, it merits special examination. In the first place when Professor Ferrier affirms that it would be wrong to exclude any possible thinking from the operation of the laws in question, because they are necessary laws, this remark has plainly no force as an argument ; for the very point in dispute is whether there are any such necessary laws. Again, it is said that the opposites of these laws involve contradictions. But how so ? In what way is it a contradiction to hold that knowledge in God may be something so entirely different from knowledge in us, that they cannot be designated by any single notion ? Let us consider what Professor Ferrier means by a contradiction. He means that which no intelligence can possibly conceive. Matter, for instance, according to him, is a contradiction, it is nonsense, it is an absurdity, because *per se* it is incapable of being conceived by any intelligence. On what grounds then is it asserted that knowledge essentially different from ours—so different as not to admit of being brought under any common law with ours—is a thing inconceivable by any intelligence ? Though it may be inconceivable by us, this will not entitle us to pronounce it inconceivable absolutely. But Professor Ferrier gives an example in which he thinks it plain that a necessary and universal law of intelligence is expressed ; and he argues that if one such law can be apprehended by us, others may be so likewise. The example is the law of contradiction—that a thing must be what it is—that A is A. But what a gross fallacy, to cite a logical principle in illustration of a question of Real Being ! Granting that by no intelligence can the law of contradiction be conceived untrue, what does such a concession amount to ? To this and nothing more—that where a thing is conceived (in any sense of the term), the conception is exactly what it is. But does this in the least degree go to prove that there cannot be knowledge or conception so radically different from ours, that the two do not admit of being designated by any common notion ? "Of course," says Professor Ferrier, "if we assign to intelligence universally *any one* necessary condition of thought and knowledge, the whole question is at an end." Not so, by any means—if a logical principle is to be called (as it ought not to be) a necessary condition of thought and knowledge. Plato being judge—and our author will not dissent from Plato here—what is requisite to bring the question to an end, is, that some common characteristic of all cognition should be indicated. *But we do not indicate any thing common to all cognition when we say that the law of contradiction is binding on reason universally.* By the law of contradiction, the exercise of the Divine Intelligence is what it is. By the same law the exercise of the intelligence of a creature is what it is. Does this imply that the two are distinguished by any common characteristic? Not at all. They may be essentially and in all respects different from each other, and yet each be what it is. The question, therefore, is not at an end, even though the universality and necessity of the law of contradiction be admitted. It will be at an end, when the knowledge of the Infinite Being, and that of finite beings like ourselves, have been designated by one notion; and that there is any notion designative of both alike, remains yet to be evinced.

As a series of necessary propositions regarding knowledge could only be established on condition of a definition of knowledge being first given, so before a series of necessary propositions regarding existence can be established, it is indispensable that existence be defined. In some systems of philosophy, the identity of knowledge and existence, the equation of the known and the existent, is assumed. Were such an assumption legitimate no definition of existence over and above the definition of knowledge would require to be given; nor would an Ontology be any thing distinct from an Epistemology. The task of the metaphysician would be ended, when he had worked out his theory of knowing; or at least, he would merely have to draw the inference, that, since knowledge and existence are coincident, real being consists in that (whatever it might be) which was proved to be the object of cognition—the object in this case being identical with the existence knowing. But Professor Ferrier does not allow us to assume that the known and the existent coincide. He finds fault with his great idol, Plato, for virtually making this assumption. "Here it was," he says, "that Plato broke down. Instead of proving the coincidence of the known and the existent, he assumed it." Now, if it be not legitimate to assume that knowledge is identical with existence, and to change our Epistemological conclusions at once into Ontological, then I repeat that just as a definition of knowledge is the *conditio sine qua non* of an Epistemology, so a separate and distinct definition of existence is the *conditio sine qua non* of an Ontology. Yet, strange to say, Professor Ferrier has not given this. Of course, he cannot reason upon existence without in reality assuming something about it; and when we look into his argument, so as to discover the notion of existence on which he implicitly proceeds, we find that it is essentially the same with that of Spinoza—"per substantiam intelligo id quod in "se est, et per se concipitur; hoc est id, cujus conceptus non indi-"get conceptu alterius rei, a quo formari debeat." Substance or absolute existence is that which is conceived by itself (the conclusions of Spinoza do not at all depend on the clause *in se est* as distinguished from *per se concipitur*), or to the conception of which the conception of nothing else is required. This is precisely the view taken by Professor Ferrier; though, as I have said, he does not present it in the form of a definition, but gives it as a result of reasoning. The third proposition of his Ontology is, that "Absolute Existence, or Being in itself, is not the contradictory;" that is, it admits of being conceived by some intelligence. Without examining the demonstration which is given of this proposition, it is enough to observe that, as an argument, it cannot but be inconclusive, no definition of absolute existence having been furnished, except what the proposition itself affords. So long as absolute existence has not been defined, we can no more prove that it is not the contradictory, than we can prove that the *relplum scalclath* of Guliver's philosopher is not the contradictory.

The fact is, that even in the way of definition, it is not legitimate to describe Absolute Existence or Real Being as that which may be conceived *per se*. It may perhaps be thought that a writer is at liberty to define terms as he pleases; but the definition in question —which contains the germ of all Spinoza's hideous conclusions— cannot be allowed; because if it does not covertly beg the whole question in dispute, it is without meaning. When it is said that Real Being is that which may be conceived *per se*, what, I ask, is it for a thing to be conceived? The term *conception* is used either as descriptive of our thinking specially, or in some wider sense. If it be employed in the former way then, in defining Real Being as that which can be conceived by itself, it is denied that any thing exists beyond the possible grasp of our apprehension—a doctrine which cannot be allowed to creep in surreptitiously under the guise of a definition. But if the term be taken in the latter sense, then the statement that Real Being is not the Contradictory or the Absolutely Inconceivable, is one *to which I can affix no meaning*. I understand what is meant by a thing being the inconceivable to me, but not what is meant by its being the inconceivable absolutely.

Professor Ferrier remarks in one place that philosophy stands much "in want of a clear and developed doctrine of the Contradictory." No question but it does—and I humbly think that the Professor's own disquisitions afford evidence of this. Not casually or *per incuriam*, but formally, and as a vital part of his system, he lays down the position, that Real Being is not the absolutely inconceivable—as if the words did, or could to us convey any idea! Let it be distinctly understood that *we cannot speak of absolute inconceivability, without saying we know not what*—speaking in an unknown tongue, or rather in a tongue which is no tongue at all—becoming barbarians alike to ourselves and to others. It is ridiculous here to adduce such examples as a square circle, or a stick with only one end, to illustrate the assertion that it is within our power intelligibly to talk of absolute inconceivability in certain cases. Examples of this sort are nothing to the purpose. I can conceive a square. I can also conceive a circle. These two conceptions are mutually repugnant. In this sense, a square circle may be pronounced the absolutely contradictory; that is to say, the expression *square circle* brings forward two ideas incapable of agreeing with one another in any mind in which the ideas separately can be realised. The same may be said, *mutatis mutandis*, of the stick with only one end, which is so mighty a favorite with our author. But who does not see, that though an expression significant of two conceptions, each of which we are capable of realising, but which are irreconcilable with one another, may in a perfectly intelligible sense be called a contradiction absolutely, it is not thereby proved to be competent for us to speak of an absolutely inconceivable, *where no ideas are brought before the mind at all?*

When Being has been identified, whether by definition or by supposed proof, with the Non-Contradictory, our author's task would seem to be ended. For, if nothing can be known by any intelligence, except a subject in synthesis with an object; and if Absolute Existence is not the Contradictory, and is therefore knowable, Absolute Existence must be the synthesis of subject and object—which is the ultimate conclusion of the Institutes—their grand Q. E. D. The equation not only of the known and the existent with each other, but of each of them with a subject united to an object, is made out. Professor Ferrier, however, is not satisfied to enter port so easily. Betwixt the Epistemology and the Ontology, he has introduced a cumbrous series of propositions forming an Agnoiology (as it is euphoniously entitled) or Theory of Ignorance, which he considers indispensable to a legitimate procedure in the Ontology, and in which he prides himself as though it were a great philosophical discovery. The Institutes, he says, "claim to have "announced for the first time the true law of ignorance, and to have "deduced from it its consequences." But when scrutinized, the theory of ignorance is found to amount to nothing more than an expression of the results of the Epistemology as a function of a new term arbitrarily, though not inappropriately, introduced. What the Agnoiology seeks to determine is, the object of ignorance; and it teaches that the object of ignorance, like that of knowledge, is a synthesis of subject and object. In Prop. I. ignorance is defined to be "a privation of something consistent with the nature of intelligence." Hence (Prop. II.) "all ignorance is possibly remediable; and (Prop. III.) we can be ignorant only of what can possibly be known; and hence also—if the Epistemology of the Institutes be supposed correct—the object of ignorance can be neither the Ego or subject *per se*, nor objects (popularly so called) *per se*, but only a synthesis of subject and object. Now it is plain that every thing here depends on the definition of ignorance as a "privation of something consistent with the nature of intelligence." The definition is a very good one; and the deductions made from it are perfectly logical; but where is the wonderful merit of defining a word and then expressing the results of the Epistemology in terms of that word? Or what occasion was there for the show and parade of demonstration with which this is done by our author? Indeed, for any purpose that it serves, the Theory of Ignorance might very well have been omitted altogether. The use to which it is put will be seen when I mention that the Ontology opens by announcing three alternatives of Being. "Absolute Existence or Being in itself is either *first*, that which we know; or it is *secondly*, that which we are ignorant of; or it is *thirdly*, that which we neither know nor are ignorant of." By showing (as he thinks he has done) that what we neither know nor are ignorant of is the contradictory, and also that Absolute Existence is not the contradictory, Professor Ferrier eliminates the third alternative, and concludes that Absolute Existence is either what we know or what we are ignorant of. But (by the Epistemology) that which we know is the synthesis of subject and object; and (by the Agnoiology) that which we are ignorant of is the synthesis of subject and object; therefore, whether Absolute Existence be the one or the other of the two alternatives to which it has been reduced, it must be the synthesis of subject and object. Now surely it was unnecessary to create an Agnoiology, merely to play the part here assigned to it. Why might the alternatives of Being not have been assumed as two, viz ; either *first*, that which admits of being known, or *secondly*, that which is unknowable, in other words, the contradictory ? (The former of these alternatives would comprehend the two first of our author). Then, when Absolute Existence was proved to be not the contradictory, it would at once follow that it must be the synthesis of subject and object ; for (by the Epistemology) nothing except a synthesis of subject and object is capable of being known.

The whole may be thus summed up. The Theory of knowing (that what is known in the synthesis of subject and object) is unproved. The condition on which alone it could be proved, even if true, (viz , that knowledge be defined) is not fulfilled. A definition of knowledge is no doubt supposed to be involved in the proposition, that along with whatever any intelligence knows, it must know itself. But, on the one hand this is not a definition of knowledge, but a statement regarding what is known ; and on the other hand it is impossible to form any idea of what is meant by an *object known*, till an exposition of knowledge itself has been rendered. There is no reason to think that a definition of knowledge, in the most unrestricted sense, admits of being given. Even were it possible to designate all the cognitions of finite minds by one notion, the assumption that the knowledge of the uncreated infinite God has any thing in common with that of his creatures, would be unwarrantable. The fundamental error of the Epistemology, that there are necessary laws by which all intelligence is governed, extends itself to the Ontology, where it is affirmed that what exists is not the contradictory. This, though presented, not as a definition, but as the result of reasoning, is in reality our author's definition of existence. That he does not demonstrate it, is evident from the consideration that no definition of existence, besides what the proposition itself affords, is furnished as the starting point of a demonstration. Absolute Existence, then, is defined as the Non-Contradictory. In other words it is what can be conceived *per se*. But unless some common characteristics of all thinking, whether divine or human, can be specified, the word *conception* must either be taken otherwise than as descriptive of our thinking specially—in which case we can attach no idea to it, and the definition of existence is meaningless ; or it must be used of our thinking specially—in which case the definition (implying as it does, that nothing exists except what we are contingently capable of conceiving) is a palpable begging of the great question at issue.

As Professor Ferrier in more than one passage illustrates his views by comparing them with those of Bishop Berkeley, and as Berkeley is the sole metaphysician of modern times whom he admits to have made an approximation to truth, it may not be useless or out of place to notice the relation in which the system of the Institutes stands to that expounded in the "Dialogues between Hylas and "Philonous," and in the "Treatise concerning the principles of human knowledge." Berkeley did not aspire to frame a necessary theory of knowledge. He limited himself to the knowledge of which we are the subjects; and this is, in fact, urged in the Institutes as the main defect of his philosophy. "Berkeley's system," we are told, "was invalidated by a fundamental weakness, which was "this, that it was rather an exposition of the contingent structure "of *our* knowledge than an exposition of the necessary structure of "*all* knowledge." And on this account "his Ontology," it is added, "breaks down; for his conclusion is, that the subject and object "together, the synthesis of mind and the universe, is what alone "truly and absolutely exists or can exist." Berkeley considered the objects of perception to be sensible qualities; and it was an essential point in his doctrine that these are incapable of existing except in a mind. He made no distinction in this respect between what are termed the secondary qualities of matter—taste, warmth, colour, audible sound, and so forth—and those which have been called primaries—extension, figure, motion, &c. The extension, figure, &c., which we perceive, are in the mind as truly, and in the same manner, as the warmth, the sweetness, the redness, or the sound which we perceive. Berkeley has often been represented as denying the real existence of sensible things: but he himself repeatedly and vehemently protests against the imputation. The real existence of sensible things is, he says, incontrovertible; but they do not exist apart from the mind. Their *esse* is *percipi*. Must not matter however, an unthinking, inactive substance, be assumed as the substratum of sensible qualities? Berkeley answers that such a substratum is inconceivable. Nay, the conception of it which we are asked to form, involves a contradiction: for sensible qualities being incapable of existing out of a mind, how can they, without contradiction, be spoken of as existing in an unthinking substratum, that is, in what is not mind? But granting that nothing besides sensible qualities is perceived; and that the existence of matter, as a substratum of sensible qualities, is an absurdity; may we not still believe in matter as the cause or occasion or instrument of our perceptions? Berkeley examines this question very minutely; and endeavours to show that in any meaning which we are able to affix to the words, an unthinking, inactive substance cannot be the cause, or occasion, or instrument, of our perceptions. Should it finally be urged that perhaps matter, an unthinking, inactive something, of which we have no positive idea whatever, exists without the mind: Berkeley replies (and here the weak point of his Ontology becomes apparent) that in affirming that matter may exist, while at the same time we acknowledge that we attach no positive idea to the term, we mean nothing. I quote the following passage from the 2nd dialogue between Hylas and Philonous. *Phil.*—"Can any more be required to "prove the absolute impossibility of a thing, than the proving it im-"possible in every particular sense that either you or any one else "understands it in?" *Hyl.*—"But I am not so thoroughly satis-"fied that you have proved the impossibility of matter in the last "most obscure, abstracted and indefinite sense." *Phil.*—"When is "a thing shown to be impossible?" *Hyl.*—"When a repugnancy "is demonstrated between the ideas comprehended in its definition." "*Phil.*—"But where there are no ideas, there no repugnancy can be "demonstrated between ideas?" *Hyl.*—"I agree with you." "*Phil.*—"Now in that which you call the obscure indefinite sense "of the word *matter*, it is plain by your own confession, there was "included no idea at all, no sense except an unknown sense, which "is the same thing as none. You are not therefore to expect I "should prove a repugnancy between ideas, where there are no "ideas, or the impossibility of matter taken in an unknown sense, "that is, no sense at all. My business was only to shew that you "meant nothing, and this you were brought to own. So that in all "your various senses you have been shewed either to mean nothing "at all, or if any thing an absurdity. And if this be not sufficient "to prove the impossibility of a thing, I desire you will let me know "what is." *Hyl.*—"I acknowledge you have proved that matter is "impossible; nor do I see what more can be said in reference to it." Now, in my judgment, Hylas was a fool to give up his case in this fashion. The impossibility of a substance different from spirit, is *not* proved, by proving its impossibility under any particular notion of it that we can form. But, says Berkeley, in affirming the possibility of matter, in some unknown sense of the word, you mean nothing. Well, what then? We may not be able, attaching any positive meaning to our words, to assert the possibility of an existence distinct from spirits; but this does not imply that such an existence is impossible. Existence may not be limited to what we are capable of conceiving. "Where there are no ideas there no re-"pugnancy can be demonstrated between ideas." Most true. Consequently, it would be unreasonable to expect that matter in some unknown sense, should be demonstrated to be a contradiction. Such a demonstration is, from the nature of the case, impossible; and just because this is so, it never can be competent for us to affirm matter to be a contradiction. Professor Ferrier, therefore, was right in saying that Berkeley's Ontology, in which necessary conclusions as to Being are drawn from a consideration of the contingent structure of our knowledge, breaks down. The very utmost that Berkeley can be admitted to have made out (even if we subscribe to his Epistemological doctrine, that the objects of perception are sensible qualities existing in the mind—and allow moreover the conclusiveness of his reasoning about causes, occasions, and instruments) is, that it is impossible for matter to exist as the substratum of sensible qualities, or as the cause, occasion, or instrument of our perceptions—a conclusion altogether different from that which he believes himself to have established, viz: that mind is a constituent factor of all existence.

The affinity between Berkeley and our author plainly consist in two things—first, that both ascribe a subjective character to the objects of our perception (the latter only going further, and maintaining the Ego to be a constituent factor of every object known)—and secondly, that both reject as absurd, the idea of any thing existing apart from mind. I have endeavored to make it plain that Professor Ferrier's position, that the Ego is an ingredient in every object known; neither has been proved by him, nor (even if true) would admit of being proved. But suppose the enquiry, instead of being extended to all possible knowledge, to be restricted, as it was by Berkeley, to our perceptive cognitions; what shall be said in that case? Is the object of perception, a synthesis of the Ego and of the Non-ego? And if this can be in any sense maintained, how will our conclusions as to what exists be thereby affected? With a few remarks on these points, I shall bring my paper to a close.

That both Professor Ferrier and Bishop Berkeley should leave their respective systems not only unproved, but even of an ambiguous import, was an unavoidable result of their having omitted to enter, the one into an exposition of knowledge, and the other into an exposition of perception. Berkeley says that sensible qualities are the objects of perception; while, according to Professor Ferrier, the Ego in synthesis with the Non-ego is always the object of perception: but what either statement amounts to, depends on the meaning affixed to the words *objects of perception;* and it is impossible to affix any precise meaning to them until *perception* itself has been explained.

What, then, is perception? It is a relation of a certain kind between the Ego and the Non-ego: in other words, it is the Ego and the Non-ego standing related to one another. Perception is not different from sensation; but a sensation, and the perception usually spoken of as acompanying it, are the same relation—the same indivisible consciousness—differently denominated. When we wish to designate the relation, so as especially to affirm the existence of one of the correlative terms, the Ego, we call it sensation; and when we wish to designate it so as specially to affirm the existence of the other of its correlative terms; the Non-ego, we call it perception. Whether correct or not, this answer to the proposed question is at at all events to the purpose: for, to ask what knowledge is, is equivalent to asking what is the common characteristic of all knowledge. Now, our perceptions or sensitive cognitions, in their manifold diversity, have this in common—that each of them is a relation between the Ego and the Non-ego. I do not here, like Professor Ferrier, represent a variety of cognitions as having something common in their objects; but I designate the cognitions themselves by one notion. Take any act of sensitive consciousness that you please, it (the cognition) is a relation between the Ego and the Non-ego. In the case, for example, when (to speak popularly) one is looking at a red object, the knowledge realised is that particular relation between the Ego and the Non-ego which we describe by saying that a red object is perceived, or that a sensation of redness is experienced.

Having defined *perception*, we are in a position now to speak of the *object of perception*, and to determine whether the object which we at any time perceive be a synthesis of the Ego and the Non-ego. In sensitive consciousness, the Ego and the Non-ego are apprehended together, both terms being necessary to the relation in which sensitive consciousness consists. The Ego is manifested to itself—not absolutely, but in its relation to the Non-ego; and at the same time, the Non-ego is manifested to the Ego—not absolutely, but in relation to the Ego. Such being the case, shall we say with Professor Ferrier that the sole object (properly so called) of perception, is a synthesis of Self and Not-self? or shall we say that the two objects, Self and Not-self, are cognized simultaneously? Which alternative must we choose? We may adopt either, by giving a proper definition to the word *object*. *Object*, in a case of sensitive perception, might be defined as that term in the relation constituting the perception, which stands in correlation to the Ego or *subject;* or, more fully, both terms, the Ego as well as the Non-ego, might be called *objects known*—the former a subjective, and the latter an objective, object.

But if such a definition were laid down, it would require to be kept in view that there are not two separate cognitions corresponding to the objects thus discriminated. It would be incorrect to say that in one cognition, the Non-ego is the object known; and that in another distinct (though simultaneous) cognition, the Ego is the object known: for the apprehension of the Non-ego by the Ego and of the Ego by itself, is a single indivisible act of consciousness; the relation betwixt the Ego and the Non-ego, having two terms indeed, but not being thereby rendered plural in its character as a relation. On the other hand, *object* might be defined in such a way as not to differ, except logically, from *act*. In this case, as the act of perceiving is nothing else than the Ego in a certain relation to the Non-ego, so the object perceived would be the Ego in a certain relation to the Non-ego; which may be not inappropriately expressed by saying that the object of perception is a synthesis, in which the Ego is an invariable, and the Non-ego a variable, factor. *In this sense*, Professor Ferrier's doctrine: that which is perceived is the synthesis of subject and object, may be admitted. Only let there be no misunderstanding as to what the admission involves. It simply means—what might have been also conveyed by the more common phraseology which recognizes the Ego and the Non-ego as two separate objects—that a relation is constituted between the Ego and the Non-ego—a single indivisible relation—whose character is partly due to the one factor (the Ego), and partly due to the other factor (the Non-ego).

By subscribing, in the sense indicated, to the doctrine of Professor Ferrier, that the object of perception is always a synthesis of the Ego and of the Non-ego, does it become necessary to go along with him in inferring that absolute (real and independent) existence cannot be predicted either of the Ego *per se*, or of the Non-ego *per se*, but only of the Ego in synthesis with the Non-ego? The answer which must be given to this question depends altogether upon the idea attached to the word *absolute*, which qualifies existence.

If absolute be the opposite of relative, then, according to the views above presented, there is no evidence warranting us to attribute absolute existence either to the Ego or the Non-ego? Is the Ego ever known to exist out of relation to the Non-ego? Do we ever catch ourselves (to use Hume's expression) without a perception? Never. Is the Non-ego ever known to exist out of relation to the Ego? On the contrary, the very knowledge of it which we realize, consists in a relation betwixt the Ego and the Non-ego. As regards the Ego, the question under consideration is the same with that which Locke discussed so unsatisfactorily: Whether the mind always thinks—for all our thinking, even the most abstract, implies perception. Now there is no proof that the mind is ever in an unthinking state; it can never catch itself without a thought; because in catching itself, it is thinking. Will it be urged that a relation implies the independent existence of the correlated terms, and that the Ego and Non-ego by whose relation to one another perception is constituted, must consequently be acknowledged as independent existences? Of course, it cannot be meant that they exist independently while the perception is taking place, for they are then in relation to one another. And why is it necessary that they should have had an independent separate existence previously to their becoming related? Perception, at all events, does not bear witness to this: it testifies only of the present: it reveals the relation, but nothing antecedent to it. I shall not in detail pursue the various possible windings of the problem into the region of mediate or inferential knowledge. Enough to remark generally, that while on the one hand it is a contradiction in terms to assert the present absolute or independent existence of an Ego and a Non-ego which are in relation to one another; on the other hand, to assert their absolute or independent existence prior to the formation of the relation at present constituted, is to utter words without meaning. Never having been conscious of the Non-ego out of relation to Self, how can we reason about the Non-ego absolutely (the Non-ego-per-se), or propose to prove anything respecting it, or speak of it all? It is utterly inconceivable by us. We may use the phrase, Non-ego-per-se; but mean nothing thereby. In like manner, never having been conscious of the Ego out of relation to the Non-ego, (for all the modes of our present Being involve an exercise of sensitive consciousness), how can we reason about the Ego absolutely (the-Ego-per-se), or propose to prove anything respecting it, or speak of it all? It is utterly inconceivable by us. We may use the phrase, Ego-per-se; but we mean nothing thereby. The conclusion therefore is, that the existence which comes to light in the diversified operations of our consciousness, is never either the Ego-per-se, or the Non-ego-per-se, but always the one related to, or (if Professor Ferrier pleases) in synthesis with, the other—the Ego in synthesis with the Non-ego, or the Non-ego in synthesis with the Ego. I say *or*, not *and*: for though philosophical writers commonly teach, that perception manifests a twofold existence, the Ego existing in relation to the Non-ego, and the Non-ego existing in relation to the Ego, there is in reality no difference between these. Self-existing-in-relation-to-Not-self is Not-self-existing-in-relation-to-Self. Each expression sets forth the relative (not independent) existence of Self; and each sets forth at the same time the relative (not independent) existence of Not-self. The two equally describe a relation, which, whether you call it X-in-relation-to-Y or Y-in-relation-to-X, is still the same relation.

It has perhaps been made sufficiently plain in the course of the preceding remarks, yet to prevent mistake I may repeat, that the existence, whether of the Ego or of the Non-ego, must not be presumed to be dependent upon the maintenance of such relations as those in which we at any time know them to exist. Though we have no evidence, for example, to shew that our minds ever exist out of relation to matter, it is not therefore demonstrated that a relation between mind and matter is indispensable to the existence of the former. This would follow, (little as Berkeley was aware of it,) if his principle, that a thing must be held to be impossible, when it has been proved so in every sense which we can conceive, were valid: for it is past doubt, that, never having been conscious of any existence which did not imply a relation betwixt the Ego and the Non-ego, we can form no conception of the existence of an Ego *per se*. But the principle is a bad one. Possible existence must not be limited to what we are capable of conceiving. In like manner, though we have no evidence to shew that matter ever exists out of relation to mind (Berkeley was right so far) it does not follow that its existence out of relation to mind is an impossibility. This was Berkeley's great fallacy. True; we can form no conception of matter *per se:* but possible existence must not be limited to what we can conceive.

As I have followed Professor Ferrier in using as interchangeable the expressions, *absolute*, and *independent* existence; it is necessary to remark that, in the above reasonings, it is not implied that the finite existence which manifests itself in sensitive perception, is independent, so as to have the principle of its being in itself: the idea naturally suggested, and indeed intended to be conveyed, by Spinoza's definition, "per substantiam intelligo id quod in se est, &c." All that has been shewn, is, that there is no evidence for the existence of the Ego independently of, or out of relation to, the Non-ego; and that there is no evidence for the existence of the Non-ego independently of or out of relation to. the Ego. Even therefore if, in Professor Ferrier's phraseology, this should be stated by saying that what exists is a synthesis of the Ego and the Non-ego, it would be gratuitous and, I have no hesitation in adding, false, to affirm that the synthesis thus recognised as existing, has the principle of its Being in itself, or, in other words, *is*, independently of a continued exercise of sustaining power on the part of the infinite Creator. There is nothing in philosophy opposed to, but on the contrary all its conclusions are in beautiful harmony with, what revelation teaches, that God "is not far from every one of us, for in him we live and move and have our being." The universe was not created once for all, and then left in some inconceivable condition of independent and abiding existence; but it is at every instant upheld by God; it is a continued product of the continued exercise of his power. It has often been remarked that to sustain the worlds which have been made requires an exercise of power not less than was implied in their original formation: but indeed it may be questioned whether there is really any essential difference between creating and sustaining. Creation is a putting forth of divine energy, in virtue of which something is, where otherwise nothing would have been; and is not the Divine Being, in sustaining the universe, constantly exerting an energy, wanting which the universe would not be?

It may perhaps be thought that the course of remark by which it has been shewn that the object of perception, the existence immediately manifested in the perceptive act, always is (in the sense explained) a synthesis of the Ego and of the Non-ego, would suffice to prove that every object known by any intelligence, or any where existing, is a similar synthesis. For, knowledge (it may be said) of whatever description, being a relation between subject and object, a relation to which both terms are necessary, and whose character is due partly to the one, and partly to the other, neither the subject *per se* nor the object *per se*, can be said to be known; but the object known, which is only logically different from the knowledge realised, is a synthesis of the two. Hence also, unless there be some existence absolutely unknowable, whatever exists must be a synthesis of subject and object. Must then the conclusions of Professor Ferrier's Institutes be accepted without limitation? *If all knowledge be a relation*, they undoubtedly must. Here, however, the question meets us: *is* all knowledge a relation? To assume this, would be quite unwarrantable. I allow that I have no conception of any knowledge which is not a relation; that is, I can frame to myself no direct positive conception of any existence which is not, like my own as revealed in consciousness, a subject standing in relation to an object; and it might therefore seem that I am shut up to go the whole length of our author's system. But no. There may be more things existing than man is able to conceive. In particular, it is necessary to guard against supposing that the Divine existence involves relation in any such sense as that in which the term is employed when we speak of those successive relations between Self and Not-self, of which our sensitive consciousness is made up. There must always, indeed, be a relation between the Creator and his creatures, of this kind—that the universe of each moment is dependent on the Divine power exerted in that moment. The frame of nature is sustained by—in other words, it constantly results from—the Fiat, the unceasingly repeated LET-THERE-BE, of Him "whose word leaps forth to its effect": but instead of warranting the inference, which forms a part of Professor Ferrier's system, that, in the existence of the Infinite Being, the two factors of subject and object can be discriminated, as in our consciousness,* this would seem to imply the reverse; for the relations betwixt subject and object which constitute the several existences manifesting themselves in nature, are at each instant due to an essentially creative act; they cannot, therefore, be met with in one of whom it is a distinctive peculiarity, to be uncreated—to have life in himself.

In bringing my examination of Professor Ferrier's metaphysical system to a close, I would observe that, though I have been obliged to dissent, and that seriously, both from his reasoning and his conclusions, the work under review must have the praise bestowed upon it of being one of unusual and refreshing originality. It is written with great clearness, in a flowing and expressive manner; and the only fault to be found with it, in respect of style, is, that it bristles too much with the forms of demonstration. The Institutes are enriched with several incidental discussions of great value; of which, however, it is impossible to take any special notice at present. There is one service which our author could render to philosophy, probably as well as any man living; and, if he could be persuaded to undertake the task, he would deserve, and receive, the thanks of all who feel an interest in the history or progress of speculation. What I refer to, has been already pressed upon his attention.

"We hope, also," says a writer in Blackwood's Magazine, (Feb., 1855,) "at no distant day, from the fair promise of the present "volume, to see Professor Ferrier engaged in a work affording a "larger field for the concrete philosophy, than the subtle discussion "of the present volume presents. We have already said that he "wields the pen gracefully, and that he is anything but a dry, blood-"less speculator; a mere metaphysician; which, like a mere mathe-"matician, a mere lawyer, a mere theologian, a mere scholar, or a "mere anything else, is a monster, always, with a most religious

*Of course, it is not meant that Professor Ferrier ascribes to the Divine Being our sensitive modes of apprehension. He disclaims such an idea. But his doctrine is that the one Absolute Existence which is strictly necessary "is a supreme and infinite and everlasting mind in synthesis with all things."

"instinct, to be shunned. Would Professor Ferrier, who evidently "reads Greek—not at all a necessary accomplishment in a Scotch "Professor of Moral Philosophy—perhaps be so kind as *work out "for us an elegant exposition of the philosophy of Plato in its princi-"ples and its applications?*" Such a work as that suggested in the part of the quotation italicised, is still a desideratum; to undertake it, would be a task not unworthy of the most brilliant genius; and we do not need to look beyond the "Institutes" for proof that Professor Ferrier possesses in a high degree the principal qualifications requisite for executing it successfully.

ON THE HYDRATE OF HYDROSULPHURIC ACID.

BY HENRY CROFT, D.C.L.,

PROFESSOR OF CHEMISTRY, UNIVERSITY COLLEGE, TORONTO.

Read before the Canadian Institute, Dec. 1st, 1855.

Very little is known with regard to the combination of water with sulphuretted hydrogen, although its existence has been pointed out by Wöhler. Its excessive instability at the ordinary temperature and pressure, renders it impossible to ascertain its formula, which is of considerable interest, inasmuch as crystalline hydrates of the hydracids are almost, if not entirely, unknown.

Wöhler obtained the compound in two ways, firstly from liquid hydrosulphuric acid, which had been formed in the usual manner by the spontaneous decomposition of the bisulphide of hydrogen in a closed tube. Among the crystals of sulphur he observed small colorless crystals, which could scarcely be any thing but the hydrate. The tube exploded on being brought into a warm room, the crystals rapidly disappearing with evolution of gas.

Secondly, by exposing a mixture of alcohol and water, of such strength as not to freeze at eighteen degrees below zero, to a freezing mixture capable of producing this degree of cold, having previously saturated it with well-washed sulphuretted hydrogen, an icy crystallization was produced, which vanished on the least rise of temperature, gas being rapidly evolved. The crystals could not be kept when enclosed in a tube, but reappeared as often as it was exposed to a temperature of 18°. The same results followed when hydrated acetic æther was employed.

Wöhler thought that he once detected octohedral crystals.*

* Annalen der Chemie und Pharmacie, B., 32.

In a second paper "On the Influence of Pressure on the Formation of Chemical Compounds"† Wöhler refers to the above observations, and adds, that in two tubes in which sulphur, but no liquid hydrosulphuric acid, had separated, the crystals were found in large quantity, they did not, however, make their appearance in a third tube in which the bisulphide was enclosed together with some hydrochloric acid. Hence the author concludes that the crystalline compound, which is no doubt a hydrate of hydrosulphuric acid, must be produced when a small quantity of water is enclosed with the gas free from any other acid, the water then combines with it under the pressure of the condensing gas (17 atmospheres). Under this pressure it is permanent at ordinary temperatures. If the tube be heated to 86° Fahrenheit, the compound rapidly becomes fluid, returning to the solid state again on being cooled to the ordinary temperature.

Several years since I had occasion to prepare the liquid sulphides of phosphorus described by Berzelius; they were preserved under water in stoppered bottles, in one of which the stopper soon became immovably fastened, by the deposition of what appeared to be sulphur.

About eighteen months afterwards, during an intensely cold winter, I observed a quantity of crystals floating on the surface of the liquid in this bottle, and the sulphide had entirely changed its appearance having become opaque and perfectly solid. The crystals were precisely similar to the feathery forms of sal ammoniac, so much so that they might readily have been mistaken for that substance, and undoubtedly belonged to the regular system.

On breaking off the stopper, the crystals began to disappear very rapidly, but a small quantity of the substance was introduced into a tube over mercury, where it was speedily converted into a gas which exhibited all the properties of pure sulphuretted hydrogen. Owing to the rapidity of decomposition it was impossible either to weigh or to dry the crystals for a quantitative analysis, although the temperature of the room was several degrees below zero.

There can be little doubt that this was the same compound as observed by Wöhler, but its formation in this case was not prevented by the presence of an acid. Pelletier and Serullas have shewn that the sulphide of phosphorus is decomposed under water with evolution of gaseous sulphuretted hydrogen, and formation of phosphoric or phosphorous acid.

† Annalen der Chemie und Pharmacie, B. 85.

NOTES OF A SOJOURN AMONG THE HALF-BREEDS, HUDSON BAY COMPANY'S TERRITORY, RED RIVER.

BY PAUL KANE, TORONTO.

Read before the Canadian Institute, Nov. 13th, 1855.

I have already had an opportunity of submitting to the members of the Canadian Institute some incidents of travel among the Indians of the far West, and especially of those occupying the north west coast, in the vicinity of Vancouver's Island.* I shall now confine myself to a tribe altogether peculiar, not only lying considerably nearer the eastern seats of Anglo-Saxon civilization on this continent, but deriving some of their most remarkable characteristics as the result of the intercourse between the Anglo-Saxon and the Indian occupants of the region referred to. In the month of June, 1846, I reached the Red River settlement of the Hudson's Bay Company, situated on the river of that name which empties itself into the Winipeg Lake. This settlement is the chief provision depôt of the Hudson's Bay Company, and it is also here that large quantities of Pimmi-kon are procured from the Half-breeds, a race, who, keeping themselves distinct from both Indians and whites, form a tribe of themselves; and although they have adopted some of the customs and manners of the French voyageurs, are much more attached to the wild and savage manners of the Red man. Fort Garry, one of the most important establishments of the Company, is erected on the forks of the Red River and the Assiniboine, in long. 97° W., and in lat. 50° 6′ 20″ N. On the opposite side of the river is situated the Roman Catholic Church, and two or three miles further down there is a Protestant Church. The settlement is formed along the banks of the river for about fifty miles, and extends back from the water, according to the original grant from the Indians, as far as a person can distinguish a man from a horse on a clear day. Lord Selkirk first attempted to form a settlement in 1811, but it was speedily abandoned. A few years afterwards several Scotch families, including some from the Orkney Islands, emigrated under the auspices of the Hudson's Bay Company, and now number about 2,000, who live as farmers in great plenty, so far as mere food and clothing are concerned. As for the luxuries of life they are almost unattainable as they have no market nearer than St. Paul's, on the Mississippi River, a distance of nearly 700 miles over a trackless prairy. The Half-breeds are more numerous than the whites, and now amount to about 4,000. These are the descendants of the

* Vide *Canadian Journal,* old series, vol. iii, p. 273.

white men in the Hudson's Bay Company's employment and the native Indian women. They all speak the Cree language and the Lower Canadian patois; they are governed by a chief named Grant, much after the manner of the Indian tribes. He has presided over them now for a long period, and was implicated in the disturbances which occurred between the Hudson Bay and North West Companies. He was brought to Canada charged with the murder of Governor Semple, but no sufficient evidence could be produced against him.

The Half-breeds are a very hardy race of men, capable of enduring the greatest hardships and fatigues; their Indian propensities predominate, and, consequently, they make poor farmers, neglecting their land for the more exciting pleasures of the chase. Their buffalo hunts are conducted by the whole tribe and take place twice a year—about the middle of June and October, at which periods notice is sent round to all the families to meet at a certain day on the White Horse plain, about twenty miles from Fort Garry. Here the tribe is divided into three bands, each taking a separate route for the purpose of falling in with the herds of buffaloes. These bands are each accompanied by about five hundred carts, drawn by either an ox or a horse. Their cart is a curious looking vehicle, made by themselves with their axes, and fastened together with wooden pins and leather strings—nails not being procurable. The tire of the wheel is made of buffalo hide and put on wet. When it becomes dry it shrinks and is so tight that it never falls off, and lasts as long as the cart holds together.

I arrived at Fort Garry about three days after the Half-breeds had departed, but as I was very anxious to witness buffalo hunting, I procured a guide, a cart for my tent, &c., and a saddle-horse for myself and started after one of the bands. We travelled that day about thirty miles and encamped in the evening on a beautiful plain covered with innumerable small roses. The next day was anything but pleasant, as our route lay through a marshy tract of country, in which we were obliged to strain all the water we drank through a piece of cloth on account of the numerous insects, some of which were accounted highly dangerous, and are said to have the power of eating through the coats of the stomach and causing death even to horses. The next day I arrived at the Pambinaw River and found the band cutting poles which they are obliged to carry with them to dry the meat on, as after leaving this no more timbered land is met with until the three bands meet together again at the Turtle mountain, where the meat they have taken and dried on the route is made into *pimmikon*. This process is conducted in the following manner: The thin slices of dried meat are pounded between two stones until the fibres separate. About fifty pounds of this is put into a bag of buffalo skin with about forty pounds of melted fat and mixed together while hot, and sewed up, forming a hard compact mass;* each cart brings home ten of these bags, and all that the Half-breeds do not require for themselves, is eagerly bought by the Company for the purpose of sending to the more distant posts where food is scarce. One pound of this is considered equal to four pounds of ordinary meat, and the *pimmikon* keeps for years perfectly good, exposed to any weather. I was received by the band with the greatest cordiality: they numbered about two hundred hunters, besides women and children. They live during these hunting excursions in lodges formed of dressed buffalo skins; they are always accompanied by an immense number of dogs, who follow them from the settlements for the purpose of feeding on the offal and remains of the slain buffaloes. These dogs are very like wolves both in appearance and disposition, and, no doubt, are a cross breed between the wolf and dog. A great many of them acknowledge no particular master, and are sometimes dangerous in times of scarcity. I have myself known them to attack the horses and eat them. Our camp broke up on the following morning and proceeded on their route to the open plains. The carts containing the women and children, and each decorated with some flag or other conspicuous emblem on a pole, so that the hunters might recognize their own from a distance, wound off in one continuous line extending for miles, accompanied by the hunters on horseback. During the forenoon, whilst the line of mounted hunters and carts was winding round the margin of a small lake, I took the opportunity of making a sketch of the singular cavalcade.

The following day we passed the Dry-dance Mountain, where the Indians, before going on a war party, have a custom of dancing and fasting for three days and nights. This practice is always observed by young warriors going to battle for the first time, to accustom them to the privations and fatigues which they must expect to undergo, and to prove their strength and endurance. Should any sink under the fatigue and fasting of this ceremony, they are invariably sent back to the camp with the women and children. After leaving this mountain we proceeded on our route, without meeting any buffalo, although we saw plenty of indications of their having been in the neighborhood a short time previous. On the evening of the second day, we were visited by twelve Sioux chiefs

* Hence its name in the Cree language; *pimmi* signifying meat, and *kon* fat.

with whom the Half-breeds had been at war for several years; they came for the purpose of negociating a permanent peace. But whilst smoking the pipe of peace in the council lodge, the dead body of a Half-breed, who had gone to a short distance from the camp, was brought in newly scalped, and his death was at once attributed to the Sioux, the Half-breeds not being at war with any other nation. A general feeling of rage at once influenced the young men, and they would have taken instant vengeance for the supposed act of treachery upon the twelve chiefs in their power, but for the interference of the old and more temperate of the body; who, deprecating so flagrant a breach of the laws of hospitality, escorted them out of danger, but at the same time told them that no peace could be concluded until satisfaction was had for the murder of their friend. Exposed as the Half-breeds thus are to all the vicissitudes of wild Indian life, their camps while on the move are always preceded by scouts, for the purpose of reconnoitering either for enemies or buffaloes. If they see the latter, they give signal of such being the case by throwing up handfuls of dust, and if the former, by running their horses rapidly to and fro. Three days after the departure of the Sioux chiefs, our scouts were observed by their companions to make the signal of enemies being in sight. Immediately a hundred of the best mounted hastened to the spot, and, concealing themselves behind the shelter of the bank of a small stream, sent out two as decoys who exposed themselves to the view of the Sioux. The latter supposing them to be alone rushed upon them, whereupon the concealed Half-breeds sprang up and poured in a volley amongst them, which brought down eight; the others escaped, although several must have been wounded, as much blood was afterwards discovered on their tracks. Though differing in very few respects from the pure Indians, they do not adopt the practice of scalping, and in this case, being satisfied with their revenge, they abandoned the dead bodies to the malice of a small party of Saulteaux who accompanied them.

The Saulteaux are a band of the great Ojibewah nation, both words signifying "the jumpers," and derive the name from their expertness in leaping their canoes over the numerous rapids which occur in the rivers of their vicinity.* The Saulteaux, although numerous, are not a warlike tribe, and the Sioux, who are noted for their daring

*I took a sketch of one of them, Peccootiss (the man with a lump on his navel.) He appeared delighted with it at first, but the others laughed so much at the likeness and made so many jokes about it, that he became quite irritated, and insisted that I should destroy it, or at least not show it so long as I remained with the tribe.

and courage, have long waged a savage war on them, in consequence of which the Saulteaux do not venture to hunt in the plains, except in company with the Half-breeds. Immediately on their getting possession of the bodies, they commenced a scalp-dance, during which they mutilated the bodies in a most horrible manner. One old woman, who had lost several relations by the Sioux, rendered herself particularly conspicuous by digging out their eyes and otherwise dismembering them. In this ceremony the Half-breeds took no part, for though a warlike people they do not practice the scalp-dance, nor do they wear scalps as ornaments.

The following afternoon we arrived at the margin of a small lake, where we encamped rather earlier than usual for the sake of the water. On the following day I was gratified with the sight of a band of about forty buffalo cows in the distance, and our hunters in full chase ; they were the first I had seen, but were too far off for me to join in the sport. They succeeded in killing twenty-five, which were distributed through the camp and proved most welcome to all of us, as our provisions were getting rather short, and I was abundantly tired of pemmikon and dried meat. The fires being lighted with the wood we had brought with us in the carts, the whole party commenced feasting with a voracity which appeared perfectly astonishing to me, until I tried myself and found by experience how much hunting in the plains stimulated the appetite.

The upper part of the hunch of the buffalo, weighing about four or five pounds, is called by the Indians the little hunch. This is of a harder and more compact nature than the rest, though very tender, and is usually put aside for keeping. The lower and larger part is streaked with rich fat, and is very juicy and delicious. These, with the tongues, are considered the delicacies of the buffalo. After the party had gorged themselves with as much as they could devour, they passed the rest of the evening in roasting the marrow bones and regaling themselves with their contents. For the next two or three days we fell in with only a few single buffalo or small herds of them, but as we proceeded they became more frequent. At last our scouts brought in word of an immense herd of buffalo bulls about two miles in advance of us. They are known in the distance from the cows by their feeding singly and being scattered wider over the plain, whereas the cows keep together for the protection of the calves, which are always kept in the centre of the herd. A Half-breed of the name of Hallett who was exceedingly attentive to me, woke me in the morning to accompany him in advance of the party, that I might have the opportunity of examining the buffalo, whilst feeding, before the commencement of the hunt. Six hours' hard riding brought us within a quarter of a mile of the nearest of the herd. The main body stretched over the plains far as the eye could reach. Fortunately the wind blew in our faces; had it blown towards the buffaloes, they would have scented us miles off. I wished to have attacked them at once, but my companion would not allow me until the rest of the party came up, as it was contrary to the law of the tribe. We therefore sheltered ourselves from the observation of the herd behind a mound, relieving our horses of their saddles to cool them. In about an hour the hunters came up to us, numbering about one hundred and thirty, and immediate preparations were made for the chase. Every man loaded his gun, looked to his priming, and examined the efficiency of his saddle-girths.

The elder men strongly cautioned the less experienced not to shoot each other, a caution by no means unnecessary, as such accidents frequently occur. Each hunter then filled his mouth with balls which he drops into the gun without wadding; by this means loading much quicker, and being enabled to do so whilst his horse is at full speed. It is true that the gun is more liable to burst, but that they do not seem to mind. Nor does the gun carry so far, or so true, but that is of less consequence as they always fire quite close to the animal. Every thing being adjusted, we all walked our horses towards the herd. By the time we had gone about two hundred yards, the herd perceived us and started off in the opposite direction at the top of their speed. We now put our horses to the full gallop, and in twenty minutes were in their midst. There could not have been less than four or five thousand in our immediate vicinity, all bulls, not a single cow amongst them. The scene now became one of intense excitement: the huge bulls thundering over the plains in headlong confusion, whilst the fearless hunters rode recklessly in their midst, keeping up an incessant fire at but a few yards distance from their victims. Upon the fall of each buffalo the successful hunter merely threw some article of his apparel—often carried by him solely for that purpose—to denote his own prey, and then rushed on to another. These marks are scarcely ever disputed, but should a doubt arise as to the ownership, the carcase is equally divided between the claimants.

The chase continued only about one hour, and extended over an area of from five to six square miles, over which might be seen the dead and dying buffaloes, to the number of five hundred. In the mean time my horse, which had started at a good run, was suddenly confronted by a large bull, that made his appearance from behind a knoll within a few yards of him, and, being thus taken by surprise, he sprung to one side and getting his foot into one of the innumerable badger holes with which the plains abound, he fell at once. and I was thrown over his head with such violence that I was completely stunned, but I soon recovered my recollection. Some of the men caught my horse, and I was speedily remounted, and soon saw reason to congratulate myself on my good fortune, for I found a man, who had been thrown in a similar way, lying a short distance from me quite senseless, in which state he was carried back to the camp. I again joined in the pursuit and, coming up with a large bull, I had the satisfaction of bringing him down at the first fire. Excited by my success I threw down my cap, and, galloping on, soon put a bullet through another enormous animal. He did not however fall, but stopped and faced me, pawing the earth, bellowing and glaring savagely at me. The blood was streaming profusely from his mouth, and I thought he would soon drop. The position in which he stood was so fine, that I could not resist the desire of making a sketch. I accordingly dismounted, and had just commenced, when he suddenly made a dash at me. I had hardly time to spring on my horse, and get away from him, leaving my gun and everything else behind. When he came up to where I had been standing, he turned over the articles I had dropped, pawing fiercely as he tossed them about, and then retreated towards the herd. I immediately recovered my gun, and, having reloaded, again pursued him and soon planted another shot in him; and this time he remained on his legs long enough for me to make a sketch. This done, I returned with it to the camp, carrying the tongues of the animals I had killed, according to custom, as trophies of my success as a hunter. I have often witnessed an Indian buffalo hunt since, but never one on so large a scale. In returning to the camp I fell in with one of the hunters coolly driving a wounded buffalo before him. In reply to my enquiry why he did not shoot him, he said he would not do so until he got him close to the lodges, as it would save the trouble of bringing a cart for the meat. He had already driven him seven miles, and afterwards killed him within two hundred yards of the tents. That evening, while the hunters were still absent, a buffalo, bewildered by the hunt, got amongst the tents, and at last got into one, after having terrified all the women and children, who precipitately took to flight; when the men returned they found him there still, and being unable to dislodge him, they shot him down from the opening in the top.

Our camp was now moved to the field of slaughter for the greater convenience of collecting the meat. However lightly I wished to think of my fall, I found myself the next day suffering considerably from the effects of it and the fatigue I had undergone. The man, whom I had brought with me as a guide, was also suffering much from an attack of the measles. Next day our hunters sighted and chased another large band of bulls, with good success. At night we were annoyed by the incessant howling and fighting of innumerable dogs and wolves that had followed us to the hunt, seemingly as well aware of the feast that was preparing for them as we could be ourselves. The plain now resembled one vast shambles; the women, whose business it is, being all busily employed in cutting the flesh into slices and hanging them in the sun, on racks made of poles tied together. In reference to the immense number of buffaloes killed, I may mention that it is calculated that the Half-breeds alone destroy thirty thousand annually.

Having satisfied myself with buffalo hunting amongst the Half-breeds, I was anxious to return to the settlement, in order to prosecute my journey, and as this closed my intercourse with the singular race of Half-breeds, I should perhaps draw my narrative at once to a close. The incidents, however, which marked my course back to the Red River settlement, are not without their interest as illustrations of the character of the country and the habits of its wild occupants. On proposing to set out I found my guide so unwell that I feared he would not be able to travel. I tried to procure one of the hunters to take his place and return with me, but none of them would consent to travel alone over so large a tract of country from fear of the Sioux, in whose territory we then were, and whom they dreaded, from the late occurrence, would be watching to cut off any stragglers. Being unable to procure a fresh man I was about to start alone, when my guide, who thought himself better, proposed to accompany me on condition that he would ride in the cart, and not be expected to attend to the horses or cooking. This I readily agreed to, as his services as guide were of the utmost importance.

We started next morning for the settlement, a distance which I supposed to be somewhat over two hundred miles. A party of twenty of the hunters escorted us for eight or ten miles, to see that there were no Sioux in the immediate vicinity. We then parted, after taking the customary smoke on separating from friends. I could not avoid a strong feeling of regret at leaving them, having experienced many acts of kindness at their hands, hardly to be expected from so wild and uncultivated a people. We found a great scarcity of water on our return, most of the swamps that had supplied us on our way out being now dried up by the heat of the season.

We fell in with a great many stray dogs and wolves, which appeared to be led on by the scent of the dead carcasses. After hobbling the horses, putting up my tent and cooking the supper, I made a sketch of our encampment, and then turned in for the night, not without some apprehensions of a hostile visit from the Sioux, as we were still on their hunting grounds and in the territory of the United States, being still a few miles south of the boundary line. During the night my guide, who was very ill and feverish, cried out that the Sioux were upon us. I started up with my gun in my hand, for I slept with it by my side, and, rushing out in the dark, was near shooting my own horse who, by stumbling over one of the tent posts, had alarmed my companion. We travelled on next day with the greatest rapidity that the ill health of my guide would permit, and on the evening of the 30th of June we encamped on the bank of the Pambinaw. I lost considerable time next morning in catching the horses, as they are able, from habit, to run a considerable distance and pretty fast, in spite of their hobbles. In the afternoon we arrived at the Swampy Lake, about fourteen miles across. A little before sunset we reached about the middle of it, but my guide complained so much that I could not proceed further. I succeeded in finding a small dry spot above water, large enough for me to sit on, but not affording room for my legs which had to remain in the water, there being no more room in the small cart than was necessary for the sick man. Having no means for cooking I was compelled to eat my dried meat raw. I tried to compose myself to sleep, but found it impossible from the myriads of mosquitoes which appeared determined to extract the last drop of blood from my body. After battling with them until four o'clock next morning, my eyes almost blinded by their stings, I went in search of the horses which had strayed away to some distance into deeper water, tempted by some sort of flags growing there. I had to wade up to my middle in pursuit of them, and it was not until nine o'clock that we were able to proceed. After leaving this dismal swamp we were within a day's march of the settlement, and my guide, believing himself to be much better, insisted upon my leaving him to drive the cart, whilst I proceeded at a more rapid rate on horseback. This, however, I would not do until I had seen him safe across Stinking River, which the horses had almost to swim in crossing. Having got him over safely, I left him, and proceeded onward in the direction of the fort. But I had not gone far before I encountered one of the numerous swampy lakes that abound in this region and render the travelling extremely difficult. I had no doubt got upon a wrong track, for, on endeavouring to cross, my horse quickly sank up to his neck in mud and water. Finding that

I could neither advance nor recede, I dismounted and found myself in the same predicament, scarcely able to keep my head above the surface. I managed, however, to reach the dry land, and with the lasso, or long line, which every voyageur in these parts invariably has attached to his horse's neck, succeeded in getting the animal out. I remounted and endeavoured to cross in another direction, but with no better success. I now found myself surrounded on all sides, as far as I could see, with nothing but swamp. My horse refused to be ridden any further. I had therefore to dismount and drag him along as I best could, wading up to my very middle in mud and water abounding with reptiles. That I had lost my way was now certain, and, as it was raining hard, I could not see the sun, nor had I a compass. I, however, determined to fix upon one certain course and to keep that at all hazards, in hopes that I might reach the Asseneboine River, by following which I could not fail to reach the settlement. After travelling in uncertainty for ten or twelve miles I had at length the satisfaction of reaching the river, and in two hours afterwards I arrived safe at Fort Garry. The next morning I learned that my guide had been brought in by two men who were looking for some stray horses. The poor fellow had got rapidly worse after my leaving, and had only proceeded a short distance when he was compelled to stop. He only survived two days after his arrival. Fort Garry is one of the best built forts in the Hudson's Bay territory. It has a stone wall with bastions mounted with cannon, inclosing large storehouses and handsome residences for the gentlemen of the establishment. Its strength is such that it has nothing to fear from the surrounding Half-breeds or Indians. The gentleman in charge was Mr. Christie, whose many acts of kindness and attention I must ever remember with feelings of grateful respect.

The office of Governor of the Red River Settlement is one of great responsibility and trouble, as the happiness and comfort of the whole settlement depend to a great extent upon the manner in which he carries out his instructions. The Half-breeds are much inclined to grumbling, and, although the Company treat them with great liberality, they still ask almost for impossibilities; indeed as far as the Company is concerned, I cannot conceive a more just and strict course than that which they pursue in the conduct of tho whole of their immense traffic. In times of scarcity they help all around them; in sickness they furnish them with medicines, and even try to act as mediators between hostile bands of Indians. No drunkenness or debauchery is seen around their posts, and so strict is their prohibition of liquor, that even their own officers can only procure a small allowance, given as part of their annual outfit on voyages.

Without entering into the general question of the policy of giving a monopoly of the Fur trade to one company, I cannot but record as the firm conviction which I formed from a comparison between the Indians in the Hudson's Bay Company territories and those in the United States, that opening up the trade with the Indians to all who wish indiscriminately to engage in it must lead to their annihilation. For while it is the interest of such a body as the Hudson's Bay Company to improve the Indians and encourage them to industry according to their own native habits, in hunting and the chase, even with a view to their own profits; it is as obviously the interest of small companies and private adventurers to draw as much wealth as they possibly can from the country in the shortest possible time, although in doing so the very source from which the wealth springs should be destroyed. The unfortunate craving for intoxicating drinks, which characterises all the tribes of Indians, and the terrible effects thereby produced upon them, render such a deadly instrument in the hands of designing men. It is well known that, although the laws of the United States strictly prohibit the sale of liquor to the Indians, it is impossible to enforce them, and whilst many traders are making rapid fortunes in their territories, the Indians are fast declining in character, wealth, and numbers, whilst those in contact with the Hudson Bay Company maintain their numbers, retain their native characteristics unimpaired, and in some degree share in the advantages which civilization places within their reach.

A METHOD OF DETERMINING THE INDEX ERRORS OF THERMOMETER SCALES.

BY W. D. C. CAMPBELL, QUEBEC.

Read before the Canadian Institute, January 26th, 1856.

The following simple method is proposed for determining the errors below 32° Ft. of Mercurial Thermometers, which have been compared and corrected above the freezing point.

If air has been carefully excluded from the tube, (as is the case in most Mercurial Thermometers,) on turning it upside down, the mercury will run from the bulb to the end of the tube, leaving a small vacuum in the bulb; by turning the thermometer quickly upright, and giving it a slight jerk, the vacuum will be brought to the aperture of the fine tube, and when the position of the thermometer is again reversed, the column of mercury in the tube will separate from that in the bulb, leaving a vacuum in the tube.

The bulb is then to be gently heated until the remainder of the mercury in it rises to the lowest point of the scale to be proved, and by again holding the tube in an upright position, the columns run together. A gentle shake will insure their joining, which is essential.

Let the bulb be now immersed in snow, or ice and water, until the mercury has nearly reached 32°, and it will be found that on again reversing the position of the tube, the mercury will separate at the same point of the scale, at which it had joined.

The thermometer being placed in a horizontal or slightly inclined position, with the bulb surrounded with wet snow, the separated column of mercury can be made to move upwards, (this is best effected by gentle *taps* at the end of the tube,) as required, while the observer reads the lower and upper extremities at such intervals as he may find necessary. The readings may be written down as follows:—

From	— 30	to	33.2
	— 29	to	34.2
	— 28	to	35.1
	— 29	to	36.1
	— 26	to	37.0
	32°	to	95.0

By applying the corrections previously known at 32° and 95°, we find the true length of the column of mercury in degrees of the scale, and the true reading at each of the lower points of the scale may be obtained by deducting the number of degrees in the column from the upper reading (corrected) thus:

Correction at 95°		+'5—true reading,		95° 5
Do.	32 =	0—	Do.	32. 0
		Column of mercury......		63° 5

Upper reading, 32°
Col. 63 5

Correct reading for — 30° is — 31.5, — error at — 30 = — 1.5. It is scarcely necessary to mention that, in applying the above method, the greatest care must be taken that the length of the column of mercury is not affected by change of temperature.

REVIEWS.

The Agriculture of the French Exhibition. By John Wilson, F.R.S. E., F.G.S., &c., Professor of Agriculture in the University of Edinburgh. Edinburgh: Adam & Charles Black. 1856.

The grand conception, which originated, we believe, with Prince Albert, of inviting all the civilized nations of the world to bring to one centre their various characteristic productions from the wide domains of nature and art, has already been productive of extensive and beneficial results. The great Exhibitions of London and Paris have now become matters of history, and although their brief existence belongs to the past, the mighty impetus which they imparted to the genius and industry of nations will continue to be felt to distant periods of the mysterious yet hopeful future. These Exhibitions are characteristic of an age of rapid progress in the useful and ornamental arts, and constitute a marked epoch in the advancement of a higher civilization, in which those great national, moral and social relations of the race, occupy a prominent position. It may be that some of these effects will not become speedily apparent; even, perhaps, when they are the most latent, they may become the silent but effectual means of accomplishing ultimately the most valuable and enduring improvements. The harmonising influences which such Expositions exert on the different races of mankind, the prejudices they dissipate, the catholicity of spirit they inspire, and the expansion of thought, improvement of taste, and general elevation of the whole mind in many of the best elements of progression and Christian civilization, which they tend to produce, form an invaluable and much needed discipline of both mind and heart, and cannot fail in the end of securing in the highest sense, "the greatest happiness of the greatest number."

The work which stands at the head of this article was prepared in the form of a lecture, and delivered by the author to his Agricultural class in the University of Edinburgh. Professor Wilson is favorably known on this side of the Atlantic. He was appointed one of the British Commissioners to the New York Industrial Exhibition in 1853, when he attended the Provincial Shows of both sections of this Province. Canada is under great obligations to him for the interest he took in our department of the London Exhibition, in 1851, and the favourable disposition he has subsequently shown towards Canadian productions, both in the Paris Exhibition, and with reference to their introduction to the Crystal Palace at Sydenham. The British department of Agriculture in the Paris Exposition was entrusted to his care, and he was also appointed a Juror in the general examination and adjudication of awards. We need scarcely say, therefore, that Professor Wilson must be highly qualified, from previous acquirements and professional duties, to speak and write on the Agriculture of the French Exhibition. We proceed to lay before our readers a few facts and statements relating to this department, gleaned principally from his lecture.

The Agriculture of France continues as yet very defective in reference to two of its most important departments, *draining*, and the use of *special manures*. The former, Professor Wilson says, is daily becoming more appreciated, and some few plans of drainage were exhibited, with a comparative statement of results. A French writer on agriculture, who has already established a European reputation, LEONCE DE LAVERGNE, observes in a recent number of the *Revue des Deux Mondes*: "That with badly worked and badly manured fields as is still the case with three-fourths of France, drainage can produce but little good effect. Great progress has to be made in most districts before that. The adoption of a good rotation costs less, and may prove as productive. Then comes the employment of some improved implements, as a good plough, a good harrow, threshing by machinery, and the use of improvers for the soil."

Guano till quite recently has been but very sparingly used in France. During the first six months of 1854, out of 225,000 tons exported from the Chincha Islands, 113,000 went to England, 98,000 to the United States, and only 5688 to France. In 1855, however, France imported 100,000 tons of this valuable fertiliser. Considerable attention seems lately to have been given in that country to the manufacture of artificial manures, several of which were exhibited. "Of these," the Professor remarks "one, the Fish Guano—

"Particularly claimed attention, inasmuch as the practicability of the manufacture was lately the subject of much discussion in scientific as well as in commercial circles. It was manufactured, I was informed, upon a considerable scale, the process differing somewhat from that suggested in this country. The fish, either the refuse of the market or otherwise, is cut into pieces, and submitted to the action of high-pressure steam (four or five atmospheres) in suitable vessels, for about an hour. It is by that time sufficiently cooked, and is then ready for the presses, which expel a great proportion of the water, and leave the residue in the form of a cake. This cake is, by means of a coarse rasp or grating machine, broken up into a sort of pulp, which is spread out in thin layers on canvass, and dried by means of warm currents of air. It is sold either in this state or more minutely divided by means of the ordinary grinding processes. It is stated in this condition to correspond to 22 per cent. of the crude weight of the fish, and to contain from 10 to 12 per cent. of nitrogen, and from 16 to 22 per cent. of phosphate. The price was

20 francs per 100 kilogrammes (about £8 per ton), and the demand regularly increasing. Probably there are few places where this manufacture could be carried out more advantageously than along the north-east coast of this country, where both the raw materials,—fish and fuel,—are so abundantly provided; and I certainly think the simple process of the "*Engrais Poisson*" is more economical than and preferable to the processes hitherto recommended."

In the agricultural implement department there was an extensive display, but nothing particularly novel or superior to what had been previously exhibited elsewhere. There were no less than 350 exhibitors, whose productions as might be expected indicated very different orders of merit."

"The practical trials of the implements were of a somewhat irregular and protracted character. Those coming immediately under the adjudication of the Agricultural Jury were carried out satisfactorily, considering the difficulties attendant upon the operations of such a large number of machines and implements, most differing from, and many of them entirely new to the agriculture of the land. The trials occasioned considerable excitement,—each time the country sent its representatives from far and near. Ministers of State and Imperial Commissioners, with their President, the Prince Napoleon, Arab chiefs, and foreigners from all parts of the globe, came to see the experiments; while the presence of a battalion and a brigade, with their martial accompaniments, conferred a *novelty*, if not a charm, upon the field. After all, these warlike accompaniments formed a striking background for such a living picture of the peaceful arts. The results of all these comparative trials will be officially made known by the Jury. The character of the English implements was well sustained, in none perhaps more than in the *ploughing* trials, when the dynamometer showed, that while it required only a force equal to 17·01, to turn over a *certain quantity* of earth in a *certain time*, with the best English plough, it required a force of more than 27 to do the same work with the *best* French one, and 32·3 with the best Belgian plough. Many other ploughs were tested, some requiring a force of 60, 80, and indeed nearly 100, so that practically one horse with the English plough would be as efficient as *four* or *five* horses attached to some of the other ploughs. In the trials of Reaping Machines, the Americans were each time victorious; the work was admirably done. An English and a Canadian machine, on *Bell's* principle, were forced to withdraw from some derangement of the working gear. These machines, from their economy of labor, and rapidity and excellence of work, appeared to produce a great effect upon the crowds who witnessed their operations. I fear, however, that the agriculture of France is not yet sufficiently advanced for their successful introduction. What Palladius said of old, is equally true now,—that they are only to be used when the fields are large, and the surface level,—and these are certainly not the present conditions of France."

"Of all implements," says M. de Lavergne, "the most necessary is the most difficult to perfect; there is not such a thing as a *perfect* plough, and it is very doubtful if it be possible to find one which shall satisfy every condition. All the ploughs were tried by the jury; those which did apparently the best work with the least draught were, the English *Howard*, the American [Canadian]

Bingham, the Belgian *Odeurs*, and the French *Frignon*. As the experiment shewed no very marked superiority in any, it is probable that each nation will keep to its own. That which is defective and imperfect in the work of the plough has to be supplied by other implements; as scarifiers, diggers, harrows and rollers. For these the superiority of the English is incontestable. Nothing can match Garrett's *cinease*, Colman's weeder, and the Norwegian harrow and clod crusher of Crosskill. These superior implements are now copied in France, as far as the high price of iron and the means of our cultivators admit."

In the trial of implements we understand that *Morse's plough*, manufactured at Milton in Upper Canada, stood next to Howard's in lightness of draught and quality of work, then came Bingham's, an iron plough, the irons of which were not polished like Morse's—a circumstance that will, to some extent at least, account for the small difference of draught on a first trial. These two ploughs were purchased with many other articles by the Canadian Government, and transmitted to the French Exhibition. It is no small honor for the daughter to be but slightly excelled by the mother, in that most ancient, important and characteristic implement, the plough.

In the fourth section, relating to the produce of cultivated crops, the first and foremost place is assigned to the French Colony of Algeria, which, after being for many years dependent for a considerable portion of its food and a drag on the mother country, has been changed by the adoption of an improved system of tillage, into a large exporter of the necessaries and of some of the luxuries of life. But Algeria is not without her rivals. Professor Wilson remarks:

"Rivalling the fine samples of hard wheats from Algeria, were the *white wheats* of Australia, Tasmania, the Cape, Canada, and Sweden. France, Spain and Belgium also exhibited beautiful wheats, both white and red; while the *red* wheats of Portugal were very highly commended. Austria and Baden both funished very comprehensive and well arranged collections of agricultural produce, and the *quality* of the wheat exhibited by Turkey shewed the richness of her soil, while the dirty unmarketable condition testified to the want of care of its inhabitants. Denmark, Sweden, Canada, and Hungary exhibited the finest samples of *barleys;* and Tasmania sent a sample of *oats* equal to any in the building. The specimens of *maize* were very numerous and of admirable quality; the finest perhaps were from Algeria, Canada, Australia, Portugal, Hungary, and Styria. *Rye* and *buckwheat*, two crops hardly known as bread corn in this country, were contributed by France, Bohemia, Denmark, Sweden, and Canada, in which countries they are very largely consumed. Samples of *rice* were contributed by South Carolina, of remarkable size and color; Algiers, Portugal, Tuscany, and the Pontfical States also exhibited their produce. Bavaria, Bohemia, and Belgium sent fine collections of *hops* of superior quality. Canada also exhibited samples showing a marked improvement in quality since 1851. The advanced state of the *flax* cultivation in France, Holland, Belgium, and Austria, was well represented; from each country an extensive series of samples of various qualities, and in the different stages of preparation, was sent. The *tobacco* specimens, I was informed, were of extraordinary quality, in many cases, I am sorry to say, superior to the samples of grain of the exhibiting country. Those most commended were contributed by Algeria, France, Austria, Baden, Spain, and Portugal. From Greece a small collection of grain was sent, as also a pot of honey from Mount Hymettus, which the umpires, still faithful to the traditions of the poets, pronounced to be the best in the Exhibition."

British agricultural produce was confined to one collection, exhibited by the British Government, and entrusted to the care of Professor Wilson, who manifested no ordinary amount of taste and skill in procuring and arranging the several articles, which excited much praise and admiration, both from the visitors and the press. The official Hand-book has the following remarks:

"Vegetable productions occupied a large space in the contributions from the English Colonies. Their prodigious variety, their relations with manufacturing industry, and with the *alimentation* of the country, assigned to them naturally a prominent position in the Exposition of 1855. But we were not prepared to see the agricultural produce of England represented with such éclat. Whilst the contributions from the Indies struck us by their variety, which, so to say, prevented all methodical classification; those from England were arranged in admirable order, and thus enabled us to appreciate at a single glance the results of that high cultivation which the necessity for a large production has forced upon this great nation. The cereals, leguminous and forage plants, and the indigenous timber woods, were represented by specimens in their natural state; the roots and cultivated fruits were represented by wax models; the domesticated animals by carefully painted portraits. This collection, in its ensemble, does the greatest honor to those who made it; our only regret is that the place assigned to it in the Annexe was somewhat removed from the great lines of circulation."

The cereals of Canada occupied a high position, and our wheat was among the best produced by any country. The native woods of this country, which were sent over in large sections, in like manner attracted much notice, inasmuch as most of them possess a high economic value. On this subject the Professor remarks:

"Thus far I have only touched upon the produce of cultivated crops, and these have for the most part been the food substances of Europe. Of these even some fine specimens were sent from our own Colonies, but their strength and importance were displayed in the admirable collection of the produce of *special crops*, or of those obtained without any cultivation at all. First and foremost of these, in number and beauty of specimens, if not in actual importance, must be classed the *woods* used for construction and for ornamental purposes. In these the English colonies of Canada, Guiana, Jamaica, and Australia, were without any rivals. The gigantic dimensions of the soft timber of Canada were only equalled by the strength of fibre and beauty of grain of the hard woods of lower latitudes. Each specimen in these large collections was correctly named, and formed an object of *study* for the economic botanist, no less than an object of commercial interest to the merchants and artificers of Europe. Such a large collection of specimens offered an excellent opportunity for testing their comparative value for different purposes of construction; and a series of experiments were carried out, the results of which, I have no doubt, will materially add to our knowledge of the relative strength of materials. The importance of these experiments would probably be more readily seen in reference to shipbuilding than to any other ordinary purpose for which wood in large quantities is required. In shipbuilding about 40 cubic feet (using round numbers) are required per ton,—say 32 cubic feet for the hull, and 8 cubic feet for fittings,—this would give for a ship of 1000 tons 32,000 + 8000 cubic feet. The two important elements for the consideration of the builder are strength and specific gravity,—both separately and in relation to each other. The value of the former is not so generally determined as that of the latter; indeed this formed the principal object of the experiment alluded to; let us see, then, how far the latter element of the physical character of timber influences the ship. The *first-class* woods entered at Lloyd's are eight in number—English oak, American oak, African oak, Morung Saul, East India teak, Greenheart, Mora, Iron bark; these mostly differ considerably in specific gravity. A cubic foot of English oak weighs 40 lbs.; of American oak, 46 lbs.; of African oak, 50 lbs.; of Malabar teak, 39 lbs.; of Mora excelsa, 62 lbs.; of Iron bark, 65 lbs. Besides these, other woods are largely used, as Honduras mahogany, which weighs 31 lbs. per cubic foot; Eucalyptus, 50 lbs.; Canada pine, 22 lbs.; and cedar, 25 lbs.

"Now, taking these specific gravities into calculation, the hull of a 1000-ton ship would require of English oak, 572 tons; of American oak, 657 tons; of African oak, 714 tons; of teak, 537 tons; of Mora, 885 tons; of Eucalyptus, 714 tons, and of Iron bark no less than 930 tons; while it would only require of Mahogany, 443 tons; of Canada pine, 316 tons; or of Cedar, 362 tons. Taking the two extremes, Iron bark and Canada pine, a difference is shown of 614 tons—nearly 200 per cent.—in the displacement tonnage of the vessel, and consequent increased capacity for freight.

"These collections contained also many woods valuable for furniture and ornamental purposes,—the black walnut of Canada, for instance, of which a suite of drawing room furniture was shown; the *Dacrydium Franklinii*, or Huon pine of Tasmania, whose fragrant odour and brilliant golden color attracted much notice. In the Algerian collection were some fine timber woods, and also some beautiful specimens of the *Thuja articulata*, whose richly marked, deep tinted knots found a ready sale in Paris at the rate of 2s. per lb. weight. The specimens of Amboyna wood in the Dutch collection were remarkably beautiful. One piece was valued at 1200 francs."

The spirit of the author's concluding observations will find a ready response among the true hearted of our race, not only in Canada, but in every civilised nation of the earth:

"This brief sketch which I have given you has touched but the surface—the salient points of interest which naturally present themselves to the ordinary observer. But a man cannot long remain an *ordinary* observer whose duties lead him, day by day, and week by week, to the examination of these great and varied evidences of Divine beneficence. He cannot compare unmoved the productive ratio of skilled and Christian Europe with that of the dark, unevangelized nations of the East. He cannot but trace the hand of Providence in adapting the wants and produce of a country to each other,—whether he seeks for it in the contributions from the ice-bound shores of Scandinavia or the sunny lands of southern latitudes. He feels, after all, how poor are man's efforts, and how small is his success, when—with all the powers of advanced civilization, the matured intellect, and the developed skill – he cannot rival the beauty and the richness of those productions which Nature has bestowed on lands over which her sway is still undisturbed. His intellect may originate,—his skill may apply,—science and art may lend means for the adaptation of Nature's gifts to his daily need, but his own *finiteness* must ever come home to his mind with the great truth that—though as *Paul* he may plant, and as *Apollos* may water,—it is *God* that giveth the increase."

We too, in Canada, have many great and wise lessons to learn from the part we have played in these palaces of Industry reared successively in the two chief capitals of Europe and of the world. We have much to be justly proud of in the appearance we have made; but our experience will have been to little purpose, if we do not also learn from it how much we have yet to accomplish in every way, to place us on an intellectual as well as an industrial equality with these, the foremost among the nations of the world.

G. B.

Researches on Colour-blindness, with a Supplement on the Danger attending the present system of Railway and Marine Coloured Signals. By George Wilson, M. D., F.R.S.E., Regius Professor of Technology in the University of Edinburgh, and Director of the Industrial Museum of Scotland. Edinburgh: Sutherland and Knox. 1855.

There are few persons, we imagine, who would not be startled if their friend standing by them, looking at the same object, and endowed with eyes to all appearance as acute of vision as their own, were to declare that the rainbow was only a white circle, that the varied hues of a sunset were but increasing shades of darkness, or that the gorgeous coloring of a picture by Titian was undistinguishable from the *chiaro obscuro* of a mezzotint; yet, reflection may convince us that such an incident is quite within the limits of possibility, since the impression of colour conveyed to the mind by some function of the apparatus of vision must depend on the organization of that apparatus, which will vary in different individuals; and this variation may in some cases be exalted into so wide a difference from the normal type as to involve the confusion of colours which are distinct to ordinary eyes, or even, as in the case suggested, the obliteration of all. Though this extreme case is very rare, we have abundant proof of its existence; and that, between the eye thus absolutely destitute of perception of colour and the normal eye, which is only insensible to the distinction between faint shades of contiguous colours, there exists a great variety of sensibility to colour in different persons, commencing with those rare cases which confound all colours indiscriminately, passing on to others, still rare, which confuse one of the primaries with another and with all composites, or which are sometimes insensible to the primary red; then to more frequent cases of confusion of one or more composites, and thus terminating, though by no marked definition, in the normal eye. To designate these various grades of defect the appropriate term *colour-blindness* has been adopted, superseding (we hope) the name of *Daltonism*, which that illustrious chemist had unenviably suggested to Continental *savans* by being one of the first to call attention to the subject through a description of his own case. The term, however, must be understood as restricted to cases where the deficiency is decidedly marked (since we are *all* more or less *colour-blind*), and does not properly include such cases as consist merely in a defective memory of colours, in which the inability to *name* any particular colour presented does not result from inability to distinguish between it and another when simultaneously contrasted to the eye.

Previous to the publication of the work which is the subject of this article, information on this interesting subject was not readily accessible, and was sufficiently scanty: a couple of admirable memoirs by Wartmann; descriptions of particular instances scattered through the Transactions of scientific societies; the investigations of Seebeck, and the digests of Brewster, Herschel, and Moigno, comprised nearly all that was then known. Fortunately the subject attracted the attention of Dr. George Wilson, the gentleman whose recent appointment to the chair of Technology in the University of Edinburgh, and the Directorship of the National Industrial Museum, has been hailed with pleasure by the scientific world; and to his exertions we owe not only a vast accession of original facts and cases, but the clear and full exposition of the whole subject contained in the work before us. Dr. Wilson appears personally to to have examined above seventy marked cases (besides numerous others communicated to him from all parts of the country) occurring in all conditions of life, and sometimes presented in a manner which conveys to the normal-eyed a sense of the ludicrous. Thus, to select a few instances almost at random, Mr. N. (who thinks his blindness an advantage to him as an amateur artist) says, "I have sometimes attempted a coloured landscape, relying upon a friend to select the appropriate crayons in regard to tint, whilst I exercised my own judgment in regard to tone; if, as has often been done for experiment, what others call a *red* crayon is given to me, whilst executing the foliage of a tree, provided it suited my ideas of depth, I have never distinguished the difference, and have now some drawings with, I am told, bright red intermixed in the foliage; and in one instance a sea piece has *light pink* crests to the waves. I selected these myself, the assorted crayons having become intermixed. * * * I remember the late Lord Y—— joking his wife for wearing a *scarlet* dress; she assured him it was bright *green*; and on comparing notes with him, I found that our defect of vision was precisely the same, although he had been scarcely aware of it until that time.—My brother, when a child, once picked up a red-hot coal, asking 'what that funny green thing was?'"

Strange as it seems, Dr. Wilson gives us several instances of artists suffering from this defect. The brother of Admiral ——— once painted a *red* tree in a landscape without being aware that he had done so: Dr. S. says he has done the same: one artist-pupil copied a *brown* horse in *bluish-green*, painted the sky *rose-colour*, and roses *blue*: another painted a head with a face *muddy-green*, and insisted on a packet of *emerald-green* being *vermilion*.

Rather awkward it must have been for Admiral ——— when he 'chose a pair of *green* trowsers once, thinking they were *brown*:' and still more for those members of the Society of Friends of whom we read 'one provided himself with a *bottle-green* coat, intending to purchase a *brown* one; and selected for his wife, who desired a dark gown, a *scarlet* merino. Another, who is an upholsterer, purchased *scarlet* for *drab*, and had to rely upon his wife and daughters to select for him the fabrics needed in his profession!' Most of all should we sympathise with that unhappy Minister in the same sober community, who selected *scarlet* cloth as material for a new coat. In little better case was that officer of the navy who purchased 'a *blue* uniform coat and waistcoat with *red* breeches *to match*,' or the undertaker's apprentice, who 'on being sent for black cloth to cover a coffin, brought scarlet;' or those journeymen tailors who 'matched the scarlet back of a livery waistcoat with *green* strings; put a ruddy *brown* side by side with a dark *green*; informed a purchaser that a red and blue stripe on a piece of trowser-cloth was *all* blue, and put a *crimson* patch on the elbows of a *dark-blue* coat.'

It is certainly curious that colour-blindness should thus be found in professions where we should least expect it: thus, says Dr. Wilson, 'dyers, painters, weavers, clothiers, and the members of other 'callings much conversant with colour, are not unfrequently colour-'blind. I, myself, have very recently been offered "any reasonable 'fee" if I would cure a worthy working tailor of almost total inabil-'ity to distinguish colours. I know of cases among haberdashers 'and silk-mercers; and on enquiring at one of the latter, who had 'served under a colour-blind master, and thereby had his attention 'directed to the matter, what became of those haberdashers who 'could not distinguish colours, he made the unexpected reply, "that 'they generally ended in mourning-warehouses."'

We find also instances of chemical students unable to tell the colours of their precipitates, and even a chemical professor who hardly dare speak to his students about the colours of bodies; office-clerks using red and black ink without knowing the difference, and obliged to ask a friend which is the red and which the black sealing-wax. Dalton himself compared red sealing-wax to one side of a laurel leaf, and a red wafer to the other, and his doctor's scarlet gown to the leaves of trees; and lastly, a house-painter, who could not distinguish any colours but black and white, and who 'trusted to his wife in selecting and mixing colours,' on one occasion painted some square yards of the wall of a public building *blue*, under the impression that he was producing a *stone-tint*.

Our limits do not allow us to follow Dr. Wilson through the many varieties of colour-blindness that he has recorded, but we quote the following as illustrations:

(*Case of Dr. Y., described by himself.*)

" The colours I see in the rainbow are blue and yellow. Crystals examined by polarised light present to my eye the same appearance as to yours—most likely; that is to say, I see the yellow and blue, the red and green, and on turning the prism round I see them changing, but I cannot retain in my eye the red and green, and could not tell them on a piece of cloth the next minute.

" The colours which I distinguish best on natural objects such as cloths, glass, etc., I think are yellow and blue, the worst are red and green. Yet when I try to answer your two questions, which I must run together, 'What colours are confounded with each other, or supposed identical or undistinguishable?' and 'What mistakes have been made in reference to colours?' I feel that I may be said not to recognise any colour. In the first place, I never could recognise corn whether it was yellow or green, the green appearing only as a darker shade of yellow. Green and red I cannot distinguish from each other. Red I never saw in the fire, gas, candles, etc., only yellow and blue. Red cabbage growing, pickled, or in infusion, are all the most beautiful blues I can conceive, and it was by not observing any change by acids in the infusions of red cabbage, when attending Professor Hope's chemistry class where I used to stare for the whole hour expecting to see the change, that I first became fully convinced of my great defect. Red, again, in the lips, cheeks, nose, roses (red), gooseberries, inflammations, and the like, looks blue to me!—(I never saw a red rose in my life) and yet on recently taking up an oil-paint, to illustrate to another my conception of the colour of the lips, you will be astonished to hear that I took up a green (*terre verte*). On another occasion I was very much annoyed at a little boy who could tell a blue line of water-colour, drawn across my finger, from blood; I could see no difference. Strawberries, cherries, etc., I can recognise without the slightest difficulty, but I don't trouble myself about their colour; I see only a difference as regards what I call *shade*. Pinks, lilacs, purples, and blues, are all the same colour, only differing in intensity. Browns, russets, maroons, olives, citrines, and a host of others, are just anything that I can guess at, but I never get further than red, brown, or green. The names of the other colours I don't think I ever uttered. Indeed I never speak of colours unless I cannot avoid it, and the only practical mistake I ever made in regard to them was purchasing a purple neckloth under the impression that it was black. That was the only mistake; for a good reason, I never bought a coloured piece of dress, *alone*, either before or since. I may mention that the same colour, when presented to my eye on different objects, especially with unlike surfaces, often, I may say generally, appears quite different on each.

"I have now given you the best account I can of my case. It appears to myself on reading it over, very absurd, and would lead one to ask, 'What can he see?' Yet I have the firm idea and *feeling* in my own mind, that I *see* colours the same, and as distinctly as you do, but they produce no lasting effect on the eye at all, and I cannot recognise them again."

(*Case of Dr. K., a medical man, described by himself.*)

"To endeavour to familiarize my eye to the primary and prismatic colors, I keep in my writing desk, and look almost daily at, a chart of the primary and prismatic colours. These, I think, I know on the card, but I make sad blunders when I leave the card and look at silks, cloths, powders, fluids, or flowers. Indeed, *I dare not name any colour*, and endeavour at all times to describe objects by other characters than those of colour.

When a boy at school, my attention was directed to my want of knowledge of colour by finding I could not see what my father called the *bright red* berries of the holly. When other children easily found out the trees which were loaded with ripe cherries, I never could till I came so near as to detect the form of the fruit. The discovery of this defect in vision distressed my father exceedingly, and he endeavoured to cultivate in me a knowledge of colour by giving me lessons in painting, making coloured charts for me of the prismatic and other colours, wishing to believe that the defect resulted from want of education in colour, not from a visual defect. I destroyed many a painting of flowers, etc., by putting on wrong colours, as blues for purples, green for some kinds of red, and yellow for others. I still remember the surprise he exhibited when he found I could not detect a red cloak spread over a hedge, across a narrow field—hedge and cloak appeared to me the same exact hue, and they do so to this day.

"Blue and yellow are to me the brightest of all colours. Red (that is scarlet) is to me a pleasing sober colour, which refreshes my eye as much as green; indeed I cannot tell any difference in colour between certain shades of these. Red sealing wax and grass, for instance, are absolutely the same exact colour. Some shades of brown, green and red, I cannot detect to be different. Prussian blue and rouge have the same hue. A rose, the lips, a ruddy complexion, and the face of a man dis-coloured by nitrate of silver, are to my eyes absolutely the same. Yet my eye can appreciate most delicately the various shades of all these colours, but they are all to me but shades of *one* colour, and that colour varieties of what I can see in the pure deep sky or in Prussian blue—in fact, blue in various dilutions. Red hot coals and gamboge yellow are to me identical in colour. Infusion of red cabbage deepened by alkalies, or reddened by acids, to me exhibits *no change of colour*, but only a greater intensity or depth of colour in the acid jar—the actual colour remains absolutely the same. I cannot detect cherries, strawberries, or the red fruits from the leaves but by their form.

"In purchases I have consequently made many mistakes. For instance, I bought a red dress thinking it a green one. I have, on more than one occasion, bought red and green trousers thinking they were brown, and had to get them dyed afterwards to get them worn. In Paris I bought a red cap to wear instead of a hat, thinking it a green one; in fact, I could give very many instances of similar mistakes.

Dr. Wilson adds to this the remark:

In the preceding explicit account, Dr K. has, in addition to direct statement, supplied an incidental proof of his colour-blindness. He refers to infusion of red cabbage as being deepened in colour by alkalies; but this infusion, which is originally purple, is not rendered darker by alkalies, but is changed into a bright green. An equally striking, and withal amusing, evidence of inability to distinguish colours is afforded by the chart of prismatic colours to which Dr. K. alludes. He was adventurous enough to prepare it himself, and the result may be anticipated; a youthful member of his family soon informed him that one of the spaces was wrongly coloured; and on asking sight of the chart I found that what was called the violet band was a full crimson, so that both extremities of the prismatic spectrum were represented as red.

Almost all the cases referred to in this work present nothing of melancholy in the subjects thereof: never having known the beauty and charm of colour, they do not suffer from the deprivation, and their mistakes are to themselves rather a source of amusement than annoyance; but one case is mentioned of a gentleman in full possession of his colour-faculty, receiving, by a fall from his horse, a concussion of the brain, which terminated in the permanent loss to him of this power.

It is painful to read that—

Whilst formerly a student in Edinburgh, he was known as an excellent anatomist; now he cannot distinguish an artery from a vein by its tint. He was previously fond of sketching in colours, but since his accident he has laid it aside as a hopeless and unpleasant task. Flowers have lost more than half their beauty for him, and he still recalls the shock which he experienced on first entering his garden after his recovery, at finding that a favourite damask rose, had become in all its parts, petals, leaves, and stem, of one uniform dull colour; and that variegated flowers, such as carnations, had lost their characteristic tints.

Alone of all the cases which I have recorded, he knows what he loses by his colour-blindness, and is even worse off in some respects than the totally blind; for if they have never witnessed colours, they will not think of these as things they cannot recall; and if they have known them, they can, as the seeing do in dreams, recall them, it may be dimly, but yet on the whole as they are. But for Mr. B., the colours which he saw, are not only effaced, but are replaced by tints the most unlike those which they once bore.

It is only due to Dr. Wilson that we should distinctly state some of the important facts and laws of which he may claim in this work to be the discoverer. These are—

1. *That the colour* RED *produces to some eyes the sensation of positive blackness;* a most valuable fact which goes a long way to explain some of the difficulties of this subject.
2. That the colour-blind have a perception of *intensity* more acute and also discordant with that of ordinary vision.
3. That the sensitiveness to *colour* of a colour-blind eye, suffers sooner from the withdrawal of light, (or by deepening of shades) than that of a normal eye, and at the same time that the perception of *form* and *outline* is more persistent to the abnormal.
4. That there is a 'chromic myopia,' or short-sightedness to *colour*, not accompanied by a corresponding short-sightedness to *form* or *outline*, so that, whereas to the ordinary short-sighted eye, *form* disappears before *colour*; in *this* myopia the colour becomes undistinguishable while the outline still remains distinct.

We cannot readily present in a separate form other valuable facts or suggestions for which Science owes much to our author, but we would particularly refer to the observations on the effect of artificial light in influencing the perceptions of the colour-blind; to those made with the colours of the spectrum, and to the practical method of relieving to some degree this natural defect by artificial means. What we have specified above will undoubtedly throw fresh lustre on an already brilliant reputation, and the more so when we consider the difficulties which meet us on the threshold of such an investigation as this. Our nomenclature of colour is altogether vague and indefinite; the term 'red' for instance includes an infinite variety of tints differing from each other both in hue and intensity, and there are (or at least there *were*) no ready means of identifying any precise tint offered: again most of the experiments must be made by means of pigments or coloured skeins of worsted or silk, and these are evidently inferior to, and indeed may give totally different results from those made with the corresponding homogeneous tints of the solar spectrum; so also, the nature of the light by which coloured objects are seen powerfully affects the impression of tint conveyed to the eye: but most of all, the difficulty lies in the want of a common language between the experimenter and the colour-blind subject. We cannot do better than give Dr. Wilson's own words on this point.

"All cases of colour-blindness agree in this; that to the extent of its occurrence in any one, it implies a condition of vision, in reference to which there is not a common experience, and therefore cannot be a common language between those conscious of colour and those unconscious of it. The information, accordingly, which they can convey to each other is almost solely of a negative kind. We cannot, for example, give to one who never saw green a positive conception of what we understand by it; we can at best make him aware that it is none of the colours he does see. And he, on his part, cannot make us understand what *positive* impression green makes upon his eye, although he may satisfy us that it is something different from that which blue or yellow makes."

Such considerations as these require not only the utmost skill and care in the investigator, but render a classification of the observed phenomena extremely difficult, if not, in the present state of our knowledge, impossible. Accordingly we find in the present treatise even the small attempts at classification made by preceding writers overthrown, and the classification with which Dr. Wilson himself sets out is abandoned before the close; there really seems no other statement at present to be made than that the varieties of colour-blindness are infinite in number and insensible in gradation.

With regard to the statistics of this defect, Dr. Wilson's researches present us with the startling result that *nearly one in eighteen of the whole population is more or less colour-blind*, a conclusion drawn from an examination of 1154 cases taken indiscriminately and comprising a corps of soldiers, of the Edinburgh police, and the students of the University. There is also no doubt that the defect is hereditary, and runs in families; and that, though generally coexistent with infancy, it may be temporarily induced by certain diseases, and even permanently by cerebral injury. A strange exemption is exhibited in the case of females, among whom Dr. Wilson has been able to furnish only two or three instances of colour-blindness. "Its occurrence," says our author, with small show of gallantry, "probably appears more rare than it is, and chiefly because the value set by women upon a nice appreciation of colours, makes them reluctant to confess that they are not quick or accurate in judging of them." Long ago Gall announced that the phrenological organ of *colour* was more developed among females than males, a fact deemed to be contrary to experience since no woman has ever been a great painter, and their perception of harmony of colour has always been considered weak, however glaring may be their merely sensuous appreciation of it; the implication contained in the above passage of our Edinburgh philosopher would seem equally to run counter to the general opinion which assigns to woman a small organ of *secretiveness*.

Whether one class of the population is more liable to colour-blindness than another, or whether such a peculiarity may not extend to even a national distinction, there are not sufficient data to determine, but the following extract is an acute and happy generalisation.

"It is worth a moment's consideration how far this peculiarity of vision characterises one race of men more than another. It is, doubtless, more common among the civilised nations, large numbers of whom are doomed, by that division of labour, which is a great source of their strength, to occupations which dwarf one or more of the external senses, than it is among the uncivilised races, each member of whom cares only to do what is "right in his own eyes," and cultivates the powers of those eyes to the fullest.

"Among both the civilised and uncivilised nations, however, there are doubtless great differences in original endowment, so far as the sense of colour is concerned; and, as may be reasonably surmised, there are corresponding differences in the extent to which colour-blindness prevails among them. Thus, those eastern and southern nations, who live under bright skies, among plants and animals of vivid and brilliant colours, exhibit—partly as a prerogative of race, partly and largely as an effect of such colours daily impressing them—a delight and skill in arranging, matching, and harmonising tints, such as are incompatible with colour-blindness, and imply its rare occurrence in those whose love of colour and command over it are so great.

"The Chinese, the Japanese, many of the tribes of Hindostan, the Venetians, the Italians, the Spaniards, the Flemings, the inhabitants of Southern France, and some of the northern Teutonic and Celtic tribes have, as florists, painters, dyers, weavers, glass and porcelain makers and stainers, excelled for centuries sister-nations in the management of colours. Among untutored races, the Indians of the American continent, the African tribes, the uncivilised races of Central and Southern Asia, and the inhabitants of the islands in the Pacific Ocean, have shown by their war-paint, their crowns of brilliant flowers, and still more brilliant birds' feathers, their brightly stained skins and parti-coloured dresses, their dedication of the most splendid coloured objects to their gods and their chiefs, besides much else; that however different their canons of taste may be, they are as passionate and exclusive lovers of colour, as the overcivilised ancient nations who allowed none but princes to wear robes dipped in the Tyrian dye, or to write with purple ink.

"On the other hand, the civilised nations of temperate climes, where the summers are short and the winters long and gloomy, living under sombre skies, amidst a Fauna and Flora of pallid and inconspicuous, or dark and subdued tints, and surrounded by masses of green which satisfy, but do not excite the eye, care little for brilliant colours in their dress or household adornments, compared with the inhabitants of more sunny regions; and probably are more liable to colour blindness than they.

"A similar observation may probably be made, with the deductions requisite in contrasting the conditions of the external senses in civilised and uncivilised nations, in reference to such races as the Esquimaux and Fuegians, and specially to the former, who live in regions bereft of vegetation during the greater portion of the year, and presenting to the eye little but the dazzling monotony of ice and snow. The sense of colour must, to a great extent, lie dormant in those so circumstanced, and become dulled through want of exercise. The tribes in question and others in similar latitudes seem very indifferent to colour, as an addition to their dress or ornaments.

What are the physical causes which give rise to this strange peculiarity? Some philosophers have sought to ascribe it to a malformation of the eye, or to some coloration of one or more of the membranes, the choroid or the retina. Dalton attributed his own colour-blindness to a *blue* tint in the *vitreous humour*, on which supposition he successfully explained most of the facts in his own case; an examination however after death shewed that this humour was *not* blue. Other theories of this kind may be set aside simply by the fact that Albinoes are normal as regards colour. Nevertheless it can hardly be doubted that variations in the prevailing tinges of the humours and membranes of the eye must produce chromatic peculiarities of vision; which would fall, however, under a different class than those now considered. Dr. Wilson discusses these points in detail with much acuteness and ingenuity, and closes his review with the following remarks:—

"I am not disposed to assert that colour-blindness, of the kind Dalton and his fellows exhibited, can be occasioned by such modifications in the colour of the membranes of the eye as I have drawn attention to. But an extreme chromatic equation, not always distinguishable in its practical manifestation from veritable colour-blindness, may certainly be occasioned by the varying condition of the membranes referred to, and on this account I have, in the introduction to this discussion, spoken of such manifestations as deserving to be ranked under a special chromatic theory of colour-blindness.

"I close this section with the expression of the hope, that the colour of the membranes within the eye-ball will now be an object of more frequent and minute examination by physiologists, than it has hitherto been. My friend, Dr. Beddoe, has indirectly supplied much interesting information on this subject, in his little work recently published,* containing the results of an examination during life, of the colour of the eyes and hair of some 5000 of the Scottish people, representing nearly all the districts of their country. According to the observations of John Hunter, already quoted, in which physiologists generally concur, a dark choroid and dark hair go together, and *vice versa.* In the future enumeration, accordingly, of cases of colour-blindness, it is desirable that the colour of the hair should be recorded, as it cannot be expected or desired that the majority of the colour blind should speedily become the subjects of pathological investigation. The colour of the iris generally, but not invariably, resembles in shade that of the hair, and a hazel or pale golden iris has been thought to be an index of colour-blindness. Of the truth of this particular conclusion no proof has been given; but it is certain that the amount of dark pigment on the back of the iris (*uvea*), increases or dim-

* A Contribution to Scottish Ethnology. By John Beddoe, B.A., M.D., 1853.

inishes in proportion to the general abundance of colouring matter tinting the choroid; and it would be highly interesting to know whether the fair-eyed and the dark-eyed—apart from colour blindness—attach a different chromatic value to the same colour. The proverbial difference between the tints preferred for dress by blondes and brunettes, and the great fondness of the negro races for white and the primary colours, are probably *in part*, at least, related to differences in the colour of the choriod, to which that of the hair and of the iris is a clue. The hair is probably the more important external index of the chromatic condition of the choroid, especially where the hair differs in shade from the iris; but this is not certain; and even if it were, it will often be impossible, in the living human subject, to look at both, so that in all cases each should be examined, and the result recorded."

There remains no other hypothesis to fall back upon but that adopted by Herschel, Wartmann, Kelland, and others; namely, that colour-blindness consists in an inability of the sensorium to distinguish between the vibrations produced by certain rays having different wave-lengths. This, translated out of the language of the Undulatory theory, merely asserts that the eye of the colour-blind is incapable of distinguishing between certain colours, and whatever may be thought of its value as an explanation, it certainly possesses the merit that it cannot be objected to.

In fact, the whole subject of colour is to this day the grand stumbling-block in the Science of Optics. We have on the one hand, the objective phenomena of natural coloration; on the other, the subjective requirements of the Undulatory theory, meeting in the prismatic spectrum as common ground. The facts of the former are still unmeasured and unclassified; the analysis of the latter, even in the hands of Fresnel and Cauchy, fails to give satisfactory account of Dispersion. The Experimentalist has to tell us how to measure the intensity and hue of a given colour, and in what way a compound of colours may produce to the eye the same impression as a single homogeneous one; the analyst has to tell us what is the law which connects the wave-length of a ray with its velocity of transmission in different media. Till both are told, Theory and Experience will be like the Youth and the fair Lily in Goethe's Tale, vainly striving to come together.

Perhaps one of the most important steps taken in this direction for a long period is the invention by Mr. Maxwell of the instrument which he calls a *colour-top*; the account of this beautiful contrivance, far superior to the methods of Newton and Young, to the diagram of Professor Forbes, and the pretty *Chromascope* of M. Soleil, we extract from this work, where it was published for the first time.

"Mr. Maxwell employs a disc of pasteboard, or metal, provided with a spindle, so as to admit of it being spun as a top or teetotum. The spindle is in two pieces, and can be unscrewed so as to allow discs of coloured paper, perforated in the centre to receive the spindle, and with a slit corresponding to a radius of the disc, to be placed on the upper surface of the top, the rim or circumference of which is divided into 100 equal parts. The paper discs admit of being placed above each other, and any portion of one disc may be made to appear above another, by passing one edge of its slit through the slit in the other.

"Thus, let a disc of red and a disc of white paper be placed together on the top, the white being the lower of the two; we may then, if we choose, cover the white entirely by the red, so that the latter only shall appear; or at will, bring the white through the slit in the red so as to let one-tenth, one-twentieth, one-twelfth, or the like quantity of the surface of the white cover that amount of the surface of the red. When the top is made to spin, one of the tints (dilutions with white) of red will be obtained, and the quantity of red and white in it may be measured by the graduation on the circumference of the circle.

"In the same way a circle of red and a circle of black will give the shades (deepenings with black) of red; and the delicacy of an eye in distinguishing the nicer gradations of colour, may be quantitatively determined."

"Again, small discs (half the diameter of the larger ones) of green, and of white or black paper, may be placed on the colour-top above the larger red and white or black discs, so that when the top is spinning, a green circle, surrounded by a red ring, will be visible to a normal eye, and these may be compared throughout their tints and shades."

We cannot help thinking that this beautiful instrument will be to the theory of colour what the thermometer has been to the theory of sensible heat, but before touching on the hypothesis of Mr. Maxwell, we must beg leave to take strong exception to the manner in which Dr. Wilson speaks of the view taken by Sir David Brewster of the constitution of the Solar Spectrum. We can willingly excuse our Author for using (as indeed he was compelled to do for want of better,) the ordinary, vague and indefinite names of colours, such as red, blue, and the like, and also for adopting, as a convenient classification the distinction of colours into primary or secondary, (a distinction in part certainly arbitrary, probably wholly so,) but when we find him speaking with favour of an hypothesis which asserts, as Sir David's does, that there exist in white light only three homogeneous tints, and that a superposition of three equal lengths of these is the real constitution of the Solar Spectrum as revealed to us by the prism, we would remind him that the experiments on which the illustrious philosopher of St. Andrew's grounds his opinion, have been persistently rejected by names of no small authority; that the conclusions drawn from them have been repudiated by a still larger class of *savans;* that the hypothesis has found no favour among continental philosophers; and that the repetition of these experiments by Helmholtz and Bernard has not led to their confirmation; and further, that some of the facts of colour-blindness brought out in this very volume, stand in direct contradiction to this view. The "beauty" of the hypothesis is a matter of opinion, (and we certainly differ from Dr. Wilson in this point,) but of the *unreality* of it, we think there is small doubt; and hold confidently to the belief that the simple and elegant explanation of our great Newton stands unimpeached in its integrity.

In an altogether different category stands the hypothesis first suggested by Newton and adopted with modification by others, such as Young, Mayer, Lambert, Herschel, and lastly by Mr. Maxwell; namely, that all possible tints can be produced by proper combination of *three* standard tints, (which may be designated as principal or primary,) and that *any* three tints may thus be assumed, provided they are capable in certain proportions of producing white, an extension due to Sir John Herschel, which Dr. Wilson erroneously attributes to Mr. Maxwell. We regret that we have not yet seen the investigations of this latter gentleman *in extenso*, the volume of the R. S. E. Transactions, in which they are published, not having yet reached this country; and we hesitate at pronouncing an opinion derived only from the letter of Mr. Maxwell, in the volume before us, giving an outline of his system neither over full nor sharply defined. Mr. Maxwell assumes three tints (or as he calls them, three pure sensations of colour,) as his primaries; he supposes these to be placed in the corners of a triangle, and then by a simple geometrical construction, namely, finding the centre of gravity of three weights placed at these points proportional to the respective intensities of the tints used in forming any required tint,—he assigns to every possible colour its position relative to them, and also the numerical measure of its intensity. Undoubtedly this construction is extremely beautiful, and the numerical expression of it is in effect little different from that of Mayer, as extended by Herschel. The only question is whether Mr. Maxwell's formula will express all the colours that exist in nature, a question that can only be answered by observation; Mr. Maxwell indeed has drawn some conclusions regarding colour-blindness, which would furnish an *experimentum crucis* of his hypothesis, but we do not find that Dr. Wilson has yet submitted it to this test. Meanwhile we cannot help suspecting that the formula may break down, at the same point as that of Mayer, in assigning the position of the browns, and indeed of all colours in which, in our opinion, black enters as a positive element, and not as a mere negation. Be this as it may, we must protest against any hypothesis of this kind, indispensable though it must be as a means of measurement and classification of colours, being designated as a *theory* of colour; nor can we assent to the conclusion drawn both by Mr. Maxwell and our author, that colour-blindness consists essentially in an absolute insensibility to one of the three tints assumed for primaries, or as Mr. Maxwell expresses it, "in the absence of a determinate sensation, depending perhaps upon some undiscovered structure or organic arrangement, which forms one-third of the apparatus by which we receive sensation of colour," a conclusion from which a subsequent remark of Dr. Wilson abstracts all the force, for he says; "It is only in fully-developed colour-blindness that vision is decidedly dichromic, and even then it is not absolutely so, at least so far as my experience goes." In other words, out of the infinite variety of colour-blindness there is one particular and limited class which may be described as *dichromic*. Such an explanation of the phenomena in general is moreover inconsistent with the fact of *chromic myopia* pointed out by Dr. Wilson, which expresses that the colour-blind can appreciate colours, when close, of which they lose the distinction at a certain distance; and still more with the fact that even the normal eye becomes colour-blind to the shades of certain colours by sufficient diminution of intensity; in short this explanation exalts into a difference of *kind*, what our author himself more than once strongly represents as being only a difference of *degree*.

With that felicity of practical application which has always distinguished Dr. Wilson, he has devoted a considerable portion towards the close of this work to a consideration of the dangers involved in the possible employment of colour-blind persons on Railways or Vessels, and of the liabilities of mistake to which the present system of signalling by coloured lights and flags is open; we regret that our space will not permit us to follow him through those interesting and useful chapters, and shall content ourselves with observing that, on the whole, Dr. Wilson recommends calling in the aid of *form* to that of *colour*, both by flags or signal-vanes of different shapes for day, and by using differently-arranged combinations of several lamps for night instead of a single one; also that of all coloured lights, the best practically would be, *white* for safety; *red* for caution; and for danger by day, *sky-blue*; by night, *yellow*. This subject strongly claims the attention of our Railway authorities, although on this side the Atlantic, accidents are sufficiently numerous from other causes, to render this particular one of comparatively small moment.

We lay down the volume with hearty thanks to Dr. Wilson both for his own experiments and researches in this obscure subject, and for having embodied all that is yet known about it in a clear and concise *resumè* which will serve as a standard of reference hereafter to the scientific investigator.

J. B. C.

Letters from the United States, Cuba, and Canada; by the Hon. Amelia M. Murray. New York: G. P. Putnam & Co., 1856.

Towards the end of July, 1854, the Hon. Miss Murray, one of the Ladies in Waiting at the Court of Queen Victoria, crossed the Atlantic, to see with her own eyes this new world and all its varied institutions. Looking about her accordingly with intelligent and observant eyes, she witnessed much that was novel, both in nature and society. The Botany of another hemisphere had its attractions for one already educated to understand its scientific novelties; the Geology had its popular aspects of interest also; while of its Zoology the *Genus Homo*, Red, Yellow, White, Black, and Brown, naturally claimed a prominent share of her attention. On all these themes accordingly, she wrote and journalized, and now prints a pleasant, superficial, *olla podrida* of observations, opinions, surmises, and deductions, which would have been read, smiled at and forgotten, but for the chance—fortunate or unfortunate as it may be,—that she deemed her flying visit to the Southern States qualified her to set, not only her friends, but the world at large right on the vexed question of American Slavery. Her new opinions, it seems, before being issued from the press were communicated to the Queen, who replied to her Lady in Waiting—according to an explanation which the *Athenæum* gives of her retirement from Court, in correction of less guarded statements,—by some very wise and womanly counsels. "Unhappily the royal letter missed its object; and before Miss Murray had the advantage of reading her august friend's advice she had pledged herself *not* to observe that discreet silence on a most intricate and vexed problem which is necessary in persons holding public situations. Miss Murray has the courage of her opinions; but as she chose to take a part in a discussion that every day threatens to rend the Union, her retirement from the Queen's household followed naturally. These are the simple facts. There was no intention to dedicate the book to her Majesty. Her Majesty never saw the proof sheets. We cannot suppose that the Queen meant to rebuke Miss Murray—as the paragraph makes her—for forming an honest opinion. Miss Murray's retirement from the Court must be assigned to a political—not a personal—motive."

A book for which its author has been made a martyr; which has occasioned her deposition by "perfidious Albion," and her banishment from Court,—which rumour persists in affirming, spite of all contradictions, that British Majesty refused the dedication of, solely because its authoress had the magnanimity to look at Jonathan's peculiar institutions through a special pair of his own rose-colored spectacles; must needs become the rage; and so here we have it presented to us, as prepared for the American palate, with, it is to be feared, a most ungrateful disrespect for the fair champion's rights of authorship.

The book is just such a lively, heterogeneous melange of news, and gossip, and hasty illogical deductions, as any intelligent lady-traveller might be expected to communicate to her friends at home; but it was certainly not worth the sacrifice which its author has incurred by extending its perusal beyond the partial and admiring circle for whom it was originally written. It does not even pretend to any preparation for the press, but abounds with such epistolary addenda as: "Lord Elgin tells me this is the day for letters to go, so I must conclude hastily;" or again, "I have not any time to read over what I have written, therefore repetitions are probable, &c." We shall not therefore seek to break the flimsy gossamer-wings of this ephemeron on the critical wheel, but content ourselves with a chance extract or two to show the character of its mottled plumage.

Some of our Authoress's themes lie a little beyond our legitimate editorial province; for she discusses Canadian and American politics with both freedom and picquancy; depicts our late Governor, Lord Elgin, as the patient, placable and good tempered dry-nurse of that awkward, and alarmingly vivacious baby: Young Canada; and draws pen and ink sketches of its public characters in this free fashion,—not omitting names, which we shall take leave to do: " * * is a singularly wild-looking little man, with red hair, waspish and fractious in manner—one of that kind of people who would not sit down content under the Government of an Angel. He has evidently talent and energy, but he seems intent only upon picking holes in other men's coats!" With like easy nonchalance she nocks off a portrait gallery of the Court and Parliament at Quebec in September, 1854, sufficiently amusing, and not without its value, as showing what her opinions may be worth on other matters requiring a little deeper insight.

It is obvious that Miss Murray by no means approves of hastily formed opinions—at least in others,—the pleasant way in which she sets the authoress of of "Uncle Tom" right on the "*peculiar Institution*" is truly edifying. "Had Mrs. Stowe"—says this patient and pains-taking observer, in one of her chance leisure moments,—"lived for some months among the institutions and the people which, in *Uncle Tom*, she thoughtlessly, perhaps not intentionally vilified, she would have used, not misused her undoubted talents!" and she thus, after an approving quotation, of an exceeding fresh and novel character, from the old sage of Bolt Court, triumphantly proves that two blacks do, after all, make a white!

"I have now taken leave of the Southern States. Louisville and Cincinnati are places in which I believe Mrs. Stowe once resided; and I quote an opinion she advances in her last work which proves her entire ignorance of negro constitution and habits. She asserts that Canada is the best locality 'to develope the energies of the black race.' Before saying this it would have been well if she had studied the conditions of the free negroes in Canada. The very climate itself is utterly unsuited for them. Mrs. Stowe quotes as mistaken and absurd the sensible remarks in Boswell's life of Johnson respecting negro slavery, which I must requote as wise and true: 'To abolish a status which in all ages God has sanctioned and man has continued would not only be robbing a numerous class of our fellow-subjects, but it would be extreme cruelty to the African savage, a portion of whom it saves from more bondage in their own country, and introduces into a much happier state of life, especially when their passage to the West Indies and their treatment there is humanely regulated. To abolish the trade would be "'to shut the gates of mercy on mankind.'" And I must add this: the opinions I have heard from intelligent slaves coincide with those here quoted. Because some slave manacles were seen by Clarkson in a Liverpool shop, he decided at once upon the inhumanity of slavery,—so says Mrs. Stowe. Tyrannical men and women in Great Britain have actually starved apprentices to death. Is apprenticeship therefore, murder? I trust no English woman can be found willing to bring such an accusation against her people. Let us imagine two brothers in this country engaged in trade: one buys a plantation with two hundred negroes to raise cotton in the Mississippi, the other sets up a mill to spin cotton at Cincinnati. Trade is bad with the elder, he must raise or buy corn and clothes to feed and clothe his labourers. Trade is tight with the other,—he dismisses his work-people, who may starve or perish, and there is no law which can make him responsible for their sufferings. I will conclude this subject with one more anecdote, for the truth of which I can vouch.

"A Southern lady and gentleman brought a mulatto slave to Cincinnati, who there fell in with some abolitionists and was imbued with a feeling of discontent. Her master and mistress observing this, proceeded to New York, where they told the girl that they did not wish to retain a servant against her will, and giving her twenty dollars, they added: take this money and your freedom. The girl took it, and went out. She entered a theatre, and was told she must go to the entrance for colored people. In Church she is ordered to sit with the blacks. Trying for a place in an omnibus, the driver says it is no place for her. She hurried back to her mistress to return the money, and entreated she might be taken or sent back to that South where black people are free!"

There are omnibuses, theatres, and churches too, it would seem, nearer home, whose directors would be of the same opinion in reference to the Cincinnati mullato: that there was no place for her. So, at least we imagine may be inferred from another little bit of portraiture from the fair pencil we have already exhibited touching off our Canadian notables, and which may serve as a counterpart to the former sketch. At Louisville the Honourable Miss Murray finds her porcelain of human clay in actual contact with two of those pipkins of the commonest black earthenware called "negro women," and no northern lady "to the manor born," could conduct herself with a more becoming dignity: "Such a frightful specimen of black nature as one of these slave women was!—her mouth just like a cat-fish, and then so sulky and unaccommodating;—she took her own share of the room and added to it as much as she could possibly steal from her neighbours. Talk of white freedom! Why I never saw women of the white classes in England as independent and assuming in manner as some of these darkies. I can imagine what they must be in the West Indies, since we have given them free scope there!" What indeed! What business have low, vulgar people, with ugly faces, to independence or free scope? We should have liked to have started the knotty ethnological problem of "the Unity of the Human Race?" in that Louisville stage-coach, and asked our authoress just to take a quiet philosophical look at it, with her practical view of things. Miss Murray would have made short work of it, or we are greatly mistaken.

It must not be supposed, however, though our authoress in general sticks to the rose-colored spectacles, that everything is perfect even on the White side of the question. The following shews that even white nature will sometimes forget itself:—

"I have heard much of Democracy and Equality since I came to the United States, and I have seen more evidences of Aristocracy and Despotism than it has before been my fortune to meet with. The 'Know-Nothings,' and the 'Abolitionists,' and the 'Mormonists,' are, in my opinion, consequent upon the mammonite, extravagant pretensions and habits which are really fashionable among Pseudo-Republicans. Two hundred thousand starving Irish have come to this country, and in their ignorance they assume the airs of that equality which they have been induced to believe is really belonging to American society. They endeavour to reduce to practice the sentiment so popular here,—but no—that will never do. Ladies don't like their helps to say they 'choose to sit in the parlour, or they won't help them at all, for equality is the rule here!' Mrs. So-and so of the 'Codfish' Aristocracy, doesn't like to have Lady Anything to take precedence of her; but Betty choosing to play at equality is quite another thing."

Our notice might be greatly enlarged by similar piquant selections, which diversify the more commonplace narrative of an American traveller's notes; but we shall content ourselves with one or two brief reminisences within our own Canadian frontier. Toronto is dismissed in less than a couple of pages. It "wants a little polish, but will be a noble city." Montreal scarcely receives a definite notice; but the capital of the Lower Province is drawn in a paragraph of which we dare not reproduce more than this fag-end: "In Queb c there are more churches and more beggars than in any other place I have yet seen on this side the Atlantic!" But we must select for our final extract one which exhibits Canada in a more agreeable aspect; and here surely is a comfortable prospect for the vidual portion of forlorn humanity, such as we may safely defy any other corner of the universe, out of Utopia, to surpass:—

"Colonel Tulloch, the Government Commissioner for settling and looking after the military pensioners who have had grants of lands in Canada, dined here. He has been very successful in improving their condition, and land is not—as it used to be—a misfortune rather than a blessing to the pensioned soldier. This improvement is partly owing to Colonel Tulloch's plan of making the grants consist of three or four acres instead of one hundred, as was formerly the case; when the occupant, unfit to clear and bring into cultivation so large a portion, was ruined by it. Now the smaller allotments are cultivated garden fashion: and one individual made fifty pounds last year by his three acres, principally by growing vegetables for the Toronto market.

"In case of the death of an occupant, his widow is left in possession on condition that she remarries with no one but a soldier; and no widow has ever yet (Colonel Tulloch declares) remained two months without a husband. Such is the anxiety for a housewife, that men of fifty marry widows fifteen years older than themselves rather than remain bachelors. What a chance for antiquated spinsters wishing to change their state!"

It would, of course, be ungallant to suppose that the favour for widows of such a ripe maturity, implied any idea in the minds of their chivalrous suitors of their being incumbrances on the military allotments! It will be seen from the brief passages we have quoted, that these "Letters from the United States," &c., are not without such attractions as may serve pleasantly enough to beguile a leisure half-hour. That they are at all likely to influence the convictions of the British public on the controversial questions they undertake to throw a fresh light upon, we scarcely think many Canadians will admit.

D. W.

The Canadian Naturalist and Geologist: By E. Billings, Barrister at Law. (No. 1, February 1856.) "Ottawa Citizen," Ottawa, Canada West.

A periodical especially devoted to the Natural History and Geology of Canada, has long been a desideratum. In the Journal of the Canadian Institute, it is true, papers of undoubted merit on subjects of natural history, essentially Canadian, have appeared from time to time; but the character of this Journal—a record in chief part of the proceedings of a mixed literary and scientific Society—is clearly of too general a scope to fulfil completely the end in question. The field moreover is so wide, the resources so abundant, that with all the efforts now making to give some literary and scientific value to the Canadian Journal, and the anxious solicitude of its editors to illustrate to the full the natural history and resources of the province, ample space is left in this important department for the cooperation of fellow-laborers. The success of a scientific periodical, like that now offered to the Canadian public by the enterprise of MR. BILLINGS, will obviously depend in a great measure on the judicious blending of elementary principles with information of a new and purely scientific character. In the number before us, the true object of the publication seems to have been well sustained. The general reader, anxious for information, yet ignorant of the technicalities of science, will find in its pages much to instruct, much to interest, and nothing to rebut. As an example, a description of a new encrinite from the Trenton limestone, is preceeded by a brief but clear exposition, aided by illustrative woodcuts, of the structural characters and organization of the crinoids generally; and this is again preceded by a sketch of the Trenton limestone itself, together with a popular account of the various rock formations throughout the province. Other articles comprise a view of the classification of the animal kingdom according to the system of AGASSIZ, with explanatory remarks; detailed descriptions, with woodcuts and a lithographed plate, of many of the more common of our Canadian fossils; and some exceedingly interesting papers on the natural history and habits of the Moose Deer, the Barren-ground, and the Woodland Carribou.

The new crinoid, referred to above, belongs to the genus *Glyptocrinus*, and is named *G. ramulosus* by the author.* It was obtained from Brigham's Lake, Township of Hull, County Ottawa. The following is MR. BILLING's description—accompanied, however, in the original by several engravings :—

" *Glyptocrinns ramulosus* ;—The body or cup of this species is covered with smooth plates, and broadly rounded or obscurely pentagonal at the bottom. The height is about equal to the diameter at the free rays. Five strong rounded ridges or keels proceed from the base up the sides, following the centre of the rays. Upon the third plate from the centre of each ray, the ridge divides into two branches, which proceed up the secondary rays to the base of the free arms.

*Mr. Billings points out in another place the resemblance of this species to Prof. Hall's *Schizocrinus nodosus*. The two have certainly much in common. The cross ridges on the plates, that salient character in *Glyptocrinus*, are here wanting.

There are four plates in each of the secondary rays. The pelvic plates are small and barely visible, being in part concealed beneath the basal plates of the rays. They have a projection at their bases which forms a ring all round under the base of the cup. In some of the specimens this ring is sharp, and overhangs, as it were, the top of the column. In other specimens it is thicker and rounded.

The free rays or arms are, at first, twenty; two springing from the top of each secondary ray. At the height of about three-fourths of an inch, they again divide, a few of them, however, (the precise number not ascertained) continuing single to their extremities. They are fringed on their inside with two rows of tentacula from two-eighths to five-eighths of an inch in length. The arms are composed of two series of ossicula which interlock with each other. [A drawing is given, shewing the wedge-shaped form of the ossicula and their mode of interlocking, much as in *Dimerocrinus*, *Eucalyptocrinus*, &c., only to a greater depth.] On the back of one of the arms, at its base, eight joints were counted in the length of one-eighth of an inch, but higher up they are more numerous. It has not yet been ascertained with certainty whether the tentacula were jointed or not. Each appears to have four or five joints.

The column is round and annulated, the projecting rings being very close to each other, and most of them thin and sharp at the base of the cup and for a short distance below. They are further apart and their edges are thicker and rounded, or slightly notched, in the remainder of the column. Between the annulations, the column is composed of thin plates with crenulated edges, the angles fitting into each other. There are from five to ten of these thin plates between each two of the projecting rings. When the number is thus large, one of them in the centre increases in thickness, and forms a new annulation. The edges of the rings are bent very slightly downwards, and each alternate one (in all the specimens examined) in the lower part of the column is notched on the inner side. [Figures are given of these various peculiarities.] The columns are much larger at the top than at the bottom. One specimen tapers from one-fourth of an inch at the base of the cup, to one-eighth at the distance of fifteen inches below. Others become more rapidly small, while some of them are more gradual in their decrease.

The form of the alimentary canal varies a great deal in different parts of the same column, being in general more or less star-shaped with five rays, but sometimes circular. The separate thicker joints are usually seen in the shape of a flattened ring with the outside margin thick and rounded, but thinned down to a sharp edge around the perforation in the centre.

We think this species grew to a great size; there are columns in the Trenton Limestone on the Ottawa river more than half an inch in diameter at the upper or larger extremity, and which when perfect appear to have been six feet in length. Their form is the same as in this species, except that the annulations are not notched at the edges. The plates of the cup are smooth—the rays are keeled—there are four plates in each of the secondary rays—the arms are branched, and composed of very numerous thin and flat joints. We think these are full grown specimens of *G. ramulosus*."

The January number of the Canadian Journal contained a list of some Lower Silurian fossils obtained from the strata laid bare by the esplanade works in Toronto. The reader will find several of these forms (*Modiolopsis modiolaris*, *Ambonychia radiata*, *Murchisonia gracilis*, *&c.*,) figured and described in full in the publication now under review.

The following remarks explanatory of the general character of the work, are quoted from the introductory address :—

"The Magazine proposed to be established will be devoted exclusively to the Geology and Zoology of the British Provinces of North America ; and in conducting it I shall endeavor to make it as useful as possible to all who may feel interested in the subjects to which it will be confined. I shall collect and compile all the information concerning the fossils and animals of the country, within my reach, commencing with the larger quadrupeds and more characteristic and common organic remains, and thence gradually proceeding to those more rare or hitherto undescribed. The works consulted will be the best European and American authorities. In the present number, some of the matter in two of the articles, as will be observed, has been taken from the Reports of the Geological Survey of Canada ; but as I understand that these invaluable documents are about to be republished for general circulation, I shall confine myself to other sources and such discoveries as I have made myself. In fact this Journal will consist more of Natural History than of Geology in the restricted acceptation of the term. It is intended principally to be of assistance to the youth of Canada, but as it will contain many new species, and even several new and very remarkable genera of extinct animals, I hope that scientific men will also regard it as favorably as they can. In conclusion, I would respectfully solicit the public men of the Province, and others who can do so without inconvenience to themselves, if they think the work worthy of encouragement, to aid it by subscribing for it, and also by using their influence in its favor."

Altogether we recommend this new periodical most strongly to the attention of our members, and to all, indeed, who look with interest on the progress of Canadian Science.

E. J. C.

"*On the course of Collegiate Education, adapted to the circumstances of British America. The Inaugural Discourse of the Principal of McGill College, Montreal.*" By J. W. Dawson, F. G. S. Montreal: H. Ramsay. 1855.

"*The Progress of Educational Development: a discourse delivered before the Literary Societies of the University of Michigan.*" By Henry P. Tappan, D. D., LL. D., Chancellor of the University. Ann Arbor: E. B. Pond. 1855.

"*On the advancement of learning in Scotland: a letter to the Patrons of the University of Edinburgh.*" By John Stuart Blackie, M. A., Professor of Greek Literature, Edinburgh University. Edinburgh: Sutherland & Knox. 1855.

No subject merits, or perhaps receives at this present moment, a more widely extended and anxious consideration in Canada than the great question of Education. In many forms and under divers aspects it meets us on all hands. The Separate Schools difficulties, the Medical Schools difficulties, the denominational and general Colleges difficulties, and the University Reform difficulties of every sort, abundantly suffice to prove that the subject is being weighed, and measured, and discussed in all its bearings. For we are a free people claiming and exercising the right of private judgment in this British Canada of ours, and have no paternal Frederick William of Prussia to drill us into an educational uniformity and save us the trouble of thinking. In this respect we are only following the example of the Mother Country. University Reform, a National system of Education, Industrial and Ragged Schools, with Schools of design, people's Colleges, and Museums of Economic Art and Science, engage scarcely less attention at home, even than the engrossing theme of Eastern War.

The learned discourse of the Chancellor of Michigan University, the title of which we have copied above, traces the rise and progress of the European Collegiate system from its first germs. Indeed, with that comprehensive cast of thought which American orators are prone to favour, he goes back a little farther, and begins his investigation with that primitive Collegiate Institution: "The Garden of Eden!" This which he classes in the first of the "three stages of learned association: The primal or ancient," was followed by the "middle, or ecclesiastical and scholastic," with which we have a little more to do. The one essential element of difference between that medieval, and our modern era, in relation to our educational Institutions, may indeed be embodied in that word "ecclesiastical."

"The arts," says Dr. Tappan, "comprised the Trivium and Quadrivium, which included together seven branches—Grammar, Logic, Rhetoric, Music, Arithmetic, Geometry, and Astronomy. Philosophy was divided into three branches, and thence called the three philosophies, namely, Theology, Law, and Medicine. A particular university, however, cultivated frequently in an especial degree, only one of these philosophies.

According to the statutes of Oxford, ratified by Archbishop Laud, there were four faculties in which the University furnished education and granted degrees—Arts, Theology, Civil Law, and Medicine.

Four years attendance on the lectures of the first faculty was required to qualify for the degree of Bachelor of Arts; and seven years for the degree of Master of Arts.

To commence the course in the faculty of Theology, a mastership in Arts was a pre-requisite. Seven years attendance on the lectures qualified for the degree of Bachelor of Divinity, and four more years for the degree of Doctor. In the faculty of Civil Law, a mastership in Arts was not a pre-requisite; but the Master obtained the Bachelor's degree in Law in three years, and the Doctor's in seven; while the simple student was required to attend five years for the first, and ten for the second.

In Medicine, a mastership in Arts was a pre-requisite; and three years attendance on the lectures qualified for a Bachelor's degree in Medicine, and seven for a Doctor's.

Degrees were also granted in particular branches, as in Logic and Rhetoric. In Music, a separate degree is given even at the present day.

The branches embraced by the Arts were multiplied as knowledge advanced. Hence, in the time of Laud, Greek, Natural Philosophy, Metaphysics, Moral Philosophy, History, and Hebrew, are specified, in addition to the seven arts before mentioned."

We have further to bear in remembrance, however, that in all times anterior to the reformation, Arts, Civil Law, and Medicine, were practically as ecclesiastical as theology. Roger Bacon wrote his *Opus Majus* under a Franciscan's cowl, and when Sir Thomas More, received from Wolsey the great seal which constituted him Lord Chancellor, he was the first layman who had filled that highest legal office for upwards of a century and a half. Learning, therefore, in medieval times, however profound it might be in certain special aspects, as in the metaphysics and dialectics of the Schoolmen, was extremely simple in the compass of its themes, and readily adapted itself to the wants of the special and well-defined class, who alone courted its honors and advantages. But the great religious revolution which closed that medieval era put an end to this convenient classification, which had rendered the term *clericus* equivalent alike to its modern form of clerk, or ecclesiastic, and that of Scholar,—by no means necessarily the modern equivalent of the other. Our modern lawyer, if he be not a proctor, confining himself to wills, divorces, or clerical scandals and heresies, is as little of a monk as our modern doctor of medicine: who when he meddles with heresies, does so rather in the *san-benito*, than in the Cowl of the Franciscan. And as for our modern Philosophers, Chemists, Civil Engineers, Geologists, Astronomers, Naturalists, and Litterateurs of all sorts: the old *Trivium* and *Qadrivium* of medieval Universities would have shut them out altogether from the mystic perfections which their seven arts symbolised. Hence, without condemning ancient university systems we can have no difficulty in arriving at the conclusion that a very different system is demanded for these modern days of ours. On this subject the new principal of McGill College remarks:

"It is a great and common error to suppose that collegiate education has reached a point where it may safely remain stationary,—that its course has been unalterably fixed by authority and precedent. It is an equally serious and prevalent error, to take it for granted that it has attained its full extent of development when its benefits are confined to a few professional men, or persons of wealth and leisure. Such views cannot in the present state of the world lead to the highest prosperity of collegiate institutions, nor cause their humanising and elevating influences to be extensively felt on the mass of society. Happily in our day wider views are becoming prevalent, and no subject has been more extensively agitated in educational circles than University Reform. This reforming spirit has not only stamped its impress on all the newer colleges, but has made a powerful impression on the oldest universities on both sides of the Atlantic: and its tendency is to make the carefully elaborated learning of all the great academic centres become more fully than it has yet been, the principal moving power in the progress of practical science, of useful art, and of popular education. As illustrations I need only refer to the reforms now in progress in the great English Universities, to the recent establishment of a Technological Chair at Edinburgh, to the Scientific Schools of Harvard and Yale, to the special courses of practical science in the new London Colleges, and in the Queen's Colleges of Ireland, and to the similar improvements in Brown University, in Amherst College, and in the University of Toronto."

On this subject, however, there can be no need to generalise or enlarge. We are not sure that the danger does not, in part at least, lie rather in this reforming direction. The Chancellor of Michigan, and most other American university reformers, are abundant in their denunciation of English Universities, not always aparently with the very best knowledge of what they are holding up to condemnation. Witness, for example, the following comparison by Dr. Tappan between the English University system and the German or Prussian one,—which is greatly more the subject of American praise than of imitation:

"Compare now the state of popular education in England with that in Germany. In England the university system has not reached a proper development. Here the teachers are only the fellows—an elect and exclusive class, while the graduates at large instead of feeling the obligation of becoming teachers in time, and finding a field open for the exercise of their vocation, go out into the world as men who are possessed of a privilege which belongs to rank and fortune. And hence, no system of popular education has, as yet, made its appearance here.

In Germany on the contrary, where the gymnasium is open to the poor as freely as to the rich, where all who honorably pass through the gymnasium cannot fail of finding access to the university, and where every educated man becoming a member of the great educational system, incurs the obligation as well as meets the demand to contribute by his labours as a teacher to its sustentation—there we find a most perfect system of popular education. As everything in education depends upon a proper supply of teachers, so there the primary or common school is provided for in a distinct institution—the Seminary or Normal School; while this again is supplied with instructors from the university and gymnasium."

It would be difficult, we think, to point out a more egregious misstatement of all that pertains, for good or evil, to the English Universities than is here set forth. If there is one thing for which the English Universities are more remarkable than all else, it is in the strong inducements they hold out to the most distinguished and worthy of their graduates to become teachers; and what is the difference between the "elect and exclusive class" of fellows, and the graduates at large, but solely this, that the former have proved their preeminence in the examinations by which the Scholarship of all has been tested, and have achieved a *rank* dependent, not on fortune, but on learning. With more justice, because with better knowledge, another American writer, Charles Astor Bristed, thus writes, in reference to Cambridge, where he studied, and graduated.

"The private tutor at an English University corresponds in many respects with the *Professor* at a German. The German Professor is not necessarily attached to any specific chair; he receives no fixed stipend, and has not public lecture rooms; he teaches at his own house, and the number of his pupils depends on his reputation. The Cambridge private tutor is also a graduate who takes pupils at his rooms in numbers proportionate to his reputation and ability. And although, while the German professor is regularily licensed as such by his University, and the existence of the private tutor *as such* is not even officially recognised by his, still this difference is more apparent than real; for the English University has *virtually* licensed the tutor to instruct in a particular branch by the standing she has given him in the examinations." We are apt indeed to deceive ourselves with names instead of things.* The German *Bursch*

* The confusion in the minds of those unfamiliar with the English University system, arises from the fact that the term Professor is there reserved exclusively for the special class of lecturers, not attached to any of the Colleges, but on

has a tutor whom he terms his *privat docent*, while his Professor often closely corresponds to the Scottish "Extra-academical lecturer." The Cambridge man, calling to his aid a private tutor terms him a *coach*, whilst the Edinburgh student styles his equivalent a *grinder:* both sufficiently expressive tropical terms. The one takes up his laggard pupil and *coaches* him on to the most advanced rank attainable by him ; The other *grinds* the dull novice up to the requisite degree of sharpness and polish, while the real amount of coaching or grinding demanded for the entrant, be it remembered, depends alike at Berlin, Cambridge, Edinburgh, or Toronto, on the standard which each University fixes as the indispensable requisite for its honors and rewards.*

As to the English Universities, their one radical defect as national institutions notoriously lies in this, that the change of opinions in a large portion of the community has degraded them from universal, and national, to merely denominational Schools of learning, a subject no longer overlooked in the reforms now in progress. But no institutions in the world turn out a greater number of highly qualified teachers on the subjects specially cultivated by them. Apart from the tutors, public and private, numbering hundreds, within the circuit of the two Universities, Oxford and Cambridge provide professors and teachers, in their own special departments of classics and mathematics, to the great majority of the public schools of England and the Colonies. The colleges of London, Manchester, Birmingham, and Durham, all the great public schools, and even mathematical and classical

---

the University foundation. The majority of these professorships are honorary appointments; the emoluments are trifling; and when, as in the case of Dr. Arnold, when filling the Oxford Chair of modern History, the duties are fulfilled, they consist of a brief course, in his case of only eight lectures, or in that of Sir James Stephen, the Cambridge modern history professor, of twelve lectures, on subjects quite apart from the regular course of studies taught by the College Professors or Tutors. The discrepancies between the two American writers quoted above are amusingly significant even in trifles. "Instead of the old names of Freshman and Sophomore, *borrowed from the English Colleges*, we will take" &c., writes Dr. Tappan, (p.40) while Mr. Bristed at the commencement of his Cambridge experience, notes that "there are no such beings as *Sophomores* at an English University," (p.18.) and at a later date, when familiar with Germany as well as England, he speaks of "the barbarous term of *Sophomore*, a name to which it is hardly necessary to say there is nothing answering in the Colleges of any other country, [but America.]" (p.437.)

* Bristed, thus writes of his Cambridge Tutor: "Travis certainly put more into me in seven months than I could have acquired by my own unassisted labors in two years."

chairs of the Scottish Universities, are supplied from the ancient seats of learning on the Cam and the Isis. The English college tutor again is precisely what we term in Canadian or American Institutions a professor ; his functions in no degree differ, and the more our Canadian professor imitates the thoroughness of the English college tutor in his mode of instruction, the better will it be for the future scholarship of the province.

We have heard much talk in America of the "Prussian system" and read much more in "Commencement Day" and other college orations, of its adaptability to American Institutions, and the great advantages already flowing from its adoption. Yet what is the fact? Amid all their differences, the University systems of England and Germany, agree in the thoroughness and substantiality of their training in so far as the subjects taught are common to both. The difference in the result lies in the character of the national mind. Germany has produced her Niebuhr, Boeckh, and Muller, but has not England also her Arnold, Thirwall, and Grote, whose synthetical cast of intellect is no less the admiration of Germany than of England. As to America's Colleges and Universities, the number in all, according to the last American Almanac, is one hundred and twenty-two ; and the greatest immediate blessing that could possibly befal them, would be the adoption, not in name but in reality, of the Prussian system, or any other system with a uniformity of plan and centralising control. As it is, an American College degree may mean anything, every thing, or nothing. A student may graduate as M. A. at one College, with acquirements that would not enable him to matriculate at another. And yet this is not because of any extravagant exceptional standard at the latter. Mr. Bristed, to whom we have already referred, thus describes his first American experiences as a student: "I was fifteen years old when I went to New Haven to enter the Freshman class, at Yale College. In the School where I prepared, one of the masters was an Englishman, and the instruction given partly on the English model. I had been fitted for Columbia College, *the standard for the Freshman class in which institution was then nearly equal to that for the Sophomore at Yale.* The start which I had thus obtained confirmed me in the habits of idleness to which a boy just emancipated from school is prone, when he has nothing immediately before him to excite his ambition. During the first year I did little but read novels and attend debating societies ; and the comparison of my experience with that of others leads me to conclude that this is the case with most boys who enter well prepared at a New England College ; they go backwards rather than forwards the first year."* At Yale Mr. Bristed carried off three out of the four classical prizes of his four years' course; graduated; devoted still another year at New Haven to College study; and then, dissatisfied with his acquirements, and wishing "to make himself a scholar," he resolved to spend some time at a European University. By chance Cambridge, in old England, became his foreign Alma Mater, and there the Yale graduate found he had the whole process to go over again; won, only with hard labor, and with a corresponding pride, a foundation Scholarship in Trinity College; and at length after five years of study there, learned to look with a philosophic sense of justice on his own coming out in the Tripos, only "second in the second class." On this subject he concludes by saying that "to take, at Cambridge, even a good Second in Classics, one must, as a general rule, have read a large quantity, and be able to display a considerable knowledge of the Ancient languages. No one knows how hard a first class is to obtain, unless he has either just got it, or just missed it."†. And this native American, returning to his own country, and writing for behalf of his countrymen, says: "were I to be questioned by an educated foreigner, an Englishman or Frenchman, German, Hollander, or Dane, upon the standard of Scholarship in our Colleges and Univerisities, I should be obliged to answer, not having the fear of King Public before my eyes, that it was exceedingly low, and that not merely according to his idea, but according to the idea of a boy fitted at a good school in New York. When I went up to Yale College in 1835, the very first thing that struck me was the classical deficiency of the greater part of the Students and some of the instructors. Yale is the largest College in our country, and one of the two most distinguished. The result of my inquiries has not led me to believe that Harvard is any better off. That the other Colleges throughout the country, many of which derive their instructors from these two New England Colleges, are if anything in at worse state, may be easily inferred."‡

Columbia College, N. Y., as we have already seen, is excepted, to some extent from this sweeping censure; and indeed the State of New York is the only one which has had the courage to attempt centralization. All its Colleges are now embraced by a central organization, consisting of a Board of Regents,§ or Senate, presided over by a

* Five years in an English University, p. 6.

† Ibid., p. 283.

‡ Ibid., p. p. 374, 377.

§ The term is by no means an American novelty, but pertains to the nomenclature of the ancient European Universities, and we should be glad to see it adopted

Chancellor, and constituting the University of the State of New York. Dr. Tappan remarks of it: "The control which this board exercises, is very slight, and the several Colleges appear to enjoy equal independence with the Colleges of other States." It is an organisation, nevertheless, capable of effecting the greatest benefit, and only requires to extend its control a little further, to make a high and uniform standard of Scholarship supersede, throughout that important State, the reckless and lawless system of diplomaed mediocrity, which has sufficed to bring the degrees of American Colleges into merited contempt.

Such a system of comprehensive and efficient centralization the Chancellor of Michigan University proposes and boldly advocates for his State, adding to his scheme the indispensable element of effective union under one system of all educational machinery, from the humblest common School to the central University, the fountain of scientific and literary rank. "A University" says Dr. Tappan, "can have no branches, unless we so designate its faculties. A University is a compact association of learned men, incorporated and existing in one place. To distribute it into branches planted in different places would prove as incompatible with its offices as to scatter abroad a Legislative Assembly, and would in fact destroy it." In this perfectly true remark, however, the Chancellor we suspect says more than he means, confounding the functions of College and University. He next refers to the attempt to create an efficient system of Grammar Schools, or "Gymnasia essential to a well ordered system of education, and without which Universities cannot reach their full proportions and efficiency." Following up this idea he thus proceeds:

"It was unfortunate that the plan could not have been properly digested and carried out. To place them [the schools] upon the university fund was suicidal of the whole undertaking; for they only diminished a nutriment which can never be sufficient for both, without deriving an adequate supply for their own existence.

The Union schools which have since arisen are but another expression of the same idea—the idea of taking pupils who have received the first rudiments of learning at the primary school, and inducting them into a system of regular training, based on the constitution of the human mind, and the natural order of the growth and unfolding of its faculties; and on the nature of different studies as ministering to this growth, and forming a philosophical discipline of the faculties graduated to this order; so that, from childhood to adolescence, and from adolescence to budding manhood, the mind shall be led along genially and cheerfully, to any point of education less than the full course, or by completing the course, to a preparation for the university. This is the true gymnastic course

---

in Canada, in the hope that it might help to some understanding of the difference between a University and a College, which at present would seem to be nearly unattainable.

—the course which Michigan has been aiming at in her intermediate schools, and which it may be her high destiny finally to mature and bring into full operation. Whatever these schools may cost, the State has no higher interest than their perfect constitution and development. They will afford the possibility of education as widely and freely as the common schools, but it will be the possibility of a higher education, consistently and harmoniously ordered. Now, a vast amount of time is lost in childhood and youth for the want of early opportunities of educational training; and young men who propose to enter the higher institutions of learning, have either to suffer the loss of knowledge which ought to have been acquired long before, or are compelled by spasmodic efforts, often ruinous to the health, and injurious to the mind itself, to make up, and that in an imperfect manner, the deficiencies of early life. Conceive of a gymnasium open to you from childhood. At twelve years of age you have acquired French, have overcome the difficulties of the Latin, and begin to feel the charms of its literature, and are grounded in arithmetic, geography, drawing, and music. At fifteen you are reading Greek and German with pleasure, and have acquired the elements of mathematics, and a general knowledge of history: And at eighteen or nineteen—instead of beginning to prepare for college, as many now do, tortured by the Latin and Greek grammars, and in the haste inspired by the consciousness that you are almost men—you find yourselves in the easy and almost natural command of languages and the principles of science, with the habits of a scholar thoroughly matured, and the art of study mastered, and ready to step into the university as an inviting field of knowledge, where everything is prepared to your hand, and where you feel prepared to put your hand to every thing, with the skill of one who, having thoroughly learned his trade, is never embarrassed in handling his tools.

Ye who know by hard experience the want of all this, sympathize with those who are to come after you, and in the true spirit of literary association, determine unitedly to labour for the elevation and perfection of the institutions of your country!

The proper constitution of these schools, by whatever name they are designated, will require great wisdom, great care, great energy, and a supply of teachers who know how to do their work.

Where shall we find these teachers? The Normal schools cannot supply them, for they are designed to supply teachers for the primary schools—a great and important work, embracing what we have called the logical basis of the whole system of public instruction. Or they can supply them only to a limited extent, and in the more juvenile classes. The University alone can supply teachers for the gymnastic schools. In Germany you will find university educated men giving instruction in arithmetic and geography; masters of their subjects, they instruct without text-books, and fill their class-rooms with the vivacity and charm of oral communication, and keep the interest of their pupils alive by the necessity of prompt answers to unexpected questions.

And here rises up to view, again, the great principle I have expounded and illustrated throughout this discourse, that in the historical order of development the highest institutions come first. *Without a perfected University, we can never have a perfected system of public education, even in the lowest degrees;* and as it has been, so must it ever be, that popular education must flow out of the higher institutions, as the showers that water the valleys and plains fall from clouds which were gathered on the mountains.

The university, the gymnasium, the Normal schools, the primary schools, once started into existence, must move on together. Each is necessary to the whole, and the prosperity of each contributes to the prosperity of the whole. Nothing but sheer sciolism or utter ignorance can conceive of any opposition between them; and none but an empiric in education, or a traitor to its cause, can aim to aid one by the sacrifice of any of the others."

This organization of the entire scheme of education for the Province, from its lowest primary or infant school, to its finishing Colleges and University, into one coherent and mutually dependent system, is not only what we want, but what seems indispensable for Canada. Nor are we without our own ideas as to how it might and should be accomplished; but we dread the intrusion of polemics into the pages of the *Canadian Journal*, the organ of an Institute which, we trust, will ever offer an arena wherein educated men of every opinion and party can meet on common ground. But this accomplished, by whatever means; and that other scarcely less important requisite: a uniform standard of University degrees, having been secured throughout the Province; the next step must be to render it an indispensable qualification for the mastership of every Grammar School, that its holder has taken his B.A. degree. By and by,—and the sooner the better,—this demand must be extended to the Common School Teachers also; and this done, and their salaries proportionably raised, so as to render the appointments worth a man of education looking forward to as objects of professional ambition, then we shall be ready to borrow a most important principle from Prussia, viz :—to make the appointments to the mastership of the Provincial Grammar and Common Schools the prizes of the most successful candidates for University honors. This is the new principle recently introduced with the very best results into various departments of public life,—not in the United States, but at home—and especially into the civil appointments of the East India Company's service; thereby substituting for the unwholesome and mischievous influences of political patronage and personal favor, the impartial test of intellectual attainments. Thus the Common Schools would be made to depend on the Grammar Schools, the Grammar Schools on the Colleges, and the Colleges on the University. We have said nothing about the Normal School, but it is not because we undervalue the influence of that admirable Institution. The function of the Normal School is to teach men *to teach*; and such a coherent system must doubtless raise its standard also; but we should just as certainly demand of the B. A., candidate for a Common School teachership the production of his first class certificate from the Council of Public

Instruction, as we should require of him his diploma of M. D., if he were candidate for a medical appointment.

And here, we touch on one of the great errors lying at the foundation of all the schemes of root and branch University reform, set forth by educational theorists. We affirm unhesitatingly that it is not the primary function of a College to provide a professional education; and this is especially true of the Faculty of Arts. American Educationists acting on a different theory are devising new courses, titles and degrees; Masters (and Mistresses too) of Science;—preceded, no doubt by Bachelor, and Spinster of Science*;—Masters of the Science of Engineering; of the Science of Agriculture; nay even of the Science of Penmanship, and the Science of Accounts! accompanied with *graduation* in Commercial Computations, Business Customs, Ornamental Penmanship, and Commercial Ethics!! Our idea is that the College course for a B. A., degree must comprehend these, in so far as they do not purely relate to special professional details, just as much as it has always been our idea that Commercial Ethics is necessarily comprehended in the Christian Ethics which are, or should be, taught every Sunday from the pulpit.

A Chair of Civil Engineering was proposed in the scheme originally shaped out for the changes effected on Toronto University; and surely in this country few Chairs could have been more useful. But men could not realize the conception of such a professorship apart from the professional routine of the Architect's and Engineer's office, and the comfortable pupils' fees; and hence we believe it was still-born. How the Chair of Agriculture escaped the same fate may well be wondered. But so long as this practical chair stands alone its position must be precarious. To complete its efficiency, a Veterinary

* "We are multiplying our Bachelors and Masters on all sides . .The fond idolators of old deified beauty and wisdom under different forms; but we will deify all our beauty under the form of wisdom, and we will place our new Goddess in our new Parthenon under the august title of *Mistress* of Arts!" Dr. Tappan's Discourse, p. 49. On the same subject a correspondent of the New York *Tribune*, writing from Ann Arbor, the seat of Michigan University, last April observes:—"The last term of the University for the year 1854-5, commences to-day. The Regents have been notified that application will be made either at this or the following term, by several females for admission into the University, and a full and equal participation in all its privileges. You will not fail to observe and to be interested in the debate on this very point in the State Teachers' Association and the position taken by Prof. Haven, and indeed all the other prominent educators in the State. The thing is a fixed fact. Females are to have, as they ought, equal advantages in this respect with men. The only question left is: Shall they have a separate institution, or go to the University? The Teachers all say the *latter*."

Chair seems indispensable, and when the Agriculturists are ready to avail themselves of it, the Professors both of Chemistry and Natural History, and perhaps also of Mineralogy and Geology, could supplement their studies with much that is useful, without at all interfering with the strictly professional education, to be learned in the field; just as the medical student must acquire his practical knowledge, not in the lecture room, but in the hospital wards and the dispensary practice. The following discriminating distinctions of the shrewd Scottish Professor of Greek, John Stuart Blackie, whose letter "on the advancement of learning in Scotland," we have named above, are well worth noticing here:

"What do we understand by learning? The word is vague; and some irrelevant criticisms and pert objections may be anticipated by defining the term distinctly in the outset. A farmer who tills his ground skilfully, and, by the blessing of God and favour of the elements, stores a large crop of life sustaining fruit in his garners, is not a learned man: he is a man of skill, industry, and experience. The same farmer, if, in addition to the careful and skilful cultivation of the soil, according to the received customs of the agricultural profession, he occupies himself with experimenting in various ways so as to produce important agricultural results by the application of new chemical or other scientific principles, may be called a scientific farmer; or, if you please, an intellectual or a speculative farmer; but no man would think of calling him a learned farmer. Let him, however, in addition to the scientific accomplishments which we have just supposed, be found at his leisure hours, with the help of dictionary and commentary, spelling his way through the Georgics of Virgil, the authors *De Re Rustica* of the Romans, and the geoponic writers of the Greeks, we should then have no hesitation in saluting him as a *geoponus eruditissimus*, a learned agriculturist and a wonder of the country-side. In the same way, any man who can make a neat incision into your blood-vessels without mistaking an artery for a vein, may be called a skilful phlebotomist, and if he does so in difficult cases, and in the most approved way, he may be called a scientific phlebotomist. But the man who not only can finger a lancet, but will explain to you the whole theory and history of blood-letting, from the precepts of earliest Egyptian drugmen in pre-Homeric times, to the diaetetic protests of Erasistratus of Ceos in the third century before Christ, and the heroic practice of a stout Broussais and Gregory, of the most recent memory; such a man who, to great practical skill and dexterity, adds extensive knowledge of the past, well arranged and digested by the organic power of ideas, you would call both a learned and a philosophic phlebotomist; you would be justified in making such a man a professor of phlebotomy."

And this might tempt us into the vexed question of Canadian Medical Education, of which it is sufficient to say that every single member of the community is so *vitally* interested in the subject that it may surely be left to the common sense of the public at large to put an end to the present state of things, which no man we ever met with pretends to defend. Medicine is the one professional education in which every member of the community has an interest, and if it be desirable that the degree of M. A., should have a definite and uniform meaning throughout the Province, it is surely no less indispensable that that of M. D. should be held by no one but a thoroughly educated and trained practitioner of the healing art. But is it reasonable to expect that any required number of such learned and philosophical phlebotomists as the Scottish Professor pictures above, should turn up by chance, and at a moment's notice, among the medical practitioners of a new country like Canada, to say nothing of a city of some forty thousand inhabitants. Edinburgh, with a population of four times the number, has filled up two Chairs in her University recently. She might have been supposed to have choice enough among her own world-famous staff. Yet the one was given to Dr. Laycock, of York, the other to Dr. Allman, of Trinity College, Dublin; and it is by getting the ablest men, irrespective alike of local interests and professional jealousies, that she has become what she is. When, however, she shall get as far ahead as our Metropolitan Toronto has done, and shall find herself with not one, but three Universities competing with each other for the granting of medical diplomas, then—it may be presumed she will make our medical schools her models in all other respects.

We have spoken of the thoroughness of the education at Cambridge, in the subjects taught and encouraged at that University. That a too limited and exclusive devotion to one or two objects of study has been engrossingly fostered at the English Universities we readily admit; but even in this respect the evil is more apparent than real, and a little, well and thoroughly learned, is worth all the popular, superficial doses of crude science and learning which figure so grandly under every variety of superlative nomenclature in the prospectuses of American Educational Institutions. Mr. Bristed, after having taken his B. A., degree with honors, at Cambridge, remarks: "I had more opportunities of observing what had often struck me before, —the development which takes place in an Englishman's mind after the age of twenty-two, when he recovers in two or three years all the ground which he *appeared* to have lost as compared with an American, Scotch, or Continental student, and gains a great deal more. The Cambridge student acquires manly habits of thinking and reading. He becomes fond of hard mental work, and has a healthy taste in his mental relaxations. The trash of the circulating library he despises as he would sugar candy. No works of fiction but the very best, and those rarely, are to be found in his room. Such a taste is indeed late in forming; but the habit of mind once started, he goes on drawing in knowledge from all quarters at a vast rate, and whatever he does take into his well prepared mind assimilates itself with matter already there, and fertilizes the whole, and fructifies; nothing of what he reads is thrown away." To such a man of ripe mind and studious habits, the acquisition of a modern language such as the French or Italian is a mere pastime, and the German only a pleasant task. What would he say to the substitution of them by our University reformers as equivalents for the Greek and Latin,—the sole keys to all the treasuries of Theology, Philosophy, and Science!

Having thus discussed, however cursorily, the direct aim and purpose of Universities and Colleges as means for the encouragement of LEARNING, we are now free to admit of a secondary purpose which they may answer, especially in a new country like Canada. Professor Blackie denounces, with not less vigorous eloquence than truth, the neglect of classical learning in Scotland; nevertheless, Scotland owes not a little of the energy and intellectual vigour of her people to the very looseness of her University system, which threw open the halls of her Colleges to hundreds who sought for knowledge, without dreaming of *learning*. With a like object in view, the scheme of the Toronto University College, provides for its unmatriculated students and encourages them to emulation and study by special and entirely distinct honors and rewards. The new Principal of McGill College thus announces the proposed popular department of that Institution:

"During the present winter it is intended to deliver a popular course, which will embrace the subjects of Natural History, Chemistry, Natural Philosophy, and Civil Engineering, a combination of interesting and important subjects which should attract large audiences.

These provisions, however, by no means exhaust the field of usefulness in this direction; and it is in contemplation, in the Session of next winter, to institute in connection with the Faculty of Arts certain special courses, bearing on some of the principal lines of industrial occupation, in the hope that in this way we may induce many young men who would otherwise receive none of the benefits of collegiate education to attend to certain selected classes. We propose then, to attempt the establishment of the following Special Courses, each to extend over two years, and to entitle the student, on examination, to a certificate or diploma

1. A course of Civil Engineering. This will embrace English Literature, Mathematics, Natural Philosophy, Chemistry, Geology and Mineralogy, Surveying, and Civil Engineering, including the construction of machinery. Such a course will be exceedingly serviceable, not only to all young men about to enter on the profession of Civil Engineering, but to many others more or less closely connected with the public works or manufactures of the Province.

2. We also hope to commence a course of Commercial Education, including English Literature, History and Physical Geography, Mathematics, Chemistry, Natural Philosophy, Natural History, Modern Languages, Commercial Law, and, if suitable arrangements can be made, Lectures on Political Economy.

3. A farther extension of our Courses of Study may be effected in the direction of Agriculture. Throughout the Colonies attention is now being directed to those scientific principles of farming which have effected such wonders in Great Britain, and the introduction of which is imperatively demanded in all the older and more worn out districts of this country. I have no doubt that there are within reach of Montreal a number of enquiring and intelligent young farmers, who would gladly avail themselves of such a course during the winter months. It would include the following subjects:—English Literature, Natural History, Natural Philosophy, Surveying, Agriculture, Chemistry, Practical Agriculture and Management of Farm Animals.

These special courses will, I believe, rather build up than detract from our general under-graduate course, while they will certainly extend our usefulness, and give us increased claims on the support of the community; and thus tend ultimately to increase the demand for collegiate instruction, while in the meantime they will give an important impulse to practical science and the arts of industry."

Much of this is unquestionably suited to the present wants of Canada, if it be really teaching that is intended, and not mere attendance on popular lectures. We attach more importance, however, to the scheme of "Options" now partially introduced into the system of Toronto University. By this, in the first half of the under-graduate course, the study of Classics and other branches essential to the educated man, whatever his future professional education may be, is rendered imperative; but in the remaining half of his course he is free to select according to his own intellectual predilictions or the special objects he has in view. The principle is admirable. The details of it want revision. The divorcement of Classics and Modern Languages specially strikes us as equally inconsistent in itself and arbitrarily opposed to the likely choice of a youth of a philological cast of mind. But the other divorcements are scarcely less arbitrary. The clause in the University programme thus refers to under-graduates of two years standing: "Students presenting themselves at this Examination are not required to take the *Greek and Latin Languages* and the *Modern Languages*, but either at their option. Neither are they required to take *Mathematics* and the *Natural Sciences*, but either at their option." The following we venture to suggest as at once a more natural and a more useful classification of options:—

I. Classics, Modern Langnages, and History; *or:*—

II. Mathematics, the Natural Sciences, and English Literature; *or:*—

III. Metaphysics and Ethics, Logic and Rhetoric, English Literature, Civil Polity, and History.

Such a choice, following on the substantial ground-work of the first two years' acquirements would admit of the student adapting his further studies to his future career in life, and taking his degree at the University with honors, while the knowledge of which it is the guarantee, is available for all the objects of his further aim and aspirations. It might be a question, indeed, whether a fourth class of options, including the Natural Sciences alone,* without Mathematics, but with correspondingly high requirements in the narrower field of study, might not be wise, with a special view to induce the student of Medicine to graduate in Arts, and thus lay a foundation calculated to fit his mind for appreciating the philosophy of the Science of Medicine, which, in the hands of so many of its half-educated practitioners degenerates into mere empiricism.

After all, however, be it remembered that a complete, efficient, and practical University system, accompanied by well organised Colleges and crowded lecture rooms, cannot be created in a new country like Canada in a day. The unfortunate University of Toronto, with all its wealthy endowments, has hitherto been treated as the Tahitians treated the first crop of wheat the Missionaries introduced among them. They *constantly pulled it up by the roots to see how it was thriving!* Somehow we are rather too prone to despond, and have inherited so much of John Bull's propensity to grumble that we are very difficult to inoculate with those sanguine anticipations of ripening triumph and glory, in which our neighbors indulge with such magnificent amplitude. The new President of McGill College concludes his Inaugural Discourse with the expression of a modest "hope that the utmost possible success and permanence may attend their united efforts in behalf of good learning." But the Inaugural Discourse of the Michigan Chancellor† winds up in a very different vein; which, considering that he is speaking of a *great State* not so old as some of Mr. Dawson's present under-graduates, may well put the Montreal President and the rest of us to the blush:

"Let me remind you that it is not in accordance with the spirit of our country to let improvements grow slowly. This great State is the growth of a quarter of a century. In our Industrial arts and improvements we are not willing to fall behind Europe according to the ratio of our respective ages. We aim not merely to equal, but even to surpass the old nations of the world, in our manu-

* Say: Chemistry, Botany, Natural History, and a choice of some such additional studies as Natural Philosophy in some of its branches most useful to the medical man, Geology and Mineralogy, with Palæontolgy and comparative Anatomy. The latter of these might be further encouraged as the special subjects for an honor degree in Medicine.

† A discourse delivered by Henry P. Tappan, D. D., at Ann Arbor, Mich., on the occasion of his inauguration as Chancellor of the University of Michigan, December 21st, 1852. PP. 51, 52.

factures, our steamboats, and our railroads. We level the forest in a day, lay down our tracks and startle the old world with the sound of our engines. Our steamers outspeed theirs across the ocean. Our yachts win the royal prize over the ancient ship builders in the sight of the Majesty of England. The Autocrat of Russia employs our engineers to make his railroads; and his steamers are built on our shores.

"Shall we be behind then only in the great matter of Education? Can we not build up Universities too? Shall we apply to the cultivation of Mind a principle of slow progression which we scorn to apply to anything else? Let it not be my countrymen—let it not be. Arouse thy energies young State of Michigan! Giant of the West! holding the great lakes in the hollow of thine hands; bearing on thy bosom, deep engraven, the memorial of thy glorious deeds; looking with eyes of light upon all thy brothers around thee, and inspiring them with thy majesty and beauty; speak out with thy strong and melodious voice the decree that here a new Athens shall arise with its schools of Philosophy and Art, and its Acropolis crowned with another Parthenon, more glorious that that of old, because illumined with the true light from heaven!"

The Parthenon of our Canadian Acropolis will not, we are satisfied, manifest any of this new-world speed. The work is all before us, and must be done, slowly, patiently, above all, thoroughly. It is easy for a time, to throw dust in the people's eyes with the help of grand names, magnificent talk of Prussian systems,—meant only to end in talk,—grandiloquent novelties of graduation titles; and the substitution of an *ad captandum* scientific nomenclature to such good old-fashioned school-boy acquisitions as writing and arithmetic: "*Sciences* of *Accounts* and *Commercial Computations!*" the "*semi-angular system of Penmanship*, both practical and ornamental!" &c., and—which is quite of a piece with this,—lists of Members of faculties eked out by the help of honorary lecturers and *Emeritus* Professors! Noah Webster bluntly explains to his countrymen that an Emeritus is one *honorably discharged from service.* We wonder what the Professor of Commercial Ethics would say to the retention of such on the list of Teachers! We would willingly hope that Canadians are not to be caught by such chaff. Nevertheless, the truth must not be disguised that Canada has yet to learn the just appreciation of a well organised system of education, extending beyond the ordinary requirements of common schooling. The very desire for learning, apart from its mere marketable value as the stepping stone to a profession, has to be created. And on this subject, the following just remarks of Professor Blackie, are not without their application to ourselves:

"To get rid of the uneasy sensation, and the shock to our self-esteem, caused by the honest presentation of these facts, I can easily imagine that some stout champion of things as they are, will come blurt out with the old question—*Well, if we are not a learned nation, what harm? If the Germans write moun-*

tains of erudite books, may we not ask, Cui bono? Is not sense better than learning: and can a man not see what is worth seeing in the world without the spectacles of books? Now, lest any person should be moved by vain talk of this kind, which is not altogether without wisdom, though somewhat of a worldly kind, I hope I have sufficiently taken care, to avoid leaving the impression that I set much value on mere learning. A man may attain wisdom and virtue without books and Universities—God be praised! Still learning performs an important part in the intellectual culture of any educated people; and it may be difficult to name a single point in which the civilized life differs more radically from the savage than in the possession and in the use of books. It is easy to laugh at the remote and unpractical character of the subjects on which many German professors write books; men of a strongly practical turn will always have their joke at the expense of those who indulge in curious, recondite, and apparently useless research; but books are as much the natural expression of a highly-trained intellect in this age, as ballads were in the age of Homer;—"By their fruits ye shall know them;"—and it remains a fact that every educated man who pens a paragraph for a newspaper, and every possessor of a pulpit who sends forth a pastoral address to his people, makes use of some part of the grand floating capital of knowledge with reference to the past, which is only the results of learned research put into a popular shape. Without learning, therefore, as an educated people, we cannot live; the only question is, whether we shall be content to take this learning at second-hand from the Germans and other learned nations, or whether it would not be more creditable, more safe, and in the long run, perhaps a shorter plan, to create that learning for ourselves at home, by Universities properly organized, and by professors supplied with proper opportunities and endowments, to make the advancement of a first-class academical learning the great object and the sole ambition of their lives."

But indeed we have to begin our work at a much lower stage than that of University organization. Much has indeed been done, and well done under the persevering zeal of Dr. Ryerson. But assuredly the standard of our Common Schools has to be elevated. Our Grammar Schools have to be made—what now they certainly are not—efficient feeders to our Colleges; and the status of our Schoolmasters must be raised. At present the scale of remuneration, and the social rank, awarded to this important class of functionaries, to whom is entrusted the intellectual and moral training of the rising generation, reflects little credit on the province. Setting aside one or two exceptional cases, the average pay of a Grammar School teacher is £175; that of a first class Common School teacher ranges from £80 to a £100; a second class teacher from £60 to £80, and a third class teacher from £45 to £60! Can it be expected that such salaries will engage the talent of the country in the all important work of education, when the highest are not more than a clerk in a store would demand; while, failing such prizes, so far as regards the remainder, a robust man may hope to make more by chopping wood? It ought not to be a matter of indifference to the people of this wealthy province that those to whom is committed the intellectual culture of their sons and daughters, are struggling with the sordid cares which pecuniary pressure involves, and degraded by a social humiliation which it is impossible to disguise; and until the Common Schools and Grammar Schools are doing their work effectively, and have been so doing for years, it is as vain to expect our Universities and Colleges to flourish, as for our farmers to look for their harvests before they have begun their clearing.

D. W.

SCIENTIFIC AND LITERARY NOTES.

GEOLOGY AND MINERALOGY.

THE GEOLOGICAL SURVEY OF CANADA.

The *London Gazette* of January 30th, dated from Buckingham Palace, announces the gratifying intelligence that Her Majesty has seen fit to confer the honor of Knighthood upon William Edmond Logan, Esq., Director of the Geological Survey of Canada; a well earned and justly merited tribute of honor, which will be confirmed by universal acclamation throughout British North America.

PRESERVATION OF ORGANIC REMAINS.

The causes which mainly influence the preservation of organic bodies in the fossil state, are the following:—

1. The habitat of the plant or animal.
2. The conditions prevailing at the spot to which its remains may be brought, or at which it meets its death.
3. The inherent power of these remains to resist mechanical disintegration.
4. Their powers of resistance to chemical decomposition.
5. The nature of the rock-matters in which they may be enclosed; and the after conditions to which these matters may be subjected.

With regard to the first condition, it is abundantly evident, that aquatic types are far more favorably circumstanced for preservation, than purely terrestrial forms; and littoral species, again, more so than pelagic tribes. But, allowing the body of the dead fish or floating cephalopod to be cast, uninjured, by winds and currents, on the shore; or the drowned mammal swept down to the river estuary; the co-operation of various conditions is required to ensure its preservation. Briefly—there may be no sediments under process of distribution at the spot; or the sediments may not be thrown down with sufficient rapidity to arrest decomposition; or the shore may be rocky and exposed, and mechanical destruction follow. Finally, if entombed forthwith, its calcareous parts may be readily dissolved to constitute a cementing material for the surrounding mass; or subsequent metamorphic agencies may obliterate all traces of its form.

The more an organised substance approaches inorganic matter in its composition, the greater, of course, will be its capability of resisting the usual process of decay.

In this light, the following Table, drawn up chiefly from the researches of M. Hugard, of the Geological Society of France, will be found to exhibit some interesting relations:

Approximate amounts of inorganic matter in animal bodies which occur more frequently in the fossil state:

Inorganic matter, 99 *or more per cent:*—Shells of Ostreæ and of some other acephalous mollusks.

Inorganic matter, 95 *to* 98 *per cent:*—Most corals; shells of most bivalves and gasteropods.

Inorganic matter, 90 *to* 95 *per cent:*—Shells of ordinary cephalopods.

Inorganic matter, 60 *to* 70 *per cent:*—Teeth of mammals, reptiles, and many fishes.

Inorganic matter, 50 *to* 66 *per cent:*—Bones of mammals, birds, and reptiles; scales of fishes; carapace, &c., of chelonians?; shells of crustaceans.

Inorganic matter, 40 *to* 50 *per cent:*—Elytra of certain insects (?).

Inorganic matter under 5 *or* 6 *per cent:*—Scales of reptiles; cartilage and hair of mammals; feathers of birds, &c.

A glance at this table will explain the cause, (as pointed out by M. D'Orbigny,*) of the rare occurrence of reptilian scales in the fossil state, whilst the scales of fishes are so abundant.—E. J. C.

PURPLE COPPER PYRITES.

Purple Copper Ore—the Buntkupfererz of the Germans; Erubescite: Dana—in pseudomorphs, after chalkopyrite, the common yellow pyrites, does not appear to have been hitherto recognised. Pseudomorphs of this kind occur, however, and seemingly in abundance, amongst the copper ores of Lake Huron. Their usual form is that of the ordinary dimetric tetrahedron, belonging to chalkopyrite. When broken across, a nucleus of this latter mineral is frequently seen within them. The purple ore may be readily distinguished from tarnished or variegated specimens of chalkopyrite, by its higher specific gravity. A portion of a crystal (G=4.77) contained 63.19 per cent. of copper; and two other specimens (in which, however, the copper was alone determined, and by a less satisfactory process,) shewed a still larger amount. In the first determination, the copper was separated from the iron by sulphuretted hydrogen, and weighed in the usual way as oxide. An analysis of 16.52 grs., thus furnished—sulphur, 3.97; copper, 10.44; iron, 1.96; or, in percentage values—sulphur, 24.03; copper, 63.19; iron, 11.86. The composition of purple copper is known to vary greatly, and its true formula is yet unsettled. Two formulæ have been proposed for it. The one adopted by Berzelius, $2Cu^2S+FeS$., requires S. 23.7, Cu. 62.5, Fe. 13 8. The other, assumed by Rammelsberg, $3Cu^2S+Fe^2S^3$, gives S. 28.1., Cu. 55.5., Fe. 16.4.; but in the analyses hitherto published, the copper is always in excess of 55.5, and generally over 60.† At the same time, it is difficult not to admit that a higher degree of sulphurization than R S must be present in the mineral. Rammelsberg attributes the excess in question to an admixture with copper glance, $Cu2S$: a compound which also occurs amongst the Lake Huron ores, and which is known furthermore to occur occasionally in other localities as a product of alteration from copper pyrites.—E. J. CHAPMAN.

* "Cours de Paléontologie et de Géologie Stratigraphiques."

† See the results of nineteen separate analyses in the 4th edition of Dana's "Mineralogy," II., 38.

PHYSIOLOGY AND NATURAL HISTORY.

To the Editor of the CANADIAN JOURNAL:

PERTH, 19th February, 1856.

SIR,—There is a variety of deer frequently killed in this vicinity, which I have never been able to find described, and should like to know if any of the members of the Institute can give any information respecting it. It is popularly known as the "Spike Horn Buck," and I adjoin the following short description.

The Spike Horn Buck has much shorter legs than the ordinary deer, but is also heavier bodied. The forehead is wider, and the horns, which are set very high on the head, are almost six inches in length, smooth and straight without any disposition to branch. As this animal is killed of all ages I think it is evidently a distinct variety from the common deer. I have had a head preserved which I shall send to the museum of the Institute as soon as an opportunity offers.

Yours, &c., W. T. MORRIS.

RANIDÆ.

In the proceedings of the Academy of Sciences of Philadelphia, for December 25th, Dr. LeConte has published a descriptive catalogue of the Ranidæ of the United States.

He remarks upon the difficulty of accurately describing those animals, and the confusion which has arisen in the synonymy, principally arising from the circumstance of the colors and markings being so extremely variable. Descriptions to be accurate must be made from living specimens, and from a number of individuals.

Dr. LeConte has had an opportunity of examining the following:

Rana Catesbiana,...............	Shaw.
" nigrescens,...............	Agassiz.
" fontinalis,...............	LeConte.
" pipiens,...............	Gmelin.
" palustris,...............	LeConte.
" clamator,...............	Daudin.
" conspersa,...............	LeConte.
" capito,...............	"
Telmatobius lentiginosus,.......	Shaw.
Acris gryllus,...............	LeConte.
" crepitans,...............	Baird.
Chorophilus nigrita,............	LeConte,
" ornatus,............	Holbrook.
Hyla versicolor,...............	LeConte, Tree frog of Pennant.
" lateralis,...............	Pennant, Cinereous of "
" femoralis,...............	Daudin,
" squirella...............	"
" delitescens,..............	LeConte.
" Pickeringii,.............	Holbrook.
" ocularis,...............	Daudin.
Scaphiopus solitarius,...........	Holbrook.
Bufo musicus,...............	Daudin.
" Americanus,...............	LeConte,
" erythronotus,.............	Holbrook,
" quercicus,...............	"
Engystoma Carolinense,.........	Wagler.

BATS.

Dr. LeConte has also published in the same number some observations on the North American species of bats, of which he enumerates and describes the following:

Vespertilio Noveboracensis,........Linn.
" cinereus,..............Palesot de Beauvais,
" crepuscularis,..........LeConte,
" fuscus, ...Palesot de Beauvois,
" Carolinensis, ...Geoff. Se Hilaire.
" currsinus,.............Leunnenck.
" phaiops, ... "
" Caroli, ... "
" pulverulentus, ... "
" subulatus, ...Say,
" lucifugus,............LeConte,
" Georgianus,..........Cuvier,
" macrotis, ...LeConte.
" pallidus,............. "
Rhinopoma Carolinense,..........St. Hilaire.

Dr. LeConte remarks that all the Bats he has seen, have an uncertain number of transverse wrinkles or plaits on the outer portion of the ear, and have the toes furnished with rather long and fine hairs, as it were fimbriated, hence these two marks are omitted as furnishing no good specific characters. All of the American bats except the Molossus (Rhinopoma,) belong to the same genus, the trifling difference in the number of the teeth does not afford a sufficient reason for considering them as different.

NEW HESPEROMYS.

Dr. LeConte has described two new species of Hesperomys, the H. cognatus and H. gracilis; these two appear to have been confounded with the Northern H. gossypinus. They are found in Georgia and Michigan.

TAPE WORMS.

Dr. Leidy has published, in the Proceedings of the Academy of Sciences, a list of all the tape worms which have come under his notice, both in man and in various animals. It is curious that he has never yet met with the Dibothrium latum (Bothriocephalus latus.)

MOSSES.

A valuable addition to the flora of the United States, has been given (l.c.) by Mr. Thomas P. James, being a list of those mosses not described in Gray's Manual, some of them being new species, amounting in number to forty-seven.

H. C.

ETHNOLOGY AND ARCHÆOLOGY.

ARTIFICIALLY COMPRESSED CRANIA.

The singular custom practised by the Flat Head Indians of the North West, of artificially compressing their skulls, is one of the most curious of all the barbarous customs, adopted by savage tribes. This unnatural operation, our artistic Canadian traveller Mr. Paul Kane remarks: not only does not appear to injure the health of the children subjected to the deforming process, but it does not injure their intellect, as is proved by their enslaving the surrounding tribes, who retain the head in its normal shape.

This barbarous practice, however, is neither of modern origin, nor peculiar to the New World. Captain Jesse, in his "Notes of a Half-Pay Officer," describes in his travels in Circassia and the Crimea, an ancient example of an artificially compressed cranium, which he saw in the Museum at Kertch. This was said to have been found in the neighborhood of the Don; and he remarks in reference to it: "According to the opinions of Hippocrates, Pomponius Mela, Pliny, and others, the Macrocephali appear to have inhabited that part of the shores of the Euxine between the Phasis and Trapesus—the modern Trebizonde."

This highly interesting specimen of the artificially elongated skull, from whence this race is assumed to have derived its name, it can scarcely be doubted must have since perished in the destruction of the Kertch Museum, when that town fell into the hands of the victorious Allies. It is scarcely to be supposed that such a prize as the ancient cranium would be found among the spoils carried off by our soldiers from the Crimean city.

AMERICA PEOPLED FROM ASIA.

The following paragraph occurs in the editorial correspondence of the Toronto *Leader*, dated Rome, Nov. 5, 1855.

"At the *table d'hote* of the hotel de la Minerve, last night, I met a priest from Wisconsin. He stated some facts as conclusive proofs of the theory that America was originally populated from Asia; the principal one of which is that many of the Indians are found to have the religion of Egypt, which they had received by way of Asia Minor. On my remarking that the theory was not a novel one, but had not been hitherto sustained by conclusive proofs, he said, 'We have no doubt whatever of its correctness.' He has been long among the Indians of the West, and speaks their languages. He has taught them not only to renounce their paganism, but also to read, to plough, and follow other industrial occupations of civilized life. He has therefore, I take it, been an eminently useful missionary; and a self-denying one, too, it would seem, for he states that for four whole years he lived almost exclusively upon fish, seldom tasting the luxury of bread."

Such notices as this, preserving the deductions of intelligent observers, are deserving of record; though, like most others leading to similar conclusions, it is extremely vague and unsatisfactory. If by "the religion of Egypt" is meant, as we presume, the ancient ante-christian creed of the Nile Valley,—which even in the days of Herodotus was obscure, and already being overlaid, like the political institutions of Egypt, by foreign intrusions,—then something greatly more definite than the mere recognition of such elements as are more or less common to all pagan mythologies, must prove a connection which chronological evidence renders so improbable.

WORKING OF AFRICAN NATIVE IRON.

At a recent meeting of the Natural History Society of Boston, Dr. A. A. Hayes exhibited specimens of Native Iron from Liberia; and gave the historical and chemical evidence of its having been in use many years by the natives. By the simple process of hammering, this iron has been converted into rude instruments. It contains one and a half per cent. of crystals of quartz and magnetic oxide of iron, and, consequently has never been heated or wrought. There is no trace of carbon, or manganese, or nickel, which, by their presence, would show it to be meteoric. This subject is interesting to the archæologist, as well as to the mineralogist, as furnishing another example of the working of metal—like the cold wrought copper of the ancient miners of Lake Superior—without smelting, or other than mechanical means.

VALUE OF NATURAL HISTORY TO THE ARCHÆOLOGIST.

In Indian grave mounds, and on sites of long-deserted Indian villages, numerous bones of wild animals are found, calculated to throw an interesting light on the old fauna of the clearings of this Continent. The following *resumé* of observations on this archæological department of Natural History in relation to England, abstracted from a communication by Mr. Joseph Clarke to the Historic Society of Lancashire and Cheshire, may suffice to shew of what essential service a knowledge of Natural History may prove to the Archæologist:—

Skeletons, in Saxon barrows, are sometimes surrounded with a row of flints, and next to them a row of small bones, and in one instance the body had been completely covered over with small bones, which were ascertained to be those of the water rat (*Arvicola amphibia*, Desm.), a species confined to banks of rivers and ponds, injuring the trees by gnawing off the bark for their store, and not visiting the habitations of man. The old English black rat (*Mus rattus*, Linn.) was not then known, having centuries since, been introduced from India. And that pest, now so common, the brown or Norway rat (*Mus decumanus*, Pall.), which has exterminated the other race, being a native of Persia, had not inflicted a visitation on this kingdom previous to 1730. It seems to be a law in nature that the weaker should disappear before the stronger; thus, our partridge (*Perdix cinerea*, Briss.) disappears before the red legged or French partridge (*Perdix rubra*, Briss.) wherever it is allowed to exist. And even man is not exempt: the Red Indian blotted out from existence the Aztec of America, to be in his turn extirpated from the earth by the intruding Anglo-Saxon. Immense numbers of the shells of one of the pests of our gardens—the common snail, (*Helix aspersa*, Mull.) have been found in some of the graves above-mentioned. Quantities of a species of *Nerita* have also been found in similar graves. Douglass figures shells of the genus *Cypriæ* in conjunction with burial places, and Mr. C. Roach Smith says, specimens of the genus *Nerita* and *Buccinum*, drilled as beads for necklaces, were discovered with remains at Settle, in Yorkshire; and at Sandwich, a gold coin and cowry-shel were found in an urn. The brown bear (*Ursus arctos*, Linn.) is one of our ancient indigenous animals, and infested some portions of this kingdom, almost as late as the sixteenth century. The beaver (*Castor Fiber*, Linn.) was noticed in Wales, by Giraldus de Barri, in 1138, and is known to have existed in great abundance at an early period on the banks of the river Hull, in Yorkshire, where the memory of its denizenship is still retained in the name of the town of Beverly—and Cambridgeshire has produced a skull of it in a fossil state. The wolf (*Canis Lupus*, Linn.) now happily exterminated continued to prowl about our homestead and sheepfolds almost to the eighteenth century. The wild boar (*Sus scrofa*, Linn.) ranged the forests about London in the reign of Henry II. and its tusks are rather abundant in or near most Roman encampments. One found at Richborough had an ornamental piece of brass attached to it, and had probably been worn as a trophy or remembrance of some animal of extraordinary endurance in the chase, or ferocity in fight. Some legs of cocks (*Gallus domesticus*, Briss.) were found at Bartlow, which might have been preserved from the latter motive. The bones of the red deer (*Cervus* *elaphus*, Linn.) and the roebuck (*Cervus capreolus*, Linn.) are found at various Roman stations, I once saw the greater part of a skeleton of the former which the peat had preserved, taken from the bottom of a ditch which emptied itself into the river at Colchester. From these facts, a fair inference may be drawn that they were once numerous in our woods and forests. The roebuck exists still in small numbers in Dorsetshire, but the red deer has been driven to take refuge in the Highlands of Scotland, which three hundred years ago were inhabited by a native buffalo (*Bos Taurus*, Linn.) since that time become extinct. It may be interesting to know that an antique Highland drinking horn, which was in the possession of the late Mr. Croker, was of the horn of this animal. In the sister kingdom of Ireland have been found, at various places, preserved in the peat bog of that Island, the skeletons of the Irish elk (*Megaceros Hibernicus*,) and in one instance the bones were discovered along with weapons of bronze, seeming to prove that this noble stag, now extinct for many centuries, was coeval with man, and came by its death by his machinations. In several instances it has been found in England, and one of the localities where it has been brought to light is in the forest of Hoylake. Amongst the osteological remains found in London, Colchester and Hartlip, are the skulls of an entirely extinct ox (*Bos longifrons*); and the same have been found in considerable numbers, along with Roman pottery at Newstead, Roxburgshire; others found at Chesterford, belong to a smaller species which may be referred to that which is now called Alderney. The bone skates of mediæval times, in the museum of Mr. C. Roach Smith, dug up in Moorfields,—probably lost when that locality was a moor, covered in winter with water, and frozen over,—are said to be the bones of horses; but some of the smaller ones are evidently the metatarsal and metacarpal bones of the red deer. A musical instrument, a sort of flute or whistle, was found with some urns, close to the Ermyn-street at Lincoln, in 1824. It is made of the tibia or thigh bone of a British bird, though now extinct, at least in Britain, the crane (*Grus cinerea*, Becks.), which in the time of Ray the naturalist, who wrote in 1611, was plentiful throughout England. Civilization has completely extirpated it, and the last straggling specimens upon record were taken in 1831.

D. W.

CHEMISTRY.

ALUMINUM.

Deville has prepared considerable quantities of this metal from *Kryolite*, a mineral from Greenland, consisting of fluoride of aluminum with fluoride of sodium. The mineral is tolerably pure, and can be readily reduced by placing it in fine powder in a porcelain crucible with layers of sodium, a bright red heat is sufficient to effect the reduction, which is accompanied by the evolution of an inflammable gas, resulting probably from the decomposition of the phosphoric acid, which can readily be proved to exist in *Kryolite.* The aluminum thus prepared is not quite pure, containing some silicium from the crucible; and Rose, who reduced it in the same way, but used an iron crucible, found it contaminated with the same metal.

Deville has succeeded in preparing a double fluoride of aluminum and sodium, which is decomposed as readily as the *Kryolite.*

Deville also remarks upon the property possessed by the alkalic fluorides of dissolving various substances, such as silica and titanic acid, the mixture becomes perfectly fluid, and if subjected to the action of a galvanic current, oxygen is evolved at one pole and silicium or titanium at the other. Alumina, on the other hand, scarcely dissolves at all in the fluoride of sodium, and when acted on by the battery, fluorine is disengaged at one pole and sodium at the other.

Silicium may be prepared by bringing the vapor of sodium in contact with silica, or even with very pure pounded glass.

CADMIUM SALTS.

Von Hauer has continued his researches on the double chlorides of cadmium, and has described the following compounds:—The *chlorobicadmiate of barium* with four of water; the *chlorobicadmiate of strontium* and *calcium*, each with seven of water; the *chloro-hemicadmiates* (dicadmiates) of *calcium* and *magnesium;* the *chloro-bicadmiates* of *magnesium*, *manganese*, *iron*, *cobalt*, and *nickel*, with twelve, and the *chloro-monocadmiate* of *copper* with four of water.

BASICITY OF OXIDES.

H. Rose has lately shewn that all oxides may be divided into two classes according to their action on chloride of ammonium, (ante, January No. p. 80)—but if perchloride of mercury be used, then three divisions may be established. This method has the advantage that we may know immediately from the color of the precipitate, to which of the three divisions the base so tested belongs.

The first division includes the strong bases which when added in excess produce a yellow precipitate of pure peroxide of mercury, even at ordinary temperatures. These are potash, soda, lithia, baryta, strontia and lime, as well as solutions of alkalic silicates.

The second section contains the weaker bases, or strong bases whose basic properties are somewhat obscured by combination with a weak acid. These give with perchloride of mercury a precipitate of a reddish-brown color, the oxy-chloride, the chloride in which cannot be converted into the oxide at the ordinary temperature, even by an excess of base. To this category belong the neutral alkalic carbonates, the sesqui-carbonate of soda, the alkalic borates (neutral and biborates), the borates of the alkaline earths, magnesia, the basic carbonate of magnesia, and also the artificial neutral carbonate. Oxide and carbonate of silver seem also to belong to this class.

The third section includes the great number of bases which do not decompose perchloride of mercury. The alkalic bicarbonates and the carbonates of the alkaline earths also belong to it.

Hence it follows, that in the humid way carbonic acid is a stronger acid than boracic, the acid salts of which act in the same way as the neutral carbonates (on alkalies), while both of them are stronger than silicic acid, which does not at all obscure the basic property of the alkali with which it may be combined.

FORMIC ACID.

Alcohol may be represented as consisting of etherine plus water, and formic acid as carbonic oxide plus water, both are resolved into their respective bodies by the action of sulphuric acid. Berthelot has shewn that formic acid may be generated by heating carbonic oxide with caustic potassa in close vessels to a temperature of 212° Fahrenheit for seventy hours, water being present.

DATISCINE.

Stenhouse has examined this substance, originally found by Braconnot in the leaves of the *Datisca cannabina*. Stenhouse obtained it from the root by extrac tion with wood spirit, and repeated crystallizations out of spirits of wine. He finds that it belongs to the family of the *glucosides*, and by weak acids can be resolved into *sugar* and *Datiscetine* which can be obtained in crystals.

By the action of dilute and strong nitric acid, nitrosalicylic and nitropicric acids are generated.

The Datisca is used by silk dyers as a dye stuff, and it appears that it would be advantageous to convert the datiscine into datiscetine, in the same way as Leeshing strengthens the coloring matters of weld and quercitron.

PYROXYLINE.

Béchamp has brought forward some further experiments to prove that pyroxyline is of the nature of a nitrate, and does not belong to the nitrobenzine class, inasmuch as the latter by alkalies and reducing agents is converted into an azotized body containing all the nitrogen, while nitric ether, the glycerine compounds, and pyroxyline, give nitric acid or different azotized compounds and the original body.

He proposes the following formulæ for pyroxyline and the other compounds obtained by him.

$C^{24}\,H^{17}\,O^{17},\ 5\,N\,O^5,\ 2\,H\,O$ = pentanitric cellulose, pyroxyline.
$C^{24}\,H^{6}\,O^{16},\ 4\,N\,O^5,\ H\,O$ = tetranitric cellulose.
$C^{24}\,H^{17}\,O^{17},\ 3\,N\,O^5,$ = trinitric cellulose.
$C^{24}\,H^{20}\,O^{20},$ = cellulose.

HORDEIC ACID.

A new acid belonging to the class of the fatty acids, $C^n\,H^n\,O^4$, has been obtained by Beekmann, by distilling barley with sulphuric acid: it possesses the usual characters of a fatty acid and has the formula $C^{24}\,H^{24}\,O^4$, and is therefore isomeric with laurostearic acid.

PIPITZAHOIC ACID.

Under this barbarous title, Mr. Weld has described an acid obtained from a purgative Mexican root, called Raiz del Pipitzahuac. Such a system of nomenclature cannot be sufficiently deprecated; names of substances obtained from plants or animals should be derived from their scientific denominations, or failing these, from some characteristic property of the bodies themselves. Chemical names are already sufficiently cacophonous without the introduction of the Mexican or the Aztec. We may probably shortly be treated to a description of the "Pipitzahoate of the oxide of Œthylmethylamylphenylammonium."

STIBŒTHYLE.

Merck has examined the action of iodide of stibœthyle upon stibœthyle. He has obtained and described the oxide, iodide, bromide, sulphate, carbonate, and acetate of *stibtriœthyle* ($Sb\,Œ^3$). The iodide crystallizes well, the rest are amorphous.

PHOSPHURETTED BASES.

Hofmann and Cahours have obtained some very interesting compounds by acting upon zincœthyle, zincmethyle, and zincamyle, with the terchloride of phosphorus, and also by treating the bodies so obtained with the iodides of œthyle, methyle, and amyle. The iodides of these radicals are readily decomposed by the oxide of silver, yielding the oxides which are possessed of strong basic properties. Many of their salts are crystallizable. Similar results were obtained by employing the chlorides of bismuth and arsenic instead of the chloride of phosphorus. The following are the formulæ of the compounds as yet examined:

$P\ (C^2\ H^3)^3$	$P\ (C^4\ H^5)^3\ (C^2\ H^3),\ I$
$P\ (C^4\ H^5)^3$	$P\ (C^4\ H^5)^4,\ I$
$P\ (C^{10}\ H^{11})^3,$	$P\ (C^4\ H^5)^3,\ (C^{10} H^{11}),\ I$
$P\ (C^2\ H^3)^3\ (C^4\ H^5),\ I$	$P\ (C^{10}\ H^{11})^3\ (C^2\ H^3),\ I$
$P\ (C^2\ H^3)^3\ (C^{10}\ H^{11}),\ I$	$P\ (C^{10}\ H^{11})^3\ (C^4\ H^5),\ I$
	$P\ (C^{10}\ H^{11})^4,\ I$

SAPONIFICATION.

It was already known that fats and oils could be decomposed into glycerine and their respective acids, both by the action of a very small quantity of bases and by the influence of water or its vapour at a high temperature, and this plan has already been adopted in some large candle factories. Pelouze has shewn that the same can be effected by the action of soaps on fatty matters at a temperature corresponding to the pressure of five or six atmospheres. He supposes that the high temperature decomposes the neutral soap into a very basic one, which then acts on the fatty matters in the same manner as a free alkali.

TESTING ACETIC ACID.

Nicholson and Price have shewn that the method of determining the strength of acetic acid by means of carbonate of soda is open to objection, owing to the alkaline reaction of the resulting acetate. The methods with carbonate of lime or baryta, or the process of Fresenius and Will are to be preferred as giving accurate results. H. C.

MATHEMATICS AND NATURAL PHILOSOPHY.

PHOTOGRAPHY.

M. Taupenot's Process.—The following information with regard to this process is condensed from M. Taupenot's paper, which appeared originally in *La Lumière*, and a translation of which was given in the Journal of the Photographic Society for September last; and also from a translation in the October number of the latter Journal, of an article in the *Bulletin de la Société Française de la Photographie.* This new method of M. Taupenot is a combination of the collodion and albumen processes; and it promises to be very useful, because the plates may be used *dry*, and apparently some time after they have been excited, while their sensibility is nearly as great as that of ordinary collodion plates.

M. Taupenot's process is briefly as follows:—

I. Coat the glass plate with iodized collodion in the ordinary manner, place it as usual in the nitrate bath, and then wash the surface with distilled water.

II. Upon the plate thus coated with collodion pour a sufficient portion of iodized albumen, pour off the excess, and set the plate up against the wall to drain.

III. To sensitize the plate plunge it into a bath of aceto-nitrate of silver, consisting of 48 grains of nitrate of silver, and about 44 minims of glacial acetic-acid to the ounce of distilled water.

IV. After exposure develope either with gallo-nitrate, (which seems, however, a very slow operation), or with pyro-gallic acid, with a heavy dose of acetic acid adding a small quantity of the aceto-nitrate.

We presume that the picture may be fixed either with hyposulphite of soda, or with cyanide of potassium.

These plates may be used the day after they have been finally sensitized. After the operations I. and II. have been performed the plate is apparently insensible to the action of light; one experiment mentioned in the *Bulletin* seems to contradict this, but we strongly suspect that the sentence must be wrongly printed. The following details of the operation may be also useful. It seems that the same aceto-nitrate bath mentioned in III. may be used for exciting the collodion film in I. The collodion itself must be *very thin*, or blisters are apt to be formed. The directions given in the *Bulletin* are rather vague; but we should imagine that a collodion containing from 1 to 1½ grains of gun-cotton per ounce would be suitable. The proper consistence of the collodion, however, seems to depend upon that of the albumen. M. Taupenot appears to use pure albumen, without adding water, but after fermentation. To the white of egg he adds about 10 per cent. of honey, and a small portion of yeast. The advantages of thus fermenting the albumen are, that beating is rendered unnecessary, and that the albumen will keep. He then adds 1½ per cent. of iodide of potassium. As a rough guide to the quantity thus indicated, we may notice that according to M. Negretti's estimate this will give about 7 grains of iodide of potassium to the white of a large egg. The following suggestion with regard to the development, from the pen of an experienced photographer (Mr. Sutton) is likely to be useful:—

"Take two glasses, into one pour the usual pyro-gallic solution, and into the other some diluted aceto-nitrate. Before developing moisten the plate with water, then pour on the pyro; no effect will be perceived at first; let it remain a minute or two, then pour off into the glass, and pour on the dilute aceto-nitrate. The development will now begin, and will advance rapidly. When the picture is nearly out pour off the aceto-nitrate, and pour on the pyro-gallic, and proceed in this way by changing the solutions (but never mixing them) until the end.

G. C. I.

VARIABLE STARS.

The following communications from Mr. J. R. Hind, which have recently appeared in the *London Times*, it will be seen are possessed of considerable interest to the scientific astronomer; they were both published in the form of letters, dated from Mr. Bishop's Observatory, Regent's Park, London, where Mr. Hind's observations are carried on; the first of these being dated on the 18th, and the second on the 21st of December last:—

NEW VARIABLE STAR OR SMALL PLANET.

About 9 o'clock on Saturday evening I remarked, near 84 Geminorum, an object shining as a star of the ninth magnitude, which I have not seen before during the five years that my attention has been directed to this part of the heavens. At 5 o'clock on the following morning it appeared to be in the same place, whence I conclude it must be a variable star of long period, recently come into view. It is, however, just possible that a small planet hereabouts might have been stationary, and the weather having continued cloudy since my last observation, I am induced to notify the circumstance, that the nature of this object may be ascertained as early as possible. Its mean place for January 1, 1856, is in right ascension 7h 46m. 33.65s., and north Polar distance 67° 37′ 17.1″. It exhibits the pale blue light which characterizes many of the telescopic planets, and nothing of the fiery appearance often presented by variable stars. Still I incline to place it in the latter class.

VARIABLE STARS.

The object to which my communication of the 18th had reference continues to occupy the same position in the heavens as on Saturday last, and is, therefore, in all probability, an addition to our list of telescopic variable stars.

While upon this subject let me point out one or two stars belonging to the same class, which are well worthy the attention of observers.

The bright star in Canis Minor, Procyon, has a small companion, the discovery of which, I believe, we owe to Admiral Smyth, who observed it in November, 1833. I have searched in vain for any previous mention of it, though Procyon has been on the list of standard stars, and consequently under constant observation in meridional instruments, for something over a century. The companion was missed by Professor Bond, of Cambridge, U. S., in 1848, but was again detected in March, 1850, by Mr. Fletcher, of Tarn Bank, Cumberland, who ascertained its position-angle with respect to Procyon. Since this date I am not aware that it has been perceived. I have repeatedly sought for it with Mr. Bishop's telescope of seven inches aperture, during the years 1853-4-5, and have always found its place perfectly blank. The appearance of the companion star, at certain distant intervals, is sufficiently established. This, however, is not the only point of interest about it. Procyon, like many other so-called "fixed" stars, possesses a considerable proper motion, whereby its actual position in the heavens is altered to the amount of 1½ second annually. When Admiral Smyth observed the small star in 1833, he estimated its position with regard to Procyon at 5° north of the parallel of declination on the eastern or following side, and its distance 145 seconds of arc. In 1850 the proper motion of Procyon would have changed the apparent angle of position of the companion (supposing it fixed) by rather more than 5°; but Mr. Fletcher's observation does not agree with this inference. He found by micrometrical measures that the small star was still about 5½° north of the parallel, as in 1833. His angle reduced to the date of Admiral Smyth's observation would bring the stars exactly on the same parallel of declination, in which position an error to the extent of 5°, even in an estimated angle, is very improbable. There is, consequently, strong reason for concluding that Procyon is carrying this small variable neighbor along with it. How far this circumstance may be supposed to account for the irregularities in the movement of the bright star, which led Professor Bessel to suggest the probable existence of a dark body in its vicinity, I will not attempt to discuss. Mr. Schmidt, of Olmütz, has lately drawn attention to the colored star on the confines of Lepus and Eridanus, which I remarked while comet-sweeping in October, 1845. At that time it was of the most intense crimson, resembling a blood-drop on the black ground of the sky. As regards depth of color, no other star visible in these latitudes could be compared to it. In brightness it was just beyond the unassisted vision of most persons, or between the 6th and 7th magnitudes, and as such I have always seen it between 1845 and 1854. Mr. Schmidt now states that its light is rapidly on the increase, while the intensity of color appears to be fading. Change of color in the variable stars as they go through their periodic fluctuations is a fact confirmed by our observations on some of these objects during the past few years, though I am not aware of any distinct reference to it in astronomical works. I will here adduce one or two instances:—

1. Near the star numbered 77, at the extremity of the South wing of Virgo, is

another which varies between the 6th and 11th magnitudes in somewhat less than a year. The following notes are extracted from our journals:—

"1853, February 19.—It is now brighter than 77 Virginis. Its color is decidedly deep yellow.

"March 14.—Less than 77 Virginis. It is now bluish white.

"March 29.—Little diminution of brightness, but a very decided difference in color and appearance between 77 and the variable. On bringing the former to the centre of the field of view it appears perfectly white. The variable star, on the contrary, has a dull aspect, and most undoubtedly very red flashes at times. I examined it attentively, and had not the least doubt of the red flashes in the variable; as certainly nothing of the kind was presented by 77 Virginis, which was always of a fine white.

"April 1.—Same appearance, but the color is of a more lurid red.

"1854, February 2.—Light vivid, with flashes of a deep red color.

"February 27.—Dull red.

"1855, March 8.—Fine yellow.

"April 7.—Of a dull amber color, or pale red.

2. A star near *lambda* Geminorum, which varies between the ninth magnitude and invisibility in about 10 months, affords similar phenomena.

"1848, March 4.—Ninth magnitude and ruddy.

"October 30.—Same brightness, but bluish.

"1852, January 17.—Bluish: no ruddiness about it.

"January 18 and 20.—The same.

"February 10.—Light more intense. It is now decidedly yellow, or deep orange. The color has certainly changed from bluish to yellow since January 18.

"February 25.—Reddish yellow.

"September 20.—Very slightly, if at all yellow.

"October 11 and 25.—There is now the yellowish tinge about its light.

"November 19.—Dull amber color.

"December 14.—Color livid: no yellowish tinge."

The same diversity of color was remarked in 1853 and 1854.

To generalize, I think I may add that when a variable star presents successively the colors blue, yellow, and red, the blue tinge is chiefly perceptible as its light increases; soon after the *maximum* is past the yellow becomes marked, while on its decrease the curious ruddy tinge and flashes of red light are noticed. Many of those stars which continue visible about their *minima* appear hazy and indistinct, as though some cloudy or nebulous medium intervened. These changes however, require closer observation, and as they can hardly fail to have an important bearing in connexion with the cause of variable light in stars, I venture to recommend them to the attention of the many amateur astronomers who possess instruments adapted for such observations.

At present the phenomena of variable stars mock all attempts at explanation.

METEOROLOGICAL PHENOMENON.

A very curious phenomenon was observed at Gateshead, at 6h. 15m. on Wednesday morning, Dec. 19th. A bright pillar of blue light appeared to stand up from the horizon at an altitude of about 30 degs. At that point it assumed a very bright appearance, resembling the bursting of a huge rocket. A stream of sparks and haze ascended to a height of about 10 degs. more. The light continued visible for about two seconds, illuminating the whole neighbourhood, and was unaccompanied by any noise. The lower parts then disappeared, leaving the haze in the form of a bright oblong cloud, which gradually diminished in brilliancy for nearly ten minutes, when it had entirely disappeared. Its position was nearly due south.

COPLEY AND ROYAL MEDALS.

The Council of the Royal Society of London has awarded the Copley Medal for 1855 to M. Léon Foucault, for his various researches in Experimental Physics. One of the two Royal Medals for the year has been conferred on Mr. John Russell Hind, for his discovery of ten planetoids, the computation of their orbits, and various other astronomical discoveries. Mr. Westwood, the Entomologist has received the other Royal Medal.

PHOTOGRAPHIC MAGNETIC APPARATUS.

A Photographic Magnetic Apparatus, constructed by Mr. Brooke, similar to that in use in the Greenwich Observatory, has been placed by Dr. Whewell at the disposal of the Syndics of the Cambridge Observatory. The apparatus exhibits and records the changes of the direction, and the horizontal and vertical intensity of the magnetic force at the place of observation. The barometric and thermometric variations are also marked by a photographic self-register.—*London Literary Gazette.*

ENGINEERING AND ARCHITECTURE.

ENGINEERING CONTRIBUTIONS.

When the Canadian Institute was established in 1849 by a few individuals connected with the three professions—engineering, architecture and surveying—they were encouraged in their efforts by a strong hope that the advantages which such an Institute, by concentrating and comparing the experience gathered from the extensive public works progressing in all parts of the Province, would manifestly afford to its members, could not fail to secure the cordial cooperation of their brethren. These reasonable expectations, however, were not realised, and in order to save the Institute from extinction, it became necessary to change its strictly professional character for one which should admit to membership all who desired by their countenance and support to forward scientific pursuits.

This change, however, did not necessarily lessen the importance of the Institute to the members of those professions with whom it originated. On the contrary, it was believed that by establishing the *Canadian Journal*—a measure determined upon by the Institute during the first session after its incorporation,—a convenient medium would be afforded for recording the progress of those important professions which would not fail to secure many valuable contributions from those who desire to see the professions take that rank to which their importance in the material progress of the country so justly entitles them, and that by means of its pages the obstacles which opposed themselves to the progress of the Institute at an early period of its existence, and which appeared chiefly to consist in the dispersion of its members over so wide an extent of country as to prevent their attendance at its meetings, would be surmounted, and that a reservoir would be created in which all would deposit the stores of experience and observation for the general advancement of the professions. Whether the labours of our bretheren have been too onerous to admit of literary pursuits,—their professional prosperity so great as to make them indifferent to the spread and increase of that knowledge which has secured their own success,—whether they have been indisposed to confide their contributions to the pages of a journal not edited by one of themselves,—or to whatever other cause it may be assigned, certain it is that the pages of the *Canadian Journal* have not heretofore borne evidence of a desire on the part of the engineering profession to assume a prominent position in the transactions of the Institute, nor do the weekly meeting of that body usually present an audience to whom papers on Civil or Mechanical Engineering could be expected to afford much interest. That such is the case can only be attributed to the absence of nearly all active co-operation on the part of the members of those professions. The pages of the *Journal* have ever been open to their contributions, and the few papers they have read at the meetings of the Institute have been uniformly listened to with patience, and on one or two occasions have elicited considerable discussion.

In commencing a new series of the *Journal*, it has been decided, notwithstanding the apathy evinced on the part of the Engineers, to devote a section specially to their pursuits. Our experience does not warrant us in indulging in any very sanguine anticipations of assistance to be derived from our professional brethren in conducting this section, but we are not altogether without hope that the members of the profession will yet appreciate the advantages that must result from the possession of a recognized representative in the "*Fourth Estate*," through which, to effect interchange of thoughts between those who are engaged, in all parts of the Province, in works of the most varied character, the expression derived from which cannot fail to be mutually interesting and instructive.

The vast engineering works aleady accomplished or in progress, the material prosperity of the country which they are so much accelerating, and the demand for first-rate engineering skill which must necessarily be thereby created, would seem to give that profession an importance sufficient to demand a record of passing events and of the advancement continually being made in its practice. We appeal, therefore, to its members for that support, by their contributions and countenance, which can alone enable us to give this section that prominence in the *Journal* which will entitle it to be received as the exponent of the "Transactions of the Civil and Mechanical Engineers of Canada." We ask them to communicate the progress of works under their charge, and to afford information of whatever may come under their notice that can contribute to the object we have in view. The importance of the information that could be accumulated by a liberal response to this appeal may be undervalued, but a brief reflection on the valuable data which would have resulted from a record of the progress of our public works to completion, with all the difficulties and triumphs of skill and perseverance incidental thereto, will fully establish the importance of our object. The history of the public works of Canada would not have been written in vain, and we doubt not, but that a faithful record of their progress would afford many buoys and land marks of inestimable value for the future.

This, however, is not the only point from which the value of the information we propose to collect should be viewed. We are of those who believe that professional eminence is best recognised when judged by a competent tribunal, and that in engineering as in other professions, empiricism can only thrive on public ignorance. Let us, therefore, lay before the public a history of our progress. Let us exhibit the manner in which we surmount difficulties and subdue unlooked for obstructions to our designs. Let each ingenious contrivance, whether for abridging labour or effecting a novel purpose, stand out in bold relief against that routine which dares not tread a path unknown to precedent. Let us proclaim our triumphs and the means by which they have been accomplished. So shall we command confidence, and we shall doubly merit it if our self-love permits us to record our failures, for they are the guide posts to success.

So much machinery is now being put in motion in every part of the Province; our Lakes and Rivers are ploughed by a fleet of steamers so rapidly augmenting, and our Railways are attaining so great a magnitude, that the peculiar pursuits of the "Mechanical Engineer" have already become of vital importance to our commercial prosperity, and whatever tends to promote economy and efficiency in the construction and working of motive power deserves the best attention of all who are interested in that trade which the geographical position of Canada is so well calculated to develope.

Those who are charged with the practical superintendence of machinery must have presented to their minds modifications of the working parts, of which a more complete developement might be productive of important results. Such suggestions, if recorded, would doubtless be fruitful of others, and data would thus be accumulated of immense value. The History of the Steam Engine, especially of the Locomotive, is prolific of instances of the value of experimental research, and both the power and speed now attainable on our Railways are due to a change in the relative dimensions and adjustments of the valves of the Engines so limited that the difference would escape the notice of any but the most observant, though it is a difference that has doubled the duty of the machine in proportion to the consumption of fuel. Again we have recent instance of a descrepancy in the performance of two magnificent Marine Engines, built in every apparent particular the counter-part of each other, so considerable as to justify us in concluding that although not detected, a variation must exist in some important part, which if developed might suggest modifications beyond the reach of theory unaided by experiment.

The consumption of fuel requisite to produce a given effect in steam machinery is a subject which claims our most careful attention, and every improvement that tends to economise that important article widens the sphere in which steam machinery can be advantageously applied; and while it is no uncommon occurrence to see a given duty performed by one engine at an expenditure of fuel less by one-half than is required by another, we may be sure that our efforts in this direction if intelligently pursued will not be in vain.

Believing that the Mechanical Engineer has an ample field wherein to exercise his talents, we have every confidence in the value of the opportunity offered by the pages of the *Canadian Journal* for recording the numerous improvements made in that branch of the profession, and for diffusing a general knowledge of those observations and improvements which, though only of trivial importance in detail, are of great consequence in the aggregate. We invite all who are engaged in such pursuits to contribute the results of their observations, in the belief that the seed thus sown will yield a fruitful harvest. A. B.

THE BROCK MONUMENT.

This structure progressed very rapidly last year, and only awaits the return of the working season for its completion. The Monument itself, exclusive of the fosse enclosure, is already erected, and the scaffolding removed. The stone lions on the angles of the sub-basement are now set up; and the bas-relief of the Battle of Queenston will be completed by Messrs. Cochrane & Pollock of Toronto, in sufficient time to be inserted in the Pedestal of the Monument in May next.

The enclosure, with the military trophies at the angles, will be executed in accordance with the original design, in the course of next summer, so as to have the whole completed by the Anniversary of the Battle of Queenston, on the 13th October, when it is proposed to Inaugurate the Statue of General Brock with all due ceremony.

From the summit, a very extensive and beautiful view is obtained,—the high lands in Pennsylvania being visible when the weather is favorable.

The following are the details of this Canadian Monument:—

The Column is of the Roman Composite Order. Its Pedestal stands on a platform of an elevation of twenty-seven feet, at the angles of which are lions rampant, supporting shields with the armorial bearings of the Hero. The sub-basement is distinguished by plainness of character and great solidity, having on one of its sides a plain polished granite slab, with a suitable inscription in letters of bronze. The sub-basement is placed on a platform slightly elevated, within a dwarf wall enclosure seventy-seven feet square, with a fosse around the interior; at each angle are placed military trophies in carved stone twenty feet in height. The entrance to the enclosure, and doorway to the interior of the Monument, will be on the east side, giving access to a gallery, or corridor, round the inner pedestal, one hundred and fourteen feet in extent, by five feet wide; on the north and south sides, in suitable vaults under the floor, are deposited the remains of General Brock, and those of his Aid-de-Camp, Col. McDonnell. The gallery is lighted by circular wreathed openings. The bold rocky scenery of the Queenston Heights which surrounds the site of this Monument and the space immediately adjoining, together with the close masses of dense foliage in picturesque clumps, as seen in connection with it add not a little to the effect of the column. The pedestal is sixteen feet nine inches square and thirty-eight feet in height, the die having on its pannelled sides appropriate basso relievos. The plinth is enriched with lions' heads and wreaths, continued round each side, with wreathed openings between each, to give light to the interior. The column itself is ninety-five feet in height and ten feet in diameter, fluted, and having an enriched base of laurel leaves entwined on the lower torus; the base of the shaft is enriched with palm leaves, upon which the flutes terminate. The capital of the column is very appropriate. It is twelve feet six inches in height; on each face is sculptured a figure of Victory ten feet six inches high, with extended arms over military shields, as volutes, having on their outward angles lions' heads, helmets, &c., the spaces between the acanthus being wreathed with palm leaves, somewhat after the example of a capital of an antique column at Albano, near Rome. The enriched abacus is fifteen feet square, in the angles of which will be spaces for persons to stand outside to view the surrounding scenery, thus avoiding the unsightly appearance of iron railings. Upon the abacus stands the cippus, of cast iron, galvanized, having within a chamber six feet in diameter, for persons to stand in to view the magnificent scenery and interesting objects which the commanding situation affords. Upon the cippus will be placed the Statue of the Hero, now in process of execution in stone, sixteen feet high, in proper military costume. From the gallery in the sub-basement a staircase of stone is continued to the summit. It is of capacious breath, of two hundred and fifty steps, worked with a solid stone newel the entire height, lighted by small loop-holes in the fluting of the column. The whole height of the Monument, including the Statue, will be 187 feet, executed wholly in Queenston stone.

There is only one column, either ancient or modern, in Europe, that will exceed the entire height of the Brock Monument,—that known as "The Monument," erected in London by Sir Christopher Wren, in commemoration of the great fire of 1666.

ST. ANDREWS CHURCH, HAMILTON.

This building, now erecting from the design of William Thomas, Esq., Architect, was commenced in 1854. The design is in the early decorated style of English Gothic Architecture, and is being constructed wholly of stone. The tower is of what is styled bush hammered and rubbed work, and the flanks and west end walling of rock work. The windows in the flank walls are three lights, and those in the end recess of four lights, each of rich and varied tracery. They will be glazed with tinted glass in ornamental quarries, arranged in geometrical figures. The roof is open to the apex, with arched principals having tracery points in the compartments, and with ceiling ribs and boarded pannels.

The tower, with double buttresses at the angles, already presents a bold and massive effect. The spire, with clustering pinnacles at the tower parapet, will be of cut-stone, and from its details, as shown in a beautifully executed chromo-lithographic view which has been forwarded to us, it will have a very striking appearance when completed. Its only fault is, that from the richness of the tower and spire the body of the building looks plain by the contrast. The entire height will be one hundred and eighty-five feet, and the whole will be completed this summer. It is worthy of special note that this will, we believe, be the first stone spire erected in Upper Canada. The total expenditure on this handsome and substantial edifice will amount to about eleven thousand pounds.

CHRIST'S CHURCH, HAMILTON.

In the year 1853 it was proposed to take down the old dilapidated building of Christ's Church, and erect a new one in the pointed style of Architecture, which has of late years come so much into favour, and to complete it with nave and side aisles. The east end, including the chancel and two compartments of the body of the Church, was completed in accordance with the new scheme in 1854. The new nave thus commenced, measures forty feet in width, and, including the side aisles, seventy-five feet in clear width. The style adopted is the early decorated; the whole of the exterior being executed in cut-stone. The ceiling of the nave is arched and groined with moulded ribs springing from very rich corbels, and with rich bosses at the intersections. The height of the nave is sixty feet. The clerestory windows are of the trefoil design, adopted as emblematical of the Trinity, and are glazed with stained glass. The interior of the Church is also finished in colours, and a very handsome chancel window of seven lights with rich tracery is filled with stained glass, executed by Messrs. Ballantine & Allan, of Edinburgh,—the same Glass Painters by whom the colored windows of the House of Lords were executed, from designs by Pugin. The whole of the exterior is to be completed in cut-stone, and the plan includes a tower and spire at the west end two hundred and twenty-five feet in height, and in a style corresponding with the richness of the parts already finished.

The estimated cost of the whole when completed is about £25,000. The Architect, Mr. Thomas, of Toronto, we understand has received instructions to renew operations; and it is expected that this Church will make some further progress towards completion during the present year.

TRAFALGAR-SQUARE, LONDON.

Fronting Parliament-street, in the British metropolis, is an open area, decorated and environed with a variety of architectural and artistic works, which, if they existed in Washington, would be pronounced by the citizens of the States the eighth wonder of the world. There is the National Gallery with a handsome, if not imposing façade; Northumberland House, with its quaint Elizabethan skreen and Percy Lion; the famous Charles I. statue; the not very famous George IV. statue; and the notorious, if not famous, Cockspur-street George III. with his redoubtable pigtail! Besides all these the lofty Nelson Column towers over the fountains and all else in the Square, making a *tout ensemble* which anybody but John Bull would find some other use for than to grumble at. What words would suffice for our colonial self-laudation could we transfer the whole to displace the stumps in one of our vacant Toronto "town lots." Yet since ever John Bull got it completed, he has been revolving in his mind, with sufficiently audible grumbling, how it is to be got rid of; and here is the latest scheme, which we would have fancied to be one of *Punch's* pleasantries, did it not come to us gravely authenticated by the testimony both of the *Times* and *Builder*:—

"Among the plans and notices deposited at the Private Bill Office of the House of Commons, for bills to be brought before the present Parliament, is one for a large hotel, on the plan of the Hotel du Louvre, Rue de Rivoli, Paris, to be built on the site of the National Gallery, and on the ground in the rear, now occupied by St. Martin's workhouse and the adjacent barrack-yard. The recommendation by a Committee of the House of Commons of the removal of the national collection of paintings from the building, suffices in some degree to give countenance to this sweeping project; though the idea generally entertained was that the whole building would be transferred to the Royal Academy, by whom the east wing is at present occupied."

LITERATURE AND THE FINE ARTS.

THE CODEX VATICANUS.

Mr. T. E. Moresby, through the *Times*, suggests an application to the authorities at Rome for permission to have the *Codex Vaticanus* No. 1209 photographed; a mode of copying manifestly superior to all others, from its certain accuracy, being equally free from the chance of errors by accident or design. "It is," he says, "probably the oldest Greek MS. of the Scriptures extant. The second volume contains the whole of the New Testament, with the exception of a few verses." If one manuscript can be photographed successfully, and that an ancient one, nearly all might; and then learned bodies and owners of private collections of MSS. might exchange copies, just as casts are now exchanged by the museums of Europe.

BACKING AND PAINTING COLLODION OR PAPER POSITIVES.

Of all the forms of Photography, perhaps a good collodion positive is the most pleasing: its softness and delicate gradation of tone far surpasses the harsh outline and metallic lustre of the Daguerreotype, or the heavy massing of light and shade, 'the soot and whitewash' of a copy on paper: it is therefore of consequence to Photographers to know the best mode and material for "backing up" in order to preserve to it these peculiar excellencies. The first method, as proposed by Dr. Diamond, of simply placing black velvet behind the plate, leaves little to be desired: the velvet can be readily applied and at the same time preserved from creasing by being pasted on to paper, the edges of which can be turned over and pasted round the glass; it is, however, an improvement if the picture be first coated with a film of transparent varnish, such as gum damar or powdered amber dissolved in chloroform, and run on the plate in the same way as the collodion: this not only prevents the velvet from rubbing the picture, and the paste from acting on it chemically, but also imparts to it something of that beautiful tone which marks the pictures when wet and which they lose on drying. It is a slight objection to the above method that the velvet will often exhibit a whitening of its threads. but more serious is the objection arising from its expensiveness: a cheaper method has accordingly been employed by pouring a black varnish (such as the black Japan, or Coachmaker's varnish) over the picture, but in order to prevent the whites of the picture from being affected, it is necessary first to give a coating of the transparent varnish above mentioned, and even then, this object is not fully attained; for, the solvent of the two varnishes being the same, they act on each other and cannot be removed without destroying the collodion film; this defect is, however, obviated by using for the black a water-varnish instead of a bituminous one; that used by bootmakers for polishing patent-leather is found to answer perfectly, it dries readily and can at any time be dissolved off without injuring the film of transparent varnish or the picture. A third method has been proposed of applying a black varnish to the other side of the plate; this, however, has the great drawback of presenting objects in reverse like the Daguerreotype.

For painting the pictures on glass, three ways are open: either to lay dry colour on the collodion picture as in the Daguerreotype, or to varnish with a transparent film, and paint in either oil or water colours on that, or lastly, to paint on the reverse side of the plate: either of these methods is good enough for such as affect this meretricious style.

For colouring positives on paper, the most obvious mode is to apply colour to the face of the picture, in fact to make a painting of it, so that it ceases to be a "Photograph" and becomes a picture, by the hand of an artist more or less skilful, of which the outline only has been sketched by Photography. Another method however has been proposed, and was published in the *Genie Industriel*, by M. Minotto, and a patent seems to have been taken out for it in England by a Mons. Duppa, in July, although there can be little doubt that this must have been granted through inadvertence, as its claim could not possibly be supported. This consists in applying to positives on paper the process used many years ago for colouring Lithographs, under the title of CHROMO-LITHOGRAPHY; for this purpose the paper was varnished or waxed so as to be rendered transparent, and the colours were daubed upon the reverse side so as to shine through. Though inartistic in the extreme, this work is said to give passable results.

There can be no doubt that these plans of colouring Photographs, however repugnant to science, are legitimate exercises of art, and furnish a cheap and easy mode of supplying portraits without any heavy call either on the purse of the patron or the skill of the artist; but a system extensively pursued in the United States must be placed in quite a different category. We have reason to believe that hardly a photograph issues from a professional gallery in the U. S. which has not been first *doctored* by the Manipulator, touching up and supplementing defective bits, and painting over and obliterating blotches and blemishes. This practice cannot be too severely reprobated, as the Photographer thus lays claim under false colours to a degree of excellence in his art from which it is certain he is removed *toto cœlo*. In the eyes of a genuine Photographer, the man who doctors a picture is an impostor to the public and a traitor to science.

J. B. C.

BUST OF TENNYSON.

The Edinburgh Correspondent of the *Inverness Advertiser* says—Mr. Brodie returned from the Isle of Wight a few days ago with what seems to be an admirable clay model for a bust of Alfred Tennyson, which has been commissioned, I believe, by one of our Edinburgh merchants, a man of taste and a great admirer of the poet. The bust in plaster will probably be sent to the Royal Scottish Academy's Exhibition this year, and it will doubtless excite a good deal of attention, for the likeness which Mr. Brodie has taken of the Laureate is really almost the only one in existence—at least it is the only one which gives a true idea of the poet's present appearance." On the same subject a writer in the Scottish Press remarks:—"As this work has been publicly referred to, we may state that we had an opportunity of seeing it in Mr. Brodie's studio, and in addition to what is said regarding it, we do not hesitate to express our belief that when the bust is exhibited, it will be generally pronounced to be the artist's highest effort in portrait sculpture. The clay model has been very carefully prepared. Mr. Brodie spent several days with Mr. Tennyson in the Isle of Wight, and had ample opportunities, of course, of studying his physiognomy—opportunities which are not often afforded, but which are of the highest value to the artist. He finished his model before returning home, and the bust may therefore be considered as complete as it was possible to make it in its present stage. The head is a very noble one, remarkable for its elevation at what phrenologists call the organ of veneration, and for the breadth and height of the forehead, over which the hair curls or rolls with a natural careless gracefulness. The features are large, and all the lines of the face powerful and strongly marked. The head is indicative alike of intellectual and physical power."

Mr. Brodie is well known as a young sculptor of great promise, and entirely self-taught. He executed a marble bust of Dante some years ago, for the late Lord Rutherfurd, which attracted great and deserved attention. He is now engaged on a beautiful statue designed to embody his idea of Œnone,—the Œnone of Tennyson's exquisite poem bearing that name.

CANADIAN INSTITUTE.

SESSION 1855-56.

THIRD ORDINARY MEETING—12*th January*, 1856.

E. A. MEREDITH, Esq., Vice President, in the Chair.

The following Gentlemen were elected Members:

R. S. JAMESON, Esq., Toronto.
T. S. HILL, Esq., Yorkville,
DOCTOR HASWELL, Toronto.
C. E. ANDERSON, Esq., Toronto.
W. McD. DAWSON, Esq., C. L. Dep't., Toronto.
G. W. WICKSTEED, Esq., Leg. Ass'y, Toronto.
EDMUND MORRIS, Esq., Toronto.
JOSEPH T. KERBY, Esq., Toronto.

Life Member.

John Page, Esq., Matilda.

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

Presented by M. De L. A. Huet Latour, N. P.—

Les Servantes de Dieu en Canada, 1853.

Essai de Logique Judicaire.

Catéchisme de l'Histoire du Canada, par M. Bibaud.

Court Traité sur l'Art Epistolaire.

Presented by the Hon. J. M. Broadhead, Washington, per A. H. Armour.

Smithsonian Report, 1854.

Statistical History of the United States' Navy, 1775 to 1853.

Report of the United States Coast Survey for year 1852.

The following Papers were read:

1. By Capt. Noble, Royal Artillery, F. R. S., "On the value of the Factor in the Hygrometric Formula."

2. By Professor Cherriman, M. A., "On a Method of reducing the general Equation of the second degree in plane co-ordinate Geometry."

3. By Professor Chapman, "Report of the Committee appointed to examine a specimen of the Proteus exhibited before the Institute."

4. By Professor Croft, D. C. L., "On some new Salts of Cadmium, and on the Iodides of Barium and Strontium."

MEAN RESULTS OF METEOROLOGICAL OBSERVATIONS AT HAMILTON, CANADA WEST, FOR THE YEAR 1855.

BY DR. CRAIGIE.

1855.	THERMOMETER.					BAROMETER.			DAYS.			YEARS.
MONTHS.	Mean at 9 a.m	Mean at 9 p.m.	Mean of both.	Highest.	Lowest.	Mean.	Highest.	Lowest.	Rainy.	Slight Showers.	Dry.	Mean Temperature of
	°	°	°	°	°	°	°	°				°
January	28·9	29·86	29·37	60	0	29·65	30·50	28·70	3	11	17	1846...50·215
February	18·857	19·43	19·143	45	—20	29·626	30·05	29·20	4	10	14	1847...48·163
March	31·22	33·00	32·11	60	11	29·559	30·04	29·00	3	8	20	1848...49·295
April	45·8	45·16	45·48	82	15	29·694	30·03	29·32	2	8	20	1849...48·105
May	58·0	55·9	56.95	85	36	29·6	29·98	29·40	1	5	25	1850...48·732
June	63·03	62·23	62·63	93	35	29·593	29·84	29·05	6	5	19	1851...48·756
July	72·1	71·2	71·65	96	50	29·71	29·90	29·48	2	12	17	1852...48·248
August	69·06	67.1	68·08	96	44	29·7465	30·02	29·28	3	3	25	1853...49·474
September	64·76	63·63	64·2	91	38	29·787	30·03	29·40	3	7	20	1854...49·013
October	48·13	47·65	47·89	83	30	29·586	29·90	29·16	5	8	18	1855...47·316
November	40·86	41·3	41·08	64	21	29·707	30·13	29·03	4	8	18	——
December	29·13	29·29	29·21	55	0	29·616	30·16	28·54	6	8	17	Mean 48·732
Mean temperature of Year			47·316			29·6645		42		93	230	

MONTHLY METEOROLOGICAL REGISTER, AT THE PROVINCIAL MAGNETIC OBSERVATORY, TORONTO, CANADA WEST—DECEMBER, 1855.

Latitude—43 deg. 39.4 min. North. Longitude—79 deg. 21 min. West. Elevation above Lake Ontario, 108 feet.

Day.	Barom. at temp. of 32°. 6 A. M.	2 P. M.	10 P. M.	MEAN	Temp. of the Air. 6 A. M	2 P. M	10 P M	ME'N	Mean Temp. + or — of the Av'age.	Tension of Vapour. 6 A. M	2 P. M	10 P M	ME'N
1	29.382	29·277	29.174	29·269	38.1°	45.9°	42.5°	41.8°	+ 11.0°	0.154	0.207	0.217	0.194
2	28.966	28·880	—	—	40·9	44·7	—	—	—	235	233	—	—
3	29.244	29·356	·499	·380	33.5	33·7	31.7	32.8	+ 2.7	177	138	143	146
4	.626	.634	·677	.654	32·3	38.8	34.2	34·2	+ 4.5	149	135	154	144
5	·706	·698	.684	·698	31.6	44.4	38·8	37.5	+ 8.1	151	168	178	167
6	.636	·632	.777	·697	38·8	42.7	33.5	37.8	+ 8.8	216	182	151	179
7	.950	30.014	30.001	.992	32·3	38.6	28.7	32·8	+ 4.1	162	136	134	141
8	.857	29·630	29·351	.577	34.1	36.8	37·0	36.0	+ 7.5	158	154	208	175
9	28.807	28.459	—	—	37.7	43.9	—	—	—	213	272	—	—
10	28.740	28·979	·266	·029	29.1	25·5	20.0	24.0	— 3.9	143	114	069	103
11	29 559	29.763	.956	·786	18·3	24.9	21·2	21·3	— 6.4	058	085	073	074
12	30.119	30.151	30·041	30.102	21·0	26.6	27·3	24.7	— 2.7	096	104	131	109
13	29.969	29.963	30.079	30·007	26.6	30·9	19·5	25.7	— 1.5	127	143	091	120
14	30.084	29·964	29.760	29·926	21·2	32.0	35.5	30.3	+ 3.3	102	153	192	152
15	29.582	·598	·682	·626	39·5	40.8	36.0	38.4	+ 11.7	216	226	163	195
16	.544	.398	—	—	35·2	39.3	—	—	—	182	214	—	—
17	.450	.424	·530	·477	32·9	35.7	26.4	31·3	+ 4.9	162	121	125	133
18	.703	·818	·918	·825	21·2	24.5	21.3	22.1	— 4.1	091	062	085	081
19	.910	·889	·946	.924	19.7	27·6	19.8	22.1	— 3.9	090	165	089	093
20	.966	.897	.770	·865	17·6	32·9	34.1	28.4	+ 2.5	083	149	162	131
21	.504	·352	·438	·435	36·2	41.2	39·8	38.7	+ 12.9	150	189	176	168
22	·508	.311	.122	.312	34.1	32.7	32.7	32.9	+ 7.2	177	156	164	165
23	.355	.359	—	—	30.5	36.1	—	—	—	155	177	—	—
24	·965	30·027	·972	·985	15.8	19·8	16.5	16.9	— 8.6	073	078	077	075
25	·747	29·600	—	—	16.0	18·0	—	—	—	080	084	—	—
26	.596	.722	·915	·775	10.8	15·8	10.2	11.1	— 14.2	067	053	057	057
27	30.014	30·052	·997	30.017	7·2	17.8	16.3	13.3	— 12.0	052	068	067	064
28	29.833	29.829	.998	29·898	15.1	19.7	5 0	12.3	— 12.9	076	078	051	061
29	.949	·769	·267	·608	-2.1	9.8	11.1	6·6	— 18.6	027	056	070	052
30	.262	.377	—	—	4.5	22.2	—	—	—	048	092	—	—
31	·662	.671	707	·686	14·4	22.4	18.3	17.7	— 7.5	070	105	081	082
M	29·701	29.697	29.701	29.702	24.8	30.5	26.3	27.0	— 0.10	0.121	0.127	0.124	0.123

Day.	Humidity of Air. 6 A. M	2 P. M	10 P. M	M'N	Direction of Wind. 6 A. M.	2 P. M.	10 P. M.	Mean Direction.	Velocity of Wind. 6 A. M	2 P. M	10 P M	ME'N	Rain in Inches.	Snow in Inches.
1	.68	.78	.81	.76	S W	S S W	S S W	S 31° W	11.2	20.6	9.6	10.31	...	...
2	93	80	—	—	S b W	W b N	W S W	W 15 S	5.8	26.0	13.0	14·25	0.145	...
3	93	71	80	78	W b S	W b S	W	W 6 S	12.2	20.3	12.2	15.55	...	Inp
4	81	58	78	74	W	S W	W S W	W 28 S	14.5	12.0	5.6	10.05	...	...
5	84	58	76	75	S W b W	S W b S	S S W	S 35 W	5.5	12.8	2.8	6.91	0.030	...
6	93	67	79	79	S W	W	W b N	W	8·2	12.9	6.5	9.02	Inap	...
7	89	58	84	78	W b S	N W	N E b E	N 6 W	5.7	6.2	4.0	7.00	...	...
8	79	71	95	82	E S E	E S E	E S E	E 21 S	12.6	11.7	9.5	11.78	1.030	...
9	95	96	—	—	E b S	W	S W b W	W 34 S	21.0	10.4	14.2	17.84	0.140	Inp
10	89	80	61	76	W b S	N W	N W b W	W 29 N	21.0	18.6	26.2	19.30	...	Inp
11	55	61	63	63	W b N	N W b N	W N W	W 29 N	13.3	23.2	14.4	15.59	...	...
12	82	71	86	80	N W	S S E	E S E	E 2 S	10.5	5.7	7.9	6.82	...	0.6
13	87	82	82	84	N N E	N N E	N b W	N 1 W	6.8	5.0	5.6	5.57	...	...
14	85	85	93	87	N N W	E	E b S	E 1 S	5.8	14.4	19.0	14.15	0.485	...
15	90	89	78	84	E	S S W	S W	S 40 W	8.5	6.2	3.2	4.29	0.015	...
16	89	90	—	—	S E b E	W N W	S W	W 34 S	0.9	5.0	12.8	6.73	...	...
17	87	58	86	76	S W b W	W b S	W	W 5 S	9.4	21.5	22.6	17.91	...	0.1
18	78	46	73	67	W b S	W N W	S W b W	W 2 N	18.8	19.5	2.6	10.66	...	...
19	81	69	80	76	W N W	S W b S	N b W	N 41 W	6.5	2.6	4.2	3.54	...	...
20	81	79	82	80	N N W	S S E	S E	S 23 E	3.0	9.9	5.8	6.73	...	...
21	71	73	73	72	S E b S	S S W	W b N	S 35 W	9.4	8.2	11.7	9.69	...	...
22	91	85	89	89	N N E	E N E	N	N 36 E	6.8	15.6	11.0	11.03	...	4.6
23	91	84	—	—	S W b W	S W b S	W	W 14 S	6.5	16.2	17.4	14.23	...	...
24	78	71	80	76	W b N	W	N	N 29 W	9.8	1.8	5 5	6.58	...	5.2
25	84	82	—	—	N E	N b E	N	N 9 E	13.0	8.0	9.8	9.68	...	3.8
26	88	53	77	74	N W	W b S	W S W	W 10 S	5.4	27·8	14.8	16.51	...	...
27	79	66	70	75	W b S	W b S	W b S	W 16 S	24.6	26.8	12.5	16.59	...	0.2
28	84	71	85	78	W	N W	N	W 41 N	8.0	21.0	2.0	9.28	...	...
29	62	77	90	77	N b E	N E	N E	N 29 E	9.0	16.1	19.8	16.28	...	15.0
30	83	75	—	—	W	W S W	W S W	W 22 S	8.7	14.0	24.8	16.56	...	...
31	78	85	78	79	W S W	W S W	W S W	W 26 S	12·2	15.2	11.8	12·43	...	...
M	.81	.70	.80	.77				W 2 S	10.15	14.04	11.06	11.38	1.845	29.5

Highest Barometer .... 30.201 at 10 a. m., on 12th } Monthly range=
Lowest Barometer .... 28.459 at 2 p. m., on 9th } 1.742 inches.

Greatest Barometric range in 24 hours, from 2 p. m., of 8th to 2 p. m., of 9th.. } = 1.171 inches.

Highest registered temperature............ 47°0 at p. m., on 9th } Monthly range=
Lowest registered temperature............ -5°2 at a. m., on 29th } 52°2

Mean maximum Thermometer......... 32°91 } Mean daily range = 14°16
Mean minimum Thermometer......... 18°75 }

Greatest daily range .... 25°6 from p. m. of 28th to a. m. of 29th.
Least daily range.............................. 6°8 from p. m. of 8th to a. m. of 9th.

Warmest day........... 1st ... Mean temperature......... 41°78 } Difference = 35°18.
Coldest day...............29th ... Mean temperature......... 6°60 }

Greatest intensity of Solar Radiation ... +58°0 on p. m. of 9th } Monthly range=
Lowest point of Terrestrial Radiation... −11°5 on a. m. of 29th } 69°5

Aurora observed on 4th, from 10.30 p. m., till midnight; possible to see aurora on 13 nights; impossible to see aurora on 18 nights.

Rain fell on 6 days, amounting to 1.845 inches—raining 28.8 hours. Snow fell on 10 days, amounting to 29.5 inches—snowing 54.7 hours.

Mean of cloudiness 0.67; most cloudy hour observed, 4 p. m., =0.74; least cloudy hour observed, 10 p. m., =0.59.

Halo's observed round the moon on 1st. at 6 a. m., diameter 45°0; on 18th, at 10 p. m., diameter 44°0; on 20th, at 10 p. m., diameter 45°0; on 26th, at 6 a. m.

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

North.	West.	South.	East.
1825.54	5358.60	1990.35	1404.06

Mean direction of the wind, W 2° S.

Mean velocity of the wind............ 11.38 miles per hour.

Maximum velocity .... 30.8 miles per hour, from 7 to 8 p. m., on 23rd.

Most windy day .... 10th...Mean velocity 19.30 miles per hour.

Least windy day .... 19th...Mean velocity 3.54 ditto.

Most windy hour .... 1 to 2 p. m....Mean velocity 13.87 ditto.

Least windy hour............ 7 to 8 a. m....Mean velocity 9.04 ditto.

Mean diurnal variation ... 4.83 miles.

MEAN temperature 0°8 above the average of 16 years.

RAIN..................... 0.323 inches above the mean of 15 years.

SNOW..................... 15.3 inches above the mean of 13 years and more than double the average; only once equalled, *i. e.* in December, 1850.

WIND..................... 4.13 miles per hour above the mean, being the greatest monthly mean velocity yet recorded.

BAROMETER.......... The greatest barometric depression ever recorded, occurred on Sunday, 9th December, at 2 p. m.

COMPARATIVE TABLE FOR DECEMBER.

YEAR.	Temperature.					Rain.		Snow.		Wind.	
	Mean.	Diff. from Aver.	Max. obs'd.	Min. obs'd.	Range.	Days.	Inch's.	Days.	Inch's.	Mean Direc'n.	Mean Force or Velocity.
	°	°	°	°	°						
1840	24.3	— 1.9	41.0	— 4.4	45.4	3	Inapp	18	...	...	...
1841	28.7	+ 2.5	45.5	+ 2.4	43.1	7	6.600	5	...	...	1.83 lbs.
1842	24.7	1.5	40.3	+ 3.8	36.5	3	0.880	17	...	...	0.61 "
1843	30.0	+ 3.8	41.1	+ 2.7	38.4	6	1.040	8	8.1	...	0.53 "
1844	28.2	+ 2 0	48.9	— 0.8	49.7	6	Imp't	6	4.2	...	0.40 "
1845	21.1	— 5.1	37.6	— 2.7	40.3	2	Inapp	12	4.7	...	0.70 "
1846	27.5	+ 1.3	49.2	+ 3.7	45.5	5	1.215	9	6.0	...	0.57 "
1847	30.1	+ 3.9	50.0	+ 6.6	43.4	7	1.185	8	6.8	...	0.35 "
1848	29.1	+ 2.9	49.1	+ 0.6	48.5	7	2.750	7	16 5	W 7° S	5.44 miles.
1849	26.5	+ 0.3	41.3	— 5.2	46.5	5	0.840	12	9.6	W 8° N	6.23 "
1850	21.7	— 4.5	48.3	— 9.7	58.0	2	0.190	18	29.5	N 44° W	7.40 "
1851	21.5	— 4.7	43.8	—10 5	54.3	6	1.075	15	10.7	W 8° N	7.37 "
1852	31.9	+ 5.7	51.0	+13.9	37.1	7	3.995	10	20.1	W 21° S	6.54 "
1853	25.3	— 0.9	42.2	— 5.2	47.4	4	0.625	13	22.3	N 38° W	4.98 "
1854	21.9	— 4.3	41.8	— 5.9	47.7	5	0.590	12	17.2	W 43° N	8.66 "
1855	27.0	+ 0.8	45.9	— 2.1	48.0	6	1.845	10	29.5	W 2° S	11.38 "
Mean	26.22	...	44.81	— 0.80	45.61	5.1	1.522	11.2	14.2	...	0.64 lbs. 7.25 miles.

MONTHLY METEOROLOGICAL REGISTER, AT THE PROVINCIAL MAGNETIC OBSERVATORY, TORONTO, CANADA WEST.—JANUARY, 1856.

Latitude. 43 *deg.* 39·4 *min. North.* *Longitude.* 79 *deg* 21 *min. West.* *Elevation above Lake Ontario,* 108 *feet.*

Day.	Barom. at temp. of 32°.				Temp. of the Air.				Mean Temp. + or — of the Av'age.	Tens. of Vapour.				Humidity of Air.				Direction of Wind.			Mean Direc-tion.	Velocity of Wind.				Rain in Inches.	Snow in Inches.
	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M	2 P.M	10PM	ME'N		6 A.M	2 P.M	10 P.M	M'N	6 A.M	2 P.M	10 P.M	M'N	6 A.M.	2 P.M.	10 P.M.		6 A.M	2 P.M	10PM	ME'N		
1	29.802	29.922	29.999	29·9183	° 15·8	° 21.2	° 20·5	° 18·65	° — 6.57	.077	.085	.098	.085	.83	.73	.86	.81	SW b W	W S W	Calm	W 10° S	5.0	6.2	0.0	4.64	...	...
2	.994	.845	·737	.8432	12·8	28.9	21.9	21·82	— 3.38	063	109	106	097	77	68	87	79	N	SE b S	N E	E 3 S	2 6	4.2	0.5	2.16	...	...
3	.545	.522	·928	.6853	24.8	28.5	15.3	21.52	— 3 63	115	115	066	093	84	73	71	75	NW b W	W b S	W S W	W	0.7	19.6	14.0	13.63	...	...
4	30.136	30.231	30·172	30.1795	9.1	12·2	12.4	11.88	—13.25	054	062	052	057	76	77	64	72	N b E	N b W	N b E	E 17 N	4.6	3.2	5.4	6.53	...	In p
5	29.970	29.798	29.726	29·8330	17.2	14.1	12.0	13 60	—11.53	081	063	068	070	81	84	83	81	E b S	NE b N	N E b N	N 38 E	20.2	16.8	12.5	14.73	...	2.0
6	.757	.773	—	—	8.6	19.7	—	—	—	058	090	—	—	83	81	—	—	N	SW b W	W	S 32 W	10.0	4.8	0.2	6.55	...	...
7	.664	.321	·343	29·4342	22·8	31.7	22.6	24·78	— 0·35	105	148	101	124	83	83	81	87	S S E	S b W	W b S	S 43 W	12.5	13.7	17.2	17.82	...	1,0
8	.452	.506	·612	.5300	128	—0.3	—4.3	-1.87	—27.00	035	038	021	032	69	83	50	72	W S W	W S W	W b S	W 14 S	23.6	28.8	21.0	24.19	...	...
9	.624	.607	·649	.6295	—1.1	0.4	—4.3	-4·63	—29·77	028	034	034	033	1.00	71	90	85	W b S	W b S	W S W	W 14 S	27.6	23·0	16.6	20.56	...	...
10	.713	.785	30·006	.8525	6·5	23·4	16.2	15.02	—10·03	045	091	084	074	.70	71	88	78	W S W	W N W	W b S	W 1 S	24·7	23.4	10.2	16.29	...	In p
11	30.048	30.062	30.055	30·0502	15·2	18.6	2.0	9.62	—15.43	071	080	029	060	79	76	67	76	SW b W	S W b S	Calm	W 23 S	11.8	11.1	0.0	7.25	...	...
12	29.975	29.776	29·621	29.7698	8.3	29.1	28.7	22.60	— 2.48	061	136	151	116	90	84	96	89	N	E	E	E 12 N	5.0	16.0	22.0	15.45	...	4.4
13	.370	·270	—	—	24.1	23·0	—	—	—	126	115	—	—	96	90	—	—	N E b N	N	N N W	N 2 E	12.0	17.0	6.2	11.64	...	2.8
14	.459	.503	.550	·5105	18·3	21.3	17.1	18.58	— 6.52	098	092	088	088	94	78	89	84	N N W	N b W	NW b N	N 25 W	15.4	10.0	8.5	11.17	...	0,1
15	.572	·510	·508	.5275	16·9	24.1	9·3	17·43	— 7.67	083	104	061	081	84	77	85	79	N W	NW b N	W b N	W 19 N	11.3	12.0	7.3	8.71	...	...
16	.382	.197	·202	·2497	18.6	25·3	24.8	23.03	— 1.97	084	121	108	103	80	87	79	80	S W	SW b W	W S W	W 24 S	18.4	18.1	13.0	15.54	...	0.5
17	.238	·265	.402	·3122	25·1	33.0	29·8	29·30	+ 4.28	112	169	142	139	81	90	86	85	W	W S W	SW b W	W 23 S	15.2	11 9	13.3	8.73	...	...
18	.435	.424	.436	.4348	29 1	32.9	29.3	29·95	+ 4.98	143	166	131	142	89	89	84	85	W b S	S W	N	N 38 W	1.0	7.8	11.2	7.47	...	In p
19	.539	·730	·803	·7112	18.3	11.2	3.6	10.40	—14.48	091	048	042	057	88	63	74	74	N	N	N	N 5 E	15.0	11.2	13.2	11.64	...	...
20	.772	.690	—	—	0.2	6.9	—	—	—	032	049	—	—	68	75	—	—	N b E	N	N N W	N 4 W	10.6	15.6	4.4	9.37	...	...
21	.611	·615	.645	.6297	10·2	13.3	5.2	9·45	—15.33	062	055	046	052	83	65	77	72	N	N N W	N W	N 25 W	13.4	11.0	5.2	9.43	...	...
22	.612	·608	·662	·6357	7.6	24·4	24 4	18.05	— 6.72	055	115	113	090	83	86	84	84	Calm	Calm	W b N	W 6 N	0.0	0.0	4.0	2.59	...	1.2
23	·710	·697	.702	7072	14.1	24.6	18.5	19.23	— 5.43	077	098	085	085	87	72	81	78	W N W	S W	SW b W	W 27 S	6.3	13.4	15.8	12·65	...	...
24	.637	.577	.872	.7160	16.5	22.9	13.3	16·80	— 7.77	077	080	061	071	80	64	72	71	SW b W	W S W	NW b N	W 21 N	18.0	21.0	12.0	17·48	...	In p
25	30.144	30.260	30.280	30.2338	—1.1	9·3	—2.1	2.42	—22.17	031	057	028	035	67	81	61	63	NW b N	W N W	W b S	N 42 W	15.5	8.0	4.1	9.20	...	...
26	30 265	30·134	29·982	30.1090	1·1	21.6	7.1	10.15	—14.33	033	081	053	058	66	69	81	74	W N W	SW b W	Calm	N 6 W	5,8	2.2	0.0	3.81	...	...
27	29.758	29.492	—	—	12.2	20·8	—	—	—	069	096	—	—	83	83	—	—	N N E	N E	N E b N	N 34 E	8.0	14.3	13.0	10.19	...	1.1
28	.176	·252	·418	29.2898	18 7	23.8	23.7	21.93	— 2.37	093	107	099	098	88	82	75	81	NE b N	Calm	W b N	N 27 W	8 2	0.0	5.4	2.96	...	0.3
29	.465	·398	.327	.3993	10.8	25 8	24.0	21·33	— 2.87	061	109	108	094	80	76	82	78	W N W	W S W	SW b W	W 21 S	0.5	9.6	11.5	8.23	...	0.2
30	.304	·333	.484	.3847	18·3	21.0	12.2	16.52	— 7.58	081	075	063	071	78	65	79	74	W b S	W S W	W b S	W 16 S	16.6	18.9	16.8	16.86	...	In p
31	·589	.527	.405	.5018	11.4	18.7	15.1	15.03	— 8.95	061	083	072	071	78	78	80	77	W S W	S W b S	Calm	W 32 S	14.8	1.8	0.0	3.91	...	...
M	29.6689	29.6446	29.6854	29·6696	13 19	20.67	14.60	16.02	— 8.78	.073	.093	.078	.080	.81	.76	.79	.78	W 15° N	W 4° N	W 24° N	W 15 N	11.43	12.08	9.18	10.69	none	13.6

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR JANUARY.

Highest Barometer .... 30.280 at 10 p. m. on 25th } Monthly range=
Lowest Barometer .... 29.186 at midnig't on 16th } 1.094 inches.

Highest registered temperature .... 34°4 at p. m. on 18th } Monthly range=
Lowest registered temperature ....—12°1 at a. m. on 9th } 46°5

Mean maximum Thermometer .... 22°65 } Mean daily range = 16°63
Mean minimum Thermometer......... 6°02 }

Greatest daily range......................... 34°6 from p. m. of 7th to a. m. of 8th.
Least daily range .... 8°4 from p. m. of 13th to a. m. of 14th.

Warmest day............ 18th ... Mean temperature.......... 29°95 } Difference= 34°58.
Coldest day............... 9th ... Mean temperature......... −4°63 }

Greatest intensity of Solar Radiation...... 44°6 on p. m. of 3rd } Monthly range=
Lowest point of Terrestrial Radiation ... −19°8 on a. m. of 9th } 64°4

Aurora observed on one night, viz., on the 15th; possible to see aurora on 12 nights; impossible to see aurora on 19 nights.

Snowing on 14 days, depth 13.6 inches—snowing 88.4 hours. No rain fell during this month at the Observatory.

Mean of cloudiness 0.66; most cloudy hour observed, 8 a. m., =0.73; least cloudy hour observed, midnight, =0.59.

No thunder or lightning recorded this month.

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

North.	West.	South.	East.
2621.41	4734.20	1585.27	972.97

Mean direction of the wind, W 15° N.
Mean velocity of the wind............ 10.69 miles per hour.
Maximum velocity .... 30.4 miles per hour, from 1 to 2 p. m. on 8th.
Most windy day .... 8th...Mean velocity 24.19 miles per hour.
Least windy day........................ 2nd...Mean velocity 2.16 ditto.
Most windy hour...... noon to 1 p. m....Mean velocity 12.34 ditto.
Least windy hour ... 11 p. m. to mid't...Mean velocity 9.02 ditto.
Mean diurnal variation ... 3.32 miles.

The mean temperature of the month, and the absolute maximum temperature of the month, were the lowest ever recorded for January.

No rain fell during the month. This deficiency of rain was not compensated by any unusual amount of snow, the quantity of snow having scarcely differed from the average.

This month was the most windy January on the records of the Observatory.

COMPARATIVE TABLE FOR JANUARY.

Year.	Temperature.					Rain.		Snow.		Wind.	
	Mean.	Diff. from Aver.	Max. obs'd.	Min. obs'd.	Range.	Days.	Inch's.	Days.	Inch's.	Mean Direc'n.	Mean Force or Velocity.
	°	°	°	°	°						
1840	17.0	— 6.8	40.6	—13.8	54.4	4	1.395	11	...	...	...
1841	25.6	+ 1.8	41.7	— 4.1	45.8	2	2.150	14	...	...	0.36 lbs.
1842	27.9	+ 4.1	45.8	+ 1.3	44.5	5	2.170	9	...	...	0.78 "
1843	28.7	+ 4.9	54.4	+ 1.5	52.9	6	4.295	12	14.2	...	0.69 "
1844	20.2	— 3.6	44.6	— 7.7	52.3	7	3.005	11	24.9	...	0.70 "
1845	26.5	+ 2.7	43.0	— 3.4	46.4	5	Imp't.	9	22.7	...	0.70 "
1846	26.7	+ 2.9	41.2	+ 0.3	40.9	5	2.335	10	6.0	...	0.55 "
1847	23.3	— 0.5	42.6	— 2.2	44.8	7	2.135	5	7.5	...	1.09 "
1848	28.7	+ 4.9	51.5	—12.0	63.5	7	2.245	8	7.1	W 9° N	5.82 miles.
1849	18.5	— 5.3	40.1	—15.2	55.3	4	1.175	10	9.2	W 27° N	6.71 "
1850	29.7	+ 5.9	46.3	+10.6	35.7	5	1.250	8	5.2	N 37° W	5.80 "
1851	25.5	+ 1.7	43.2	—12.8	56.0	4	1.275	10	7.8	W 13° S	7.69 "
1852	18.4	— 5.4	37.3	— 7.0	44.3	0	0.000	19	30.9	W 22° N	7.67 "
1853	23.0	— 0.8	40.9	— 6.6	47.5	1	0.290	6	7.5	N 27° W	6.34 "
1854	23.6	— 0.2	45.2	— 4.3	49.5	7	1.270	11	7.5	W 12° N	6.86 "
1855	25.9	+ 2.1	48.2	— 4.7	52.9	5	0.525	13	23.3	W 10° N	7.67 "
1856	16.0	— 7.8	33.1	—12.1	45.2	0	0.000	14	13.6	W 15° N	10.69 "
Mean	23.83		43.51	— 5.42	48.94	4.4	1.595	10.6	13.4		7.25 miles.

MONTHLY METEOROLOGICAL REGISTER, ST. MARTIN, ISLE JESUS, CANADA EAST—DECEMBER, 1855.

(NINE MILES WEST OF MONTREAL.)

BY CHARLES SMALLWOOD, M. D.

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

Day.	Barom. corrected and reduced to 32° Fahr.			Temp. of the Air.			Tension of Vapor.			Humidity of Air.			Direction of Wind.			Velocity in miles per hour.			Rain in Inches.	Snow in Inches.	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0.		
	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.			6 A.M.	2 P.M.	10 P.M.
1	29.545	29.482	29.440	25.5	43.6	35.4	.147	.274	.189	.92	.80	.89	S S E	SbyW	S S E	3.66	2,64	1.23	...	...	Cir. Cum. Str. 4.	Cir.Cum.Str.10.	Str. 4.
2	.246	28.987	28.965	34.2	48.0	42.0	194	290	253	90	83	85	S E	SE by S	S W	6.92	3.31	6.43	0.166	...	Cir. 4.	Cum. Str. 8.	Cir. Str. 9.
3	.239	29.293	29.484	33.0	37.1	32.1	179	167	167	89	70	83	W S W	W S W	S W b W	12.81	17.45	2.54	...	...	Str 2.	Do. 2.	Str. 9.
4	.634	.860	.836	31.0	34.0	33.1	178	186	187	92	87	90	W S W	S W	S W	10.82	11.70	8.44	...	...	Do. 9.	Do. 8.	Cum. Str. 4.
5	.852	.857	.880	25.6	43.1	33.3	147	252	178	92	85	86	S by W	S W	S S W	14.82	4.06	1.23	...	...	Clear.	Clear.	Clear, ft Au. Bo.
6	.857	.767	.805	28.0	37 2	33.0	153	199	199	88	84	96	S E	NEbyN	SW by S	0.20	Calm	0.06	0.133	In p	Do.	Cum. Str. 8.	Snow.
7	.938	30.001	30.124	31.6	32.0	19.1	182	146	103	94	73	82	NWbW	W N W	W by N	6.06	11.05	10.62	...	...	Do.	Clear.	Clear, Aur. Bor.
8	30.083	29·974	29.850	13.1	29.8	19.0	088	152	110	87	84	88	W	W	S E	4.00	1.78	0.08	...	...	Do.	Do.	Do.
9	29.408	.041	28.738	20.0	32.3	30.0	114	191	177	90	95	95	NE byE	NE byE	NE byE	6.22	9·21	12.53	1.900	In p	Snow.	Sleet.	Sleet.
10	28.689	28.820	29.110	32·5	30.6	21.8	197	152	115	95	78	82	S W	W	W S W	12.22	11.06	15.82	...	In p	Cum. Str. 4.	Cir. Str. 10.	Cir. Str. 10.
11	29.560	29.736	.976	11.0	12·6	8.0	087	073	028	93	73	80	W	W	WbyN	17.13	21.18	16.73	...	...	Do. 10.	Do. 8.	Clear, Zod. Light
12	30.177	30.264	30.329	5.5	13.1	7.7	031	083	028	82	81	80	W	W	W byS	17.12	10.55	4.27	...	...	Clear.	Clear.	Do. Aur. Bor.
13	.296	.206	.231	5.0	15.6	10.1	031	078	074	82	73	82	NEbyN	NE byE	N N W	0.38	5.33	2.13	...	...	Do.	Str. 10.	Do. Aur. Bor.
14	.172	·282	.297	20.0	29.1	23.2	114	161	129	87	89	90	W S W	W	NE byE	1.73	1.60	0.27	...	...	Cum. Str. 9.	Cum. Str. 6.	Cum. Str. 9.
15	.119	·101	.091	18.3	32.0	31.1	153	167	178	88	83	92	NE byE	NE byE	NEbyN	9·93	9.07	9.10	...	0.90	Snow.	Snow.	Do. 10.
16	29.839	29·545	29.580	18.5	33.0	33.4	161	199	205	89	99	99	N E	N E	S W	4 68	5.82	0.62	0.388	...	Cir. Str. 10.	Rain.	Rain.
17	.540	·489	.504	31.3	38.1	32.0	185	227	186	96	90	94	S W	S W	S W	9.93	16.00	9.02	0.243	...	Do. 6.	Cir. Str. 4.	Cum. Str. 8.
18	.721	.832	.989	20.5	25.0	21.7	118	128	123	88	80	88	W	W	W	12.15	10.32	7.70	...	...	Clear.	Cir. Cum. Str. 4.	Do. 9.
19	30.139	30.126	30.149	14.2	17.1	7.0	095	096	061	90	83	92	N N W	N E	N E	1.99	3.01	Calm	...	...	Cir. Str. 10.	Do. 5.	Do. 6.
20	.259	.124	.124	0.9	20.9	12.6	042	077	080	84	60	81	NWbW	N E	E by N	0.06	Calm	Calm	...	...	Clear.	Clear.	Cir. Cum. Str. 9.
21	29.923	29.753	29.634	9.4	18.6	31.0	067	097	185	93	79	95	NE byE	NE byE	S by E	2.02	1.27	0.50	...	...	Cir. Str. 10.	Cir. Str. 9.	Cir. Str. 10.
22	.700	.834	.510	33.0	38.9	31.8	187	194	191	90	75	95	W byS	EbyN	NE by E	Calm	0.61	5.63	...	0.40	Do. 9.	Do. 9.	Snow.
23	.346	.533	.589	31.1	35.0	34.4	186	203	204	99	91	98	W	W S W	S S W	13.45	10.42	6.08	0.140	2.60	Rain.	Do. 8.	Cum. Str. 10.
24	30.071	30.173	30.152	14.4	15.8	10.1	091	087	065	86	78	74	W	W byS	NE byE	19.03	9.67	4.64	...	...	Str. 4.	Do. 4.	Str. 10.
25	.058	29.892	29.679	4.2	4.0	5.3	038	051	058	95	80	92	NE byE	NE byN	NEbyN	5.60	18.26	20.23	...	3·40	Snow.	Snow.	Snow.
26	29.435	.620	.916	4.8	9.2	3.8	056	061	050	95	80	85	W N W	W	W	20.16	20.80	14.83	...	2.68	Do.	Clear.	Clear, Zod. Light
27	.954	30.037	30.059	4.2	11.2	8.6	038	077	066	95	83	92	S W	W	S W	3.41	10.76	4.32	...	0.34	Clear.	Cir. Str. 8.	Cir. Str. 8.
28	.914	29.908	30.078	9.3	12.1	3.8	067	080	034	93	83	90	W N W	W by N	N W	4.06	4.17	7.11	...	3.06	Str. 10.	Do. 4.	Clear, Zod. Light
29	30.239	30.196	30.085	23.2	5.1	10.4	014	027	023	87	68	81	W	NEbyN	NE byE	1.11	0.01	5·01	...	...	Clear.	Do. 10.	Str. 10. [Light.
30	29.297	29.407	29.671	1.1	11.2	1.8	043	067	049	92	73	94	NEbyN	W S W	S W	19.22	12.20	7·77	...	6.30	Snow.	Clear.	Clr., Au. Bo. Zod.
31	.731	.845	.852	16.4	26.8	17.5	098	118	102	90	73	88	W W	W S W	S S W	6.37	14.23	1 86	...	0.75	Do.	Cir. Str. 4.	Cir. Str. 10.

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

(NINE MILES WEST OF MONTREAL.)

BY CHARLES SMALLWOOD, M. D.

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

Day.	Barom. corrected and reduced to 32° Fahr.			Temp. of the Air.			Tension of Vapor.			Humidity of Air.			Direction of Wind.			Mean direction of Wind.	Velocity in miles per hour.			Rain in Inches.	Snow in Inches.	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0.		
	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 PM	6 A.M.	2 P.M.	10 P.M.		6 A.M.	2 P.M.	10 PM			6 A.M.	2 P.M.	10 P.M.
1	29.836	30.016	30.241	18.4	17.0	2.1	.106	.096	.052	.87	.83	.89	w s w	w	w n w	w 24 ° s	7.14	20.31	6.34	...	...	Cum. Str. 6.	Clear.	Clr. Zod. L. B.
2	30.283	.233	139	1.1	12.9	3.6	048	064	049	90	63	87	NE by N	NE by E	NE by E	E 37 N	4.25	4.70	6.01	...	Inp	Do. 10.	Cir. Cm. St. 4.	Cir. Str. 2.
3	29.842	29.547	29.614	14.0	24.4	25.0	091	127	129	87	85	82	NE by E	NE by E	w s w	E 43 N	7.54	6.74	2.00	...	6.50	Snow.	Snow.	Do. 10.
4	30.237	30.260	30.520	—5.3	—1.0	—12.6	031	035	019	89	74	63	w n w	w n w	w n w	w 13 N	25.97	15.06	4.74	...	...	Clear.	Clear.	Clr. Zod. L. B.
5	.411	.356	.184	—20.9	—10.1	—4.9	016	023	034	85	76	80	NE by E	NE by E	NE by E	E 35 N	7 37	5.31	16.05	...	...	Cir. Cum. 4.	Cir. Cm. St 10	Str. 10.
6	.081	29.838	.077	—1.8	6 0	—8.1	039	059	029	87	90	84	N E	E N E	N E	N 40 E	21.66	14.51	1.09	...	...	Cir. Cm. St. 9.	Str. 6.	Clr. Zod. L. B.
7	.146	.987	29.901	—13.9	5.4	7.8	023	056	063	90	88	90	E by N	E N E	E N E	E 24 N	0.44	13.20	8.12	...	Inp	Cir. Str. 2.	Cir. Str. 2.	Cir. Str. 6.
8	29.531	.456	.553	18.8	14.6	—0.4	110	069	039	88	64	83	w s w	w by s	w by s	w 12 s	11.68	16.80	18.20	...	2.15	Snow.	Cir. Cm. St. 3.	Clr. Zod. L. B.
9	.639	.641	.642	—9.0	1.0	—7.4	028	044	033	83	80	81	w by s	w by s	w by s	w 12 s	13.41	16.75	10.65	...	...	Cir. Cum. 4.	Cir. Str. 6.	Do.
10	.654	.871	.902	—8.1	8.0	9.0	026	065	067	79	80	87	w by s	w by s	w by s	w 12 s	11.91	28.40	22.15	...	...	Cir. Str. 8.	Do. 6.	Do.
11	30.036	30.051	30.210	6·1	17.0	5.9	059	079	031	89	74	90	w by s	w	N w	w 10 s	17 .10	17.32	6.92	...	...	Clear.	Clear.	Do.
12	·256	.251	.193	4.2	9.1	8.3	056	067	065	93	90	91	E N E	NE by E	NE by E	E 37 N	0.41	2 30	12.13	...	...	Cir. Str. 9.	Cum. Str. 10.	Cir. Str. 10.
13	29.780	29.580	29.454	11.0	13.6	14.0	068	083	091	80	82	87	NE by E	NE by E	NE by E	E 37 N	18.16	23.35	35.27	...	8.70	Snow.	Snow.	Snow, gt. stm.
14	.576	.590	.603	16.2	20.0	17.3	105	107	096	94	82	84	NE by E	N N W	N W b w	N 22 E	28.14	6.47	Calm	...	3.51	Do.	Do.	Do.
15	.614	.536	.562	15.2	27.4	12.7	095	156	088	87	85	87	w n w	w s w	s w by w	w 18 s	Calm	Calm	2.00	...	...	Cir. Str. 6.	Clear.	Clear.
16	.496	.314	.255	11.1	26.1	25.0	087	141	129	93	88	88	w s w	w s w	s w	w 35 s	15.40	7.75	2.22	...	2.80	Str. 10.	Snow.	Cir. Str. 10.
17	.273	.342	.475	23.7	27.9	17.0	135	153	096	90	88	83	w s w	w s w	w n w	w 34 s	3.07	2.40	5.53	...	Inp	Cir. Cum. 4.	Cir. Str. 2.	Clear.
18	.621	.568	.678	15.5	22.9	13.0	105	099	088	90	69	87	w s w	w by N	N w	N 43 w	5.88	6.66	1.56	...	...	Cum. Str. 6.	Cum. Str. 6.	Cir. Str. 8.
19	.811	.849	.982	—3.0	10.7	—4.7	041	065	038	90	80	89	N by E	w s w	w by N	N 16 w	5.00	4.80	4.91	...	...	Clear.	Clear.	Clear.
20	.970	.895	.751	—15.5	9.0	—3.0	019	051	036	80	66	84	s w b s	s w	s w	w 29 N	3.06	0.06	2.41	...	...	Do.	Do.	Light Cir.
21	.738	.621	.689	—12.4	14.0	—1.9	023	067	043	89	71	90	w by s	s w	w s w	w 25 s	0.00	2.10	3.63	...	...	Do.	Do.	Clear.
22	.764	.662	.741	—9.1	19.0	14.5	029	070	085	89	60	93	w by s	w s w	w by s	s 40 w	0.03	1.34	7.53	...	...	Do.	Do.	Cir. Cm. St. 10.
23	.707	.746	.782	9.0	23.0	13.3	067	106	081	90	76	92	w s w	s w by w	s w by w	w 6 s	8.21	13.25	13.00	...	...	Do.	Do.	Clear.
24	.652	.514	.684	20.9	25.8	7.5	112	132	055	96	84	81	s w by w	s w by w	N W b w	w 24 s	22.11	16.43	23.06	...	1.10	Cum. Str. 10	Cum. Str. 9.	Do.
25	30.113	30,168	30.252	—10.3	—0.2	6.2	023	036	030	79	74	76	N W b w	w	w s w	w 18 N	26.61	21.80	12.17	...	...	Clear.	Clear.	Clr. Zod. L. B.
26	.232	.094	.095	—8.0	17.9	7.0	027	098	061	80	87	90	w s w	w s w	s w	w 34 s	7.53	8.46	5.44	...	...	Do.	Do.	Do.
27	29.900	29.712	29.670	—1.9	24.0	3.2	038	112	049	85	79	85	s w	s w	s by E	w 8 s	5·11	1.08	0.03	...	...	Do.	Light Cir. 4.	Do. Aur. Bor.
28	.516	.441	.550	—0.5	11.2	8.5	059	068	065	86	80	95	w n w	NE by E	E by N	E 17 N	1.60	13.22	2.95	...	...	Cir. Cm. St. 6.	Cir. Str. 4.	Do. Zod. L. ft.
29	.680	.598	.561	9.6	26.1	17.5	068	118	089	92	73	89	N E	s s w	s s w	s 18 w	0.07	0.05	0.14	...	Inp	Cum. Str. 6.	Cum. Str. 9.	Cir. Str. 2.
30	.367	.345	.387	12.7	29.1	18.0	073	152	101	87	89	90	s s w	w s w	s w by w	s 10 w	0.05	0.50	6.91	...	2.00	Do. 10.	Snow.	Do. 4.
31	.705	.727	.755	1.4	13.8	1.0	041	074	043	84	80	82	NE by E	w by N	s by w	w 20 s	7.47	6.60	1 87	...	0.50	Clear.	Clear.	Clr. Zod. L. ft.

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

Barometer	Highest, the 12th day	30.329
	Lowest, the 10th day	28.689
	Monthly Mean	29 429
	Monthly Range	1.640
Thermometer	Highest, the 2nd day	50°.4
	Lowest, the 19th day	23°.4
	Monthly Mean	20°.84
	Monthly Range	73°.8

Greatest Intensity of the Sun's Rays .... 90°.2

Lowest Point of Terrestrial Radiation .... 25°.0

Mean of Humidity .... .872

Rain fell on 6 days, amounting to 2.970 inches; it was raining 23 hours 20 minutes.

Snow fell on 12 days, amounting to 20.43 inches; it was snowing 92 hours 15 minutes.

The most prevalent Wind was W—1318.70 miles.

The least prevalent Wind was E by N—2.00 miles.

The most windy day was the 26th; mean miles per hour. 18.56.

The least windy day was the 20th; mean miles per hour, 0.02.

Most windy hour, from 2 till 3, a. m., on the 24th—36.40 miles; resolved with the Four Cardinal Points, gives N 768.20 miles, S 287.20 miles, W 3789.00 miles, E 1108.80 miles; total 5952.20 miles.

Aurora Borealis visible on 5 nights—might have been seen on 7 nights.

Zodiacal Light visible during the month.

The electrical state of the atmosphere has been marked by a very high tension of a negative character.

OZONE—was in moderate quantity, amounting to saturation on the 16th.

EMARKS ON THE ST. MARTIN, ISLE JESUS, METEOROLOGICAL REGISTER FOR JANUARY.

Barometer	Highest, the 4th day	30.520
	Lowest, the 16th day	29 255
	Monthly Mean	29.777
	Monthly Range	1 265
Thermometer	Highest, the 30th day	59°.10
	Lowest, the 5th day	—20°.90
	Monthly Mean	7°.59
	Monthly Range	50°.00

Greatest Intensity of the Sun's Rays .... 79°.4

Lowest Point of Terrestrial Radiation .... —20°.9

Mean of Humidity .... .828

No rain fell during the month.

Snow fell on 12 days. amounting to 28.11 inches; it was snowing 74 hours 40 minutes.

The most prevalent Wind was N E by E—1627.90 miles; it was blowing from this quarter 122, hours. 10 minutes.

The least prevalent Wind was N N W—1.00 miles; it was blowing 1 hour from this point.

The most windy day was the 15th; mean miles per hour, 25.56.

The least windy day was the 29th; mean miles per hour, 0.08.

Most windy hour, from 2 till 3, p. m.. on the 13th—44.40 miles.

The total miles traversed by the Wind was 6351.23 miles, viz.: N 395.40 miles, S 95.77 miles, W 4115.66 miles, E 1744.40 miles.

Aurora Borealis visible on 2 nights—might have been seen on 15 nights—impossible on 14 nights.

The electrical state of the atmosphere has been marked by very high tension.

Electromation almost constantly affected.

OZONE—was in moderate quantity.

This is the coldest January on record here, being 10°.29 less than the mean of January, 1855.

MONTHLY METEOROLOGICAL REGISTER, QUEBEC, CANADA EAST, DECEMBER, 1855.

BY CAPT. A. NOBLE, R.A., F.R.S., AND MR. WM. D. C. CAMPBELL.

Latitude, 46 *deg.* 49.2 *min. North*; *Longitude*, 71 *deg.* 16 *min. West.* *Elevation above the level of the Sea*, 200 *feet.*

Date.	Barometer corrected and reduced to 32 degrees, Fahr. 6 A.M.	2 P.M.	10 P.M.	MEAN.	Temp. of Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Tens. of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N	Humid'y of Air. 6 A.M.	2 P.M.	10 P.M.	M'N	Direc'n of Wind. 6 A.M.	2 P.M.	10 P.M.	Vel'ty of Wind. 6 A.M.	2 P.M.	10 P.M.	Rain in Inches.	Snow in Inches.	Remarks.
1	29.481	29.376	29.376	29.411	° 24.3	° 32.5	° 33.4	° 30.1	.116	.129	.129	.125	0.87	0.70	0.68	0.75	Calm.	W N W	Calm.	0.0	3.8	0.0	...	...	
2	.286	.024	28.900	.070	31.8	38.8	39.3	36.6	139	168	162	155	77	71	68	72	Calm.	E N E	Calm.	0.0	5 2	0.0	.092	...	
3	28.978	.062	29.277	.106	34.1	35.2	29.7	33.0	175	147	092	138	89	71	56	72	W N W	N N W	N N W	14.7	10.9	14.3	...	...	3rd—Auroral arch, altitude of dark segment 8°.
4	29.414	.619	.718	.584	27.3	29.5	30.5	29.1	086	102	127	105	57	62	75	65	N N W	W S W	Calm.	15.2	7.2	0.0	...	...	
5	.737	.780	.809	.775	32.1	35.0	33.2	33.4	136	139	149	141	75	68	79	74	Calm.	W N W	Calm.	0.0	5.2	0.0	...	...	
6	.806	.737	.695	.746	31.1	34.9	31.1	32.4	131	147	148	143	75	73	85	78	Calm.	Calm.	Calm.	0.0	0.0	0.0	...	...	
7	.742	.807	.865	.805	31.0	32.6	26.0	29.9	144	153	101	133	83	83	70	79	N b W	Calm.	W	7.2	0.0	16.0	...	...	
8	.847	.802	.728	.792	20.4	24.3	17.3	20.7	071	072	078	074	62	55	78	65	W	W	S	13.9	9.3	3.8	...	...	
9	.517	.260	28.735	.171	14.3	24.0	26.2	21.5	080	121	144	115	91	92	1.00	94	Calm.	E	E N E	0.0	35.9	39.4	...	8.0	
10	28.536	28.666	.992	28.718	29.3	33.2	22.1	28.2	163	154	096	138	1.00	82	79	87	S E	W S W	W S W	5.2	8.0	13.9	...	...	
11	29.292	29.490	29.705	29.496	13.6	14.3	10.2	12.7	060	059	045	055	71	67	61	66	W S W	W S W	W S W	12.4	10.0	8.0	...	...	
12	.923	30.067	30.201	30.064	1.8	7.3	4.0	4.4	035	042	045	041	69	63	79	70	W N W	W N W	W N W	11.3	10.0	7.2	...	...	
13	30.242	.136	.132	.170	−0.1	12.3	12.8	8.3	035	045	050	043	74	55	60	63	W S W	Calm.	Calm.	3.8	0.0	0.0	...	...	
14	.132	.173	.273	.192	13.5	21.9	13.5	16.3	064	081	057	067	75	67	67	70	W S W	W S W	Calm.	2.0	3.8	0.0	...	1.0	
15	.262	.112	29.985	.120	15.6	19.1	23.0	19.2	075	086	124	095	81	80	98	86	E N E	E N E	E N E	12.4	16.0	13.9	...	.8	
16	29.881	29.618	.394	29.631	26.9	31.2	32.3	30.1	138	174	182	165	93	1.00	1.00	98	E N E	E N E	Calm.	14.7	13.9	0.0	.357	.4	
17	.431	.347	.310	.363	33.5	34.7	32.3	33.5	171	166	160	166	90	82	88	87	Calm.	W	W N W	0.0	5.2	3.8	...	.7	
18	.448	.637	.873	.653	21.8	18.2	14.4	18.1	099	066	062	076	82	64	69	72	W S W	W N W	W N W	12.4	7.2	11.5	...	...	
19	30.016	30.038	30.050	30.035	11.0	13.2	8.3	10.8	054	051	062	056	71	61	91	74	W b N	W b N	W b N	12.4	2.0	2.0	...	...	
20	.066	.055	.050	.057	0.7	11.9	7.2	6.6	048	055	056	053	98	68	86	84	S	W N W	Calm	2.0	3.8	0.0	...	...	
21	29.952	29.738	29.602	29.764	4.1	19.8	24.2	16.0	055	090	107	084	96	80	81	86	Calm.	Calm.	Calm.	0.0	0.0	0.0	...	2.0	
22	.522	.630	.532	.561	26.3	32.4	28.7	29.1	136	168	129	144	95	92	81	89	Calm.	W S W	E	0.0	2.0	15.6	...	4.0	
23	.227	.384	.464	.358	29.5	29.1	30.3	29.6	149	087	169	135	90	54	1.00	81	E N E	Calm.	Calm.	17.9	0.0	0.0	...	2.0	
24	.766	30.036	30.192	.998	26.2	11.9	3.3	13.8	091	045	040	059	63	56	71	63	W S W	W S W	W S W	15.4	10.0	8.0	...	...	24th—At 10, p. m., a lunar halo 60° in diameter.
25	30.144	29.988	29.699	.944	2.7	5.7	5.9	4.8	044	051	055	050	81	82	88	84	E	E N E	E N E	7.2	16.0	34.1	...	10.0	
26	29.153	.373	.702	.409	11.4	2.6	0.2	4.7	059	043	034	045	76	80	71	76	E N E	W	N W	10.9	16.0	13.9	...	3.0	
27	.889	.828	.927	.881	−4.4	8.5	2.3	2.1	030	055	045	043	77	79	85	80	W	N W	W S W	6.2	11.3	8.8	...	...	
28	.849	.713	.953	.838	−0.6	7.7	−7.9	−0.3	046	043	024	037	1.00	64	60	75	W N W	W N W	W N W	5.2	5.2	5.2	...	...	
29	30.056	30.024	.829	.970	−17.6	−9.6	−9.6	−12.3	019	026	027	024	90	87	87	88	W N W	W	E S E	5.2	6.2	3.8	...	2.0	
30	29.378	29.227	.512	.372	5.2	4.9	7.0	5.7	040	045	050	045	65	76	76	72	E N E	E N E	Calm.	16.0	17.9	0.0	...	3.0	
31	.637	.694	.763	.698	8.1	18.0	10.8	12.3	067	064	067	066	1.00	62	88	83	Calm.	W N W	Calm.	0.0	6.2	0.0	...	2.0	
M	29.6648	29.6594	29.6885	29.6709	16.29	20.49	17.48	18.09	.0889	.0927	.0908	.0903	.817	.725	789	.777				6.94	8.01	7.20	.449	38.9	

MONTHLY METEOROLOGICAL REGISTER, QUEBEC, CANADA EAST, JANUARY, 1856.

BY CAPT. A. NOBLE, R.A., F.R.S., AND MR. WM. D. C. CAMPBELL.

Latitude, 46 *deg.* 49.2 *min. North; Longitude*, 71 *deg.* 16 *min. West. Elevation above the level of the Sea*, 200 *feet.*

Date.	Barometer corrected and reduced to 32 degrees, Fahr.				Temp. of Air.				Tens. of Vapour.				Humid'y of Air.				Direc'n of Wind.			Vel'ty of Wind.			Rain in Inches.	Snow in Inches.	Remarks.
	6 A. M.	2 P. M.	10 P. M	MEAN.	6 A. M.	2 P. M	10 P. M.	M'N.	6 A. M.	2 P. M.	10 P. M.	M'N	6 A. M.	2 P. M.	10 P. M.	M'N	6 A. M.	2 P. M.	10 P. M	6 A. M	2. P M	10 P M			
1	29.716	29.810	30.158	29.895	° 18.3	° 17.5	° 1.4	° 12.4	.087	.064	.028	.060	0.83	0.64	0.55	0.67	W S W	W S W	Calm.	11.3	15.2	0.0	...	...	
2	30.254	30.191	.062	30.169	−3.2	9.5	12.5	6.3	036	058	080	058	85	80	97	87	Calm.	Calm.	W	0.0	0.0	7.2	...	1.0	
3	29.809	29.537	29.374	29.573	18.1	22.3	22.6	21.0	102	123	124	116	1.00	1.00	1.00	1.00	E N E	E S E	Calm.	12.4	7.2	0.0	...	4.0	
4	.779	30.138	30.362	30.093	—3.0	—3.6	11.5	—6.0	028	022	015	022	65	54	52	57	W N W	N W	N W	12.4	13.9	17.9	...	...	
5	30.454	.348	.200	.334	-16.0	—3.8	—0.4	—6.7	021	035	047	035	96	87	1.00	94	Calm.	N N E	E N E	0.0	10.0	17.6	...	1.0	
6	29.964	29.886	29.971	29.940	0.5	1.8	—0.7	0.5	048	045	045	046	98	88	98	95	E N E	E N E	Calm.	20.3	18.3	0.0	...	...	
7	30.044	29.930	.748	.907	—3.5	4.0	11.8	4.1	038	044	067	046	77	77	84	79	Calm.	E N E	E N E	0.0	5.2	11.3	...	8.0	
8	29.512	.230	.316	.353	17.5	16.8	1.8	12.0	084	082	039	068	80	83	77	81	E N E	W S W	W S W	16.0	10 9	10.0	...	5.2	
9	.345	.326	.343	.338	—6.2	−2.4	—1.6	—3.4	025	030	035	030	69	71	77	72	W	W	W	13.9	11.3	10.0	...	...	
10	.373	.331	.463	.389	—2.1	4.8	13.1	5.3	028	051	070	050	64	86	83	78	W S W	W S W	W	10.0	13.4	19.0	...	...	
11	.640	.850	30.032	.841	9.4	12.9	7.8	10.0	057	056	043	052	80	67	64	70	W	W S W	W	14.3	10.9	5.2	...	...	
12	30.111	30.194	.115	30.149	—0.5	8.6	7.2	5.1	044	045	052	047	96	65	79	80	N N W	N W	E	3.8	5.2	3.8	...	...	
13	29.963	29.778	29.512	29.758	13.5	13.6	16.0	14.4	085	073	095	084	1.00	86	1.00	95	E N E	E N E	E N E	21.3	45 4	46.0	...	9.0	13th—Gusts of wind at the rate of 52 miles per hour.
14	.439	.422	.421	.427	17.6	18.1	18.4	18.0	101	089	091	094	1.00	86	87	91	E N E	E N E	Calm.	42.5	39.4	0.0	...	3.0	
15	.391	.342	.330	.355	16.5	21.4	13.4	17.1	091	091	080	087	94	85	94	91	W S W	S W	W S W	7.2	6.3	3.8	...	...	
16	.350	.201	.129	.227	11.0	17.2	19.5	15.9	077	098	095	090	1.00	99	86	95	W	Calm.	Calm.	8.8	0.0	0.0	...	2.0	
17	.141	.123	.160	.175	21.8	26.8	19.1	22.6	119	145	089	118	98	98	82	92	Calm.	W S W	W S W	0.0	3.8	3.8	...	...	
18	.383	.360	.496	.413	12.4	18.2	16.3	15.6	067	067	070	068	82	65	73	73	W S W	W S W	W S W	7.2	6.2	7.2	...	...	
19	.562	.644	.674	.627	0.6	1.3	—3.6	—0.6	035	028	033	032	72	56	80	69	N W	W N W	W	6.2	6.2	10.0	...	...	
20	.709	.595	.476	.593	—5.0	6.6	4.4	2.0	033	036	039	036	87	56	69	71	W N W	W	W N W	10.0	13.9	3.8	...	...	
21	.440	.397	.436	.424	4.5	9.1	6.2	6.6	040	040	040	040	69	57	63	63	W	W	W S W	10.0	13.4	5.2	...	...	
22	.460	.499	.496	.485	—4.1	4.5	9.0	3.1	035	040	053	043	88	69	76	78	W	W	W	5.2	7.2	10.0	...	...	
23	.486	.256	.584	.444	14.2	19.3	12.2	15.2	065	076	073	071	74	70	90	78	W	W	N W	10.0	14.7	5.2	...	...	22nd—At 8, a. m., coloured ring round sun 40° in diameter.
24	.541	.372	.443	.452	14.8	22.3	4.4	13.8	087	091	038	072	97	74	65	79	W S W	W S W	W S W	2.0	3.8	15.2	...	3.0	
25	.672	.872	.961	.835	—7.8	—1.8	—0.9	—3.5	027	029	036	031	76	64	77	72	N W	N W	N W	8.0	13.9	14.3	...	...	
26	.904	.809	.812	.855	1.5	12.2	6.5	6.7	048	048	044	047	94	59	70	74	W	W	W	10.0	10.0	8.0	...	...	
27	.662	.549	.558	.590	2.8	15.2	8.8	8.9	037	049	047	044	68	54	67	63	W S W	S W	S W	8.8	8.8	6.2	...	...	
28	.494	.402	.459	.452	—0.2	11.1	6.3	5.7	045	056	050	050	90	73	79	81	E	E	E	2.0	2.0	2.0	...	...	
29	.523	.546	.423	.497	7.5	14.8	14.4	12.2	049	067	084	066	74	74	94	81	Calm.	Calm.	Calm.	0.0	0.0	0.0	...	2.0	
30	.326	.228	.249	.268	7.4	18.6	15.4	13.8	063	087	082	077	95	83	89	89	Calm.	Calm.	N	0.0	0.0	7.2	...	3.0	
31	.369	.530	.644	.514	7.0	8.7	1.4	5.7	048	042	045	048	73	60	88	74	W N W	W N W	W N W	12.9	15.2	3.8	...	...	
M	29.6402	29.6031	29.6261	29.6231	5.33	11.15	8.10	8.19	0565	0615	0590	0590	.846	.739	.805	.797				9.2	10.7	8.1	...	41.2	

REMARKS ON THE QUEBEC METEOROLOGICAL REGISTER FOR DECEMBER.

Maximum Barometer, 10 p.m. on the 14th	30.273
Minimum Barometer, 6 a.m. on the 10th	28.536
Monthly Range	1.736
Monthly Mean	29.6709
Maximum Thermometer on the 2nd	40°1
Minimum Thermometer on the 29th	—19.2
Monthly Range	59.3
Mean Maximum Thermometer	23.37
Mean Minimum Thermometer	11.02
Mean daily Range	12.35
Mean monthly Temperature	18.09
Greatest daily Range of Thermometer, on 28th	26°0
Least daily Range of Thermometer, on 22nd	3°0
Warmest Day, 2nd. Mean Temperature	36.6
Coldest Day, 29th. Mean Temperature	—12.3
Climatie Difference	48.9
Greatest intensity of Solar Radiation, on the 6th	80.0
Lowest point of Terrestrial Radiation, on the 29th	—26.0

Possible to see Aurora on 11 nights.
Aurora visible on 7 nights.
Total quantity of Rain, .449 inehes.
Total quantity of Snow, 38.9 inches.
Rain fell on 2 days.
Snow fell on 13 days.

REMARKS ON THE QUEBEC METEOROLOGICAL REGISTER FOR JANUARY.

Maximum Barometer, 6 a.m. on the 5th	30.454
Minimum Barometer, 2 p.m. on 17th	29.123
Monthly Range	1.331
Monthly Mean	29.6231
Maximum Thermometer, on the 17th	27°0
Minimum Thermometer, on the 5th	—16.5
Monthly Range	43.5
Mean Maximum Thermometer	13.81
Mean Minimum Thermometer	—0.81
Mean daily Range	14 62
Mean monthly Temperature	8.19
Greatest daily Range of Thermometer, 24th	30.6
Least daily Rango of Thermometer, 14th	3.9
Warmest day, 17th	22.6
Coldest day, 5th	—6.7
Climatic difference	29.3

Possible to see Aurora on 16 nights.
Aurora observed on 12 nights.
Total quantity of Rain —.
Total quantity of Snow, 41.2 in.
Snow fell on 11 days.

TABULAR STATEMENT

OF THE

MEAN RESULTS OF METEOROLOGICAL OBSERVATIONS MADE AT ST. MARTIN, ISLE JESUS, C. E., FOR 1855.

BY CHARLES SMALLWOOD, M. D.

(Compiled for the Canadian Journal.)

MONTHS. 1855.	Mean of Barom. in inches.	Mean Temp. of air.	Mean of Humidity.	Am't of Evaporation in inch.	Depth of Snow in inches.	Depth of Rain in inches.	Days of Snow.	Days of Rain.	Snowing in hours.	Raining in hours.	Most prevalent Wind.	Least prevalent Wind.	Mean Maximum Velocity.	Mean Minimum Velocity.	Thunder on days.	Aurora on nights.	Range of Barometer in inch.	Range of Thermometer.
		°							H. M.	H. M.								°
January	29.926	17.88	.897	Frosty Weather.	20.10	1.436	8	4	78.10	25.50	N E by E	E	18.33	0.00	......	1	1.671	61.2
February	29.400	11.23	.857		15.00	....	8	...	21.50	....	N E by E	N	15.87	0.00	......	2	0.844	74.5
March	29.716	24.08	.815		15.60	0.531	7	2	58.10	7.40	W by S	E by N	17.71	0.05	......	5	1.142	56.6
April	29.849	40.15	.808	1.70	4.34	4.194	4	10	17.40	41.20	W	N	33.80	0.10	1	3	1.171	71.1
May	29.637	56.85	.743	4.22	....	1.756	...	6	....	15.10	N E by E	E	12.11	0.00	2	3	0.621	62.9
June	29.757	62.39	.809	2.61	....	8.217	...	15	....	81.50	W S W	E by S	6.47	0.60	2	0	0.881	55.6
July	29.803	72.73	.757	3.19	....	2.351	...	7	....	14.15	S	S by E	10.72	0.15	4	3	0.587	52.6
August	29.862	64.94	.773	3.80	....	4.366	...	11	....	34.40	W	S by E	13.37	0.00	3	5	1.000	64.8
September	29.832	58.55	.803	3.04	....	3.471	...	12	....	42.29	N W by W	E	12.25	0.10	1	2	0.826	57.3
October	29.695	46.35	.849	1.40	2.10	8.728	1	17	14.00	98.35	W S W	E	16.45	0.43	......	3	0.958	45.6
November	29.838	31.58	.884	Frosty Weather.	8.34	3.923	4	10	30.10	50.30	W N W	E by N	24.37	0.65	......	5	1.268	57.2
December	29.429	20.84	.872		20.43	2.970	10	4	92.15	23.20	W	E by N	18.56	0.04	......	5	1.640	73.8

WINTER.																		
December 1854..	29.540	7.35	.850	...	18.67	0.110	10	1	44.31	4.30	N E by E	E	22.25	0.00	......	3	1.534	78.1
January 1855....	.926	17.88	.897	...	20.10	1.436	8	4	78.10	25.50	N E by E	E	18.33	0.00	......	1	1.671	61.2
February	.400	11 23	.857	...	15.00	....	8	...	21.50	....	N E by E	N	15.87	0.00	......	2	0.844	74.5
Quar'ly Means .	29.622	12.15	.868	...	53.77	1.546	26	5	143.91	29.87	N E by E	N	18.81	0.00	......	6	1.349	71.2
SPRING.																		
March	29.716	24.08	.815	...	15.60	0.531	7	2	58.10	7.40	W by S	E by N	17.71	0.05	......	5	1.142	56.6
April	.849	40.15	.808	1.70	4.34	4.194	4	10	17.40	41.20	W	N	33.80	0.10	1	3	1.171	71.1
May	.637	56.85	.743	4.22	...	1.756	...	6	....	15.10	N E by E	E	12.11	....	2	3	0.621	62.9
Quar'ly Means .	29.734	40.36	.788	5.92	19.94	6.481	11	18	75.50	63.70	W	N	21.20	0.05	3	11	0.978	63.5
SUMMER.																		
June	29.757	62.39	.809	2.61	....	8.217	...	15	....	83.50	W S W	S by E	6.47	0.60	2	......	0.881	55.6
July	.803	72.73	.757	3.19	....	2.351	...	7	....	14.15	S	E by S	10.72	0.15	4	3	0.587	52.6
August	.862	64.94	.773	3.80	....	4.366	...	11	....	34.40	W	S by E	13.37	....	3	5	1.000	64.8
Quar'ly Means .	29.807	66.68	.779	9.60	....	14.934	...	33	....	132.05	W	E by S	10.18	0.25	9	8	0.822	57.6
AUTUMN.																		
September	29.832	58.55	.803	3.04	....	3.471	...	12	....	42.29	NW by W	E	12.25	0.00	1	2	0.826	57.3
October............	.695	46.35	.849	1.40	2.10	8.728	1	17	14.00	98.35	W S W	E	16.45	0.43	......	3	0.958	45.6
November	.838	31.58	.884	...	8.34	3.923	4	10	30.10	50.30	W N W	E by N	24.37	0.65	......	3	1.268	57.2
Quar'ly Means .	29.788	45.49	.845	4.44	10.44	16.122	5	39	44.10	190.94	W N W	E by N	17.67	0.36	1	8	1.280	53.3
Yr'ly Means 1855	29.730	42.29	.822	19.96	85.91	41.943	42	98	312.15	437.39	W	E by N	15.33	0.16	14	37	1.050	61.10
Do. do. 1854	29.677	41.57	.804	23.36	97.45	40.505	53	80	222.06	231.16	N E by E	S S E	19.53	0.16	14	50	1.017	59.95
Do. do. 1853	29.578	42.89	.825	19.40	116.81	44.201	37	99	....	....	W	S S W	15.81	0.32	17	39	0.993	59.27

GENERAL METEOROLOGICAL REGISTER FOR THE YEAR 1855.—Provincial Magnetical Observatory, Toronto, C. W.

Latitude, 43°.39.4 *North*; *Longitude*, 79°.21.5 *West*. *Elevation above Lake Ontario*, 108 *feet*; *approximate elevation above the Sea*, 342 *feet*.

	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Year 1855.	Year 1854.	Year 1853.
Mean Temperature	25.95	15.41	28.46	42.43	53.07	59 93	67.95	64.06	59.49	45 39	38.58	26.99	43.98	45.21	44.78
Difference from average (16 years)	+1.63	−7.68	−1.91	+1.09	+1.56	−1.44	+1.15	−2.15	+1.39	+0.21	+1.82	+0.77	−0.29	+0.87	+0.44
Thermic Anomaly (Lat. 43°40 N)	−6.85	−19.29	−11.64	−7.77	−5.03	−4.67	−0.75	−4.44	−2.01	−8.41	−4.62	−9.01	−7.02	−5.8	−6.2
Highest Temperature	49.0	39.0	49.4	69.4	77.5	91.5	92.8	83.5	82.6	68.0	59.2	47.0			
Lowest Temperature	−5.4	−25.4	−2.9	10.7	33.0	36.2	49.2	40.0	33.0	22.6	15.5	−5.2			
Monthly Range	54.4	64.4	52.3	58.7	44.5	55.3	43.6	43.5	49.6	45.4	43.7	52.2	50.63	50.90	48.47
Mean Maximum Temperature	32.83	23.19	36.52	52.93	65.40	68.89	76.75	74.61	68.44	52.60	45.50	32.91			
Mean Minimum Temperature	17.51	4.81	19.63	32.06	41.42	50.68	60.05	54.09	49.94	34.55	28.74	18.75			
Mean daily Range	15.29	18.38	16.89	20.87	23.98	18.21	16.70	20.52	18.51	18.05	16.76	14.16	18.19	19.77	16.89
Greatest daily Range	35.0	34.2	37.3	37.2	39.4	30.8	33.0	34.2	28.8	33.2	26.5	25.6			
Mean Height of Barometer	29.6395	29.6248	29.5129	29.6539	29.6513	29.5134	29.6111	29.6530	29.7211	29.5514	29.6643	29.7020	29.6249	29.6077	29.6299
Difference from average (12 years)	+0.0097	+0.0123	−0.1185	+0.0468	+0.0678	−0.0684	+0.0138	+0.0169	+0.0670	−0.0884	+0.0455	+0.0557	+0.0050	−0.0122	+0.0100
Highest Barometer	30.552	30.088	30.079	29.998	29.902	29.811	29.833	30.019	30.092	29.923	30.131	30.201			
Lowest Barometer	28.717	29.172	28.792	29.233	29.283	28.942	29.337	29.130	29.247	28.945	28.983	28.459			
Monthly Range	1.835	0.916	1.287	0.765	0.619	0.869	0.496	0.889	0.845	0.978	1.148	1.742	1.032	1.074	0.986
Mean Humidity	.82	.80	.81	.75	.65	.78	.79	.74	.79	.76	.74	.77	.77	.79	.79
Mean Elasticity of Aqueous Vapour	0.125	0.088	0.132	0.208	0.258	0.406	0.530	0.444	0.406	0.247	0.190	0.123	0.263	0.279	0.271
Mean of Cloudiness	.79	.71	67	.51	.46	.65	.59	.44	.45	.68	.60	.67	0.60	0.59	0.57
Mean direction of the Wind	W 10 N	N37 W	W 16 N	N 36 W	N 1 W	W 21 N	S 19 W	W 27 N	N 20 E	W 8 N	W 24 N	W 2 S	W 28 N	N 42 W	N 38 W
Mean velocity (miles per hour)	7.67	8.17	9.95	7.57	5.93	5.70	6.47	6.97	7.61	9.88	10.81	11.38	8.18	6.02	5.08
Difference from average (8 years)	+0.85	+1.22	+2.94	+0.77	+0.51	+1.40	+2.11	+2.39	+2.47	+4.54	+4.56	+4.13	+2.33	+0.53	−0.33
Total amount of Rain (inches)	0.525	1.770	1.485	2.030	2.565	4.070	3.245	1.455	5.585	2.485	4.590	1.845	31.650	27.765	23.550
Difference from average (15 years)	−1.176	+0.682	−0.128	−0.541	-0.410	+1.028	−0.475	−1.261	+1.127	−0.444	+1.564	+0.323	+0.286	−3.576	−8.076
No. of days Rain	5	2	5	8	6	17	13	7	12	14	8	6	103	114	109
Total amount of Snow (inches)	23.3	21.8	18.1	1.6	0.9	...	...	...	...	0.8	3.0	29.5	99.0	49.5	53.2
Difference from average (13 years)	+9.9	+3.5	+8.2	−0.4	+0.8	...	...	...	...	−0.4	+0.5	+15.3	+37.4	−8.9	−6.1
No. of days Snow	13	14	11	3	2	...	...	...	...	5	6	10	64	52	52
Number of Fair days	13	12	15	19	23	13	18	24	18	12	16	15	198	199	204
Number of Aurora's observed	1	4	5	9	4	4	2	5	2	4	5	1	46	52	57
Possible to see Aurora (No. of nights)	8	12	16	19	20	17	19	24	20	17	19	13	204	203	233
Number of Thunder storms observed	0	0	0	5	3	4	13	5	6	2	0	0	38	58	34

MEAN METEOROLOGICAL RESULTS AT TORONTO, DURING THE YEAR 1855.

BY PROFESSOR KINGSTON, M.A.

DIRECTOR OF THE PROVINCIAL MAGNETIC OBSERVATORY, TORONTO.

Read before the Canadian Institute, 2d February, 1856.

The mean temperature of the year 1855 was 43°.98, or 0°.29, below the average of 16 years. This was caused by the great and continued depression in February, for which there was no adequate compensation during the rest of the year, notwithstanding that the mean temperature of every month was above the average, with the exception of February, March, June and August.

The hottest month in the year was July, and the coldest February. The climatic difference was 52°.5, which is 8°.8, above the average, and 1°.1, greater than in the preceding year.

The mean temperature of February was 15°.4, which is the lowest monthly temperature on record, except that of February 1843, when the temperature of the month was 14°.5.

The lowest temperature ever recorded, —25°.4, occurred on February

be increased by 1°. Even with this modification the temperature of every month was below that dependent on geographical position excepting the temperature of July, which was, however, only 0°.25 in excess.

The highest reading of the barometer was 30·552 in., at 6 A. M. of January 8th, and the lowest 28.459 inches, at 2 P. M. of December 9th, giving a range 2.093 inches, the greatest range on record. The minimum just given, 28.459 inches, is the lowest ever registered at the Observatory.

The mean humidity of the year was ·77; the greatest monthly humidity ·82, having been that of January, and the least ·65 that of May. Complete saturation occurred five times, viz —on February 13th, at midnight; March 15th, at 6 A. M.; June 10th, at 6 A. M; September 21st, at midnight; and November 17th, at 10 P. M. There were besides, five instances in which the humidity fell short one per cent. only of complete saturation—on January 12th, at 10 P. M.; February 13th, at 10 P. M.; February 14th, at 6 A. M.; March 13th, at midnight; and November 12th, at 10 P. M. The lowest humidity ·19 was on April 27th, at 2 P. M.

The extent of sky clouded was on an average three-fifths of the whole; and for nine months the sky was on an average more than half overcast. Clouds were most prevalent in January, and least so in August.

The mean direction of the

MEAN METEOROLOGICAL RESULTS AT TORONTO, DURING THE YEAR 1855.

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

Read before the Canadian Institute, 2d February, 1856.

The mean temperature of the year 1855 was 43°.98, or 0°.29, below the average of 16 years. This was caused by the great and continued depression in February, for which there was no adequate compensation during the rest of the year, notwithstanding that the mean temperature of every month was above the average, with the exception of February, March, June and August.

The hottest month in the year was July, and the coldest February. The climatic difference was 52°.5, which is 8°.8, above the average, and 1°.1, greater than in the preceding year.

The mean temperature of February was 15°.4, which is the lowest monthly temperature on record, except that of February 1843, when the temperature of the month was 14°.5.

The lowest temperature ever recorded, —25°.4, occurred on February [illegible] having been on January 17, 1840, when it fell to — 18°.4.

The hottest day was July 19th, with a mean temperature 79°.45; and the coldest day February 6th, when the mean temperature of the day was —14°.38. It is to be noticed that the coldest day, February 6th, was also the day in which the lowest temperature occurred. The mean temperature of the day was nearly 10° lower than that of any day ever before experienced at the Observatory.

The greatest daily range was 39°.4, and occurred on May 24th. The range of the whole year from —25°.4, on February 6th, to 92°.8, on July 19th, was 118°.2; the greatest yearly range that occurred in past years having been 111°.3, in 1846.

There have been 42 instances in which the temperatures at the hours of observation have deviated more than 20° from the normal march of temperature, the most extreme instances being at 8 A.M. on February 6th, when the temperature was 45°.7, below the normal, and at 6 A.M. on January, when the temperature was 23°.7, above it.

The most remarkable periods of continued deviation are as follows:

February 3— 9 when the mean deviation was .... —23°.1,
February 23—24 .... —20°.6,
February 26—28 .... —13°.3,
December 26—29 .... —14°.4,

The thermic anomalies, as given in the table, would make it appear that the mean temperature of every month was below that proper to the latitude of Toronto; but as the depression is, to the extent of 1°, due to the elevation of Toronto above the sea level, the temperature of each month should be increased by 1°. Even with this modification the temperature of every month was below that dependent on geographical position excepting the temperature of July, which was, however, only 0°.25 in excess.

The highest reading of the barometer was 30·552 in., at 6 A.M. of January 8th, and the lowest 28.459 inches, at 2 P.M. of December 9th, giving a range 2.093 inches, the greatest range on record. The minimum just given, 28.459 inches, is the lowest ever registered at the Observatory.

The mean humidity of the year was ·77; the greatest monthly humidity ·82, having been that of January, and the least ·65 that of May. Complete saturation occurred five times, viz.—on February 13th, at midnight; March 15th, at 6 A.M.; June 10th, at 6 A.M.; September 21st, at midnight; and November 17th, at 10 P.M. There were besides, five instances in which the humidity fell short one per cent. only of complete saturation—on January 12th, at 10 P.M.; February 13th, at 10 P.M.; February 14th, at 6 A.M.; March 13th, at midnight; and November 12th, at 10 P.M. The lowest humidity ·19 was on April 27th, at 2 P.M.

The extent of sky clouded was on an average three-fifths of the whole; and for nine months the sky was on an average more than half overcast. Clouds were most prevalent in January, and least so in August.

The mean direction of the wind [illegible] mean velocity of 8·1 miles per hour, a velocity one-third greater than that of any other former year. This excess of mean velocity, when compared with that of former years is to be noticed, not only with respect to the year taken as a whole, but to each month also taken separately.

The depth of rain has been 31·650 inches, which is ·286 more than the average. By adding 9·9 inches, the equivalent corresponding to the 99 inches of snow that has fallen, we obtain a total fall of 41·55 inches. The greatest quantity of rain fell in September, and the least in February. The rain was distributed over 103 days, and the snow over 64, so that there have been 198 days without either rain or snow.

Frost occurred in every month but July; the latest in spring having been on June 12th, and the earliest in autumn on August 18th. The last snow in spring was on May 8th. at noon; and the first snow in autumn on October 13th, at 8 A.M. The Indian Summer, which was not well marked, occurred from October 16th to October 26th. Toronto Bay was clear of ice on April 16th, and again crossed on foot on the 21st December.

There have been 38 thunder-storms in the year. Of these none occurred in January, February, March, November or December; 13 occurred in July; 12 were distributed through April, May, and June; 13 through August, September and October. The most violent were those of April 18th, May 15th, June 21st, July 12th, 13th, and 27th, August 15th and 31st, and September 1st, 9th, 7th, and 25th.

On 204 nights the atmosphere has been suitable for the display of any aurora which might have existed; and on 40 of them auroras have been actually seen. The most remarkable were those of August 23d and October 4th. That of October 4th was accompanied by considerable magnetic disturbance.

METEOROLOGICAL OBSERVATORY AT UNIVERSITY OF QUEEN'S COLLEGE, KINGSTON, FOR JANUARY, 1856.

BY JAMES CARMICHAEL AND JOHN MAY.

Latitude 44°. 13'. 30". *Longitude* 76°. 31'. 51". *Height above the Sea* 280 *feet.*

Observations taken at 9, A.M., (Local Time.)

Day of the Week.	Day of the Month.	Barometer Reading.	Thermometer.	Corrected for Index error, Capillary action, and to temperature of 32°.	Dry Bulb Therm.	Wet Bulb Therm.	Temp. of Dew-point computed.	Elastic Force of Vapour.	Humidity 0–1.	Wind Direction.	Wind Force in lbs. per square foot.	Cloud 0–10.
Tuesday	1	29·900	32·5	29·905	18·5	18·	14·2	·104	·785	W.S.W.	1·125	1
Wednesday	2	29·100	32·	29·097	24·	23·5	19·75	·128	·765	S.	·125	4
Thursday	3	29·502	40·2	29·568	31·5	30·5	30·5	·189	·768	S.	·75	10
Friday	4	30·262	36·	30·248	2·	1·5	−2·25	·068	·642	W.N.W.	1·125	0
Saturday	5	30·200	30·	30·203	−3·	−2·5	−2·25	·060	·640	N.E.	·5	5
Sunday	6	29·836	27·	29·838	2·	1·5	2·25	·068	·642	N.E.	1·000	4
Monday	7	29·838	35·25	29·827	17·	16·25	10·2	·090	·780	E.	·75	10
Tuesday	8	29·452	34·	29·443	10·5	10·	6·25	·077	·783	W.S.W.	1·125	10
Wednesday	9	29·604	31·	29·603	−2·5	−3·	1·8	·066	·681	W.	·875	10
Thursday	10	29·720	28·5	29·725	0·	0·	0·	·051	1·000	W.	·125	9
Friday	11	30·062	31·5	30·061	19·	18·	10·5	·061	·730	W.	·25	5
Saturday	12	30·086	41·	30·058	19·	18·	10·5	·061	·732	W.	1·25	7
Sunday	13	29·426	31·	29·425	16·	15·5	11·75	·066	·680	W.	1·	10
Monday	14	29·498	33·	29·492	19·5	17·	9·5	·068	·728	N.E.	·	10
Tuesday	15	29·502	43·	29·500	32·5	32·	8·25	·084	·946	N.W.	·25	9
Wednesday	16	29·404	37·5	29·388	22·	21·25	15·2	·068	·775	S.W.	·5	9
Thursday	17	29·296	45·5	29·254	25·	24·75	23·7	·148	·952	S.W.	·875	8
Friday	18	29·582	48·	29·536	23·75	23·25	19·6	·127	·856	W.N.W.	0·	10
Saturday	19	29·767	39·	29·745	4·5	4·	·25	·074	·782	N.N.E.	5·	5
Sunday	20	29·820	37·25	29·804	−4·5	−3·5	−4·	·052	·643	N.N.E.	·25	5
Monday	21	29·674	38·5	29·658	6·	5·	−2·5	·051	·731	N.N.E.	·25	10
Tuesday	22	29·648	33·5	29·642	−1·5	−1·25	·6	·045	·679	N.	0·	1
Wednesday	23	29·694	31·5	29·693	14·	13·75	12·3	·097	·858	W.	·25	0
Thursday	24	29·670	38·5	29·651	21·5	21·25	19·3	·136	·930	S.W.	2·	0
Friday	25	30·198	38·75	30·178	−6·	−5·75	−3·8	·036	·869	N.W.	·75	0
Saturday	26	30·248	38·	30·224	1·	1·	1·	·053	1·000	N.	·5	0
Sunday	27	29·762	27·	29·764	3·	2·75	·85	·063	·679	W.	0·	10
Monday	28	29·288	37·	29·272	13·	12·5	8·7	·088	·871	N.W.E.	0·	8
Tuesday	29	29·570	42·	29·540	19·	18·5	15·5	·110	·882	N.W.	0·	8
Wednesday	30	29·374	45·5	29·338	19·5	18·75	16·4	·114	·882	W.	1·25	8
Thursday	31	29·672	45·	29·644	9·5	9·	5·2	·075	·727	W.	3·00	8
Sums	...	920·837	1124·75	920·363	354·75	342·5	283·53	2·680	24·354	...	20·375	200
Means	...	29·704	36·28	29·689	11·45	11·05	9·14	·086	·786	...	·657	6·5

Observations taken at 3, P.M. (Local Time.) — Self-Registering Thermometers, Rain, Wind

Day of the Month.	Dry Bulb Max. in Air.	Dry Bulb Min. in Air.	Dry Bulb Mean in Air.	Wet Bulb Min. Wet.	Rain in previous 24 hours On Ground.	Rain Feet above Ground.	Wind, Max. in previous 24 hours.
1	21·	18·25	19·625	17·75	...	...	4·25
2	26·75	17·5	22·125	16·5	...	...	0·00
3	34·00	24·	29·	23·	...	...	1·50
4	32·	1·	16·5	5·	...	...	4·25
5	0·	−3·5	−1·75	−3·5	...	...	1·25
6	8·5	−2·5	5·5	−2·5	...	...	1·25
7	18·	4·	11·	3·	...	...	1·50
8	20·	2·	11·	2·	4	Snow inches.	7·00
9	0·	−1·5	−·75	−1·5	...	...	2·50
10	14·	−3·5	5·25	−2·5	...	...	3·25
11	24·	10·	17·	9·	...	...	2·125
12	24·5	18·5	21·5	17·5	...	...	·375
13	21·	13·5	17·25	13·	...	...	4·00
14	23·	11·	17·	10·5	...	...	2·75
15	32·5	16·5	19·5	15·5	12	inches.	0·25
16	25·5	3·	14·25	2·5	...	...	3·125
17	31·	28·	29·5	22·	...	...	2·50
18	31·	22·	26·5	21·	1	inch.	0·00
19	28·5	4·	16·25	2·5	...	...	1·50
20	7·	−7·5	−·25	−8·75	...	...	0·25
21	11·25	5·	8·125	4·5	...	...	0·75
22	17·25	−6·25	5·5	−6·	...	...	·00
23	26·	11·	18·5	11·	...	...	0·25
24	26·5	21·	23·75	21·	...	...	4·125
25	19·	−9·	5·	−7·	...	...	3·50
26	14·	−1·75	6·875	·5	...	...	0·75
27	18·	−4·	6·	−1·	...	...	0·00
28	18·	14·	16·	14·	...	...	0·00
29	24·75	15·	19·875	14·	...	...	0·00
30	20·5	17·	18·75	16·5	...	...	2·50
31	16·	7·	11·5	5·5	...	...	4·50
Sums	621·5	245·75	438·75	246·	17	...	60·
Means	20·05	7·92	14·1	7·93	·55	...	1·94

Observations taken at 3, P.M., (Local Time.)

Day of the Month.	Barometer Reading.	Thermometer.	Corrected for Index error, Capillary action and to temperature of 32°.	Dry Bulb Therm.	Wet Bulb Therm.	Dew-point computed.	Elastic Force of Vapour.	Humidity 0–1.	Wind Direction.	Wind Force in lbs. per square foot.	Cloud 0–1.	Remarks: On the Prevalent Diseases.	Remarks: On the Weather, and any remarkable circumstance.
1	29·050	40·	28·996	21·5	21·	17·3	·117	·941	W.	·875	1		Beautiful.
2	30·016	41·	29·991	25·75	24·75	19·3	·126	·939	S.	·0	4	Small	
3	29·530	42·	29·500	32·	30·	25·8	·160	·802	W.	·875	0		
4	30·382	47·	30·337	7·	6·5	2·7	·068	·678	W.N.W.	1·	0	Pox.	Bay frozen over.
5	30·042	33·75	30·033	1·	1·	1·	·064	1·000	N.E.	1·	10		
6	29·862	30·5	29·864	9·75	9·	3·5	·070	·731	N.E.	·875	4	Influ-	
7	29·868	54·5	29·803	18·	17·5	12·9	·099	·826	E.	·875	10		Snowy and stormy.
8	29·520	57·5	29·467	2·	1·5	−2·2	·068	·642	W.S.W.	1·	8	enza.	
9	29·642	54·75	29·578	1·25	1·	8·	·067	·679	W.	1·5	2		
10	29·578	54·5	29·514	24·	13·5	9·7	·085	·871	W.	1·	1		
11	30·100	55·5	30·035	24·	16·7	16·7	·115	·762	W.	·875	8	Rheu-	
12	30·008	44·5	29·964	22·5	22·	18·2	·121	·937	N.E.	·125	10		
13	29·294	36·	29·280	18·5	18·	14·2	·104	·782	N.E.	1·25	10	ma-	Stormy with
14	29·568	57·75	29·495	22·	21·	13·5	·102	·728	N.	·875	6		snow and wind.
15	29·582	58·	29·510	19·25	19·	16·6	·114	·874	N.W.	·0	1	tisms.	Mild and pleasant.
16	29·330	63·	29·235	24·75	24·	18·3	·121	·937	S.W.	1·25	10		Snowy.
17	29·344	61·	29·254	30·	29·25	27·2	·168	·905	W.	·25	10	Colds,	
18	29·574	63·	29·480	29·5	29·	26·	·161	·898	W.S.W.	0·	10	&c.,	
19	29·298	44·5	29·266	7·5	7·	5·2	·069	·775	N.N.E.	5·	0	&c.,	
20	29·720	55·5	29·709	7·	7·5	6·7	·088	·689	N.N.E.	·25	10		
21	29·658	54·	29·597	9·75	9·25	5·5	·087	·727	S.W.	0·	5		Solar halo.
22	29·668	43·	29·630	17·5	17·5	14·6	·106	·878	W.	·25	10	Scarlet	
23	29·748	52·	29·692	25·	25·	19·9	·129	·804	W.S.W.	1·	0		
24	29·606	55·5	29·542	33·	22·75	21·3	·136	·943	S.W.	·75	10	Fever	Flumes of snow.
25	30·284	58·	30·216	6	5·75	3·8	·071	·680	W.N.W.	·5	0		
26	30·142	39·	30·122	14·25	13·25	7·2	·080	·782	N.	·0	0	in the	Very bright.
27	29·610	55·	29·588	17·	16·75	15·3	·109	·943	N.	·0	10		
28	29·341	54·	29·277	18·	17·75	16·3	·113	·930	N.N.E.	·0	10	vicinity	Snowy.
29	29·344	57·5	29·275	21·	21·	7·7	·082	·571	N.N.W.	·25	10		
30	29·386	56·75	29·319	20·	18·5	6·7	·078	·601	W.S.W.	0·	10	of the City.	
31	29·616	56·	29·540	16·	14·5	4·1	·672	·643	W.	·25	8		
Sums	919·778	1538·5	918·202	529·	507·5	370·5	3·150	24·899	...	17·375	188		
Means	29·670	49·6	29·624	17·	16·4	11·9	·102	·803	...	·560	6·06		

ABSTRACT.

	Barometer Inches.	Barometer Inches.	Temperature of Air.	Temperature of Air.	Temperature of Evaporation.	Temperature of Evaporation.	Temperature of Dew-point.	Temperature of Dew-point.	Elastic Force of Vapour.	Elastic Force of Vapour.	Humidity 0–1.	Humidity 0–1.	Max. in Sun's rays.	Max. in Air.	Min. in Air.	Max. Wet.	Min. Wet.	Rain Inches in 24 hours.	Snow.	Wind Pressure in lbs.	Wind Pressure in lbs.	Cloud 0–10.	Cloud 0–10.
Max.	30·248	30·337	31·5	30·	30·5	30·	30·5	27·2	·148	·168	1·	1	71	34	28	...	23	12	...	3	1·5	10	10
Mean.	29·689	29·620	11·45	17·	1·05	16·4	9·14	11·9	·086	·102	·780	·803	...	20·05	7·92	...	7·9	5·5	...	·657	·560	6·5	6·06
Min.	29·234	28·996	−6	1·	·5	1·	−4	−2·2	·036	·064	·642	·571	...	0·	−9	...	−8·75	0·	...	0·	·0	6·	0·

THE

CANADIAN JOURNAL

OF

INDUSTRY, SCIENCE, AND ART:

CONDUCTED BY

THE EDITING COMMITTEE OF THE CANADIAN INSTITUTE.

NEW SERIES. NUMBER III.

MAY, 1856.

TORONTO:
PRINTED FOR THE CANADIAN INSTITUTE,
BY LOVELL AND GIBSON, YONGE STREET.

The Canadian Journal is printed exclusively for gratuitous distribution among the Members of the Canadian Institute, and such Institutions and Societies as the Council may determine; but Members may purchase extra copies at 2s. 6d. per number, and Provincial Literary and Scientific Societies may obtain the Journal at the same rate, by an annual payment in advance.

⁂ *Communications for the Journal to be addressed to the General Editor,* DR. WILSON, *University College, Toronto.*

THE CANADIAN JOURNAL.

NEW SERIES.

No. III.—MAY, 1856.

THE ANCIENT MINERS OF LAKE SUPERIOR.

BY DANIEL WILSON, LL. D.,

PROFESSOR OF HISTORY AND ENGLISH LITERATURE, UNIVERSITY COLLEGE, TORONTO.

Read before the Canadian Institute, January 26th, 1856.

During the past summer of 1855, it was my good fortune to accomplish a long desired visit to the ancient copper country of Lake Superior, where, more perhaps than on any other spot of this continent, may be witnessed the incipient traces of aboriginal arts and civilization. On that occasion I had an opportunity of exploring part of the rich copper-bearing region of Keweenaw Point and the adjacent country, and witnessing for myself evidences of ancient mining operations, which prove the existence, at some remote period, of the rudiments of native metallurgic arts.

The Keweenaw Peninsula is traversed obliquely by a range of trap rock, rising in some places into magnificent cliffs of several hundred feet in height; and in this igneous rock, which passes in a south-western direction across the Keweenaw Lake into the inland country, are found the rich copper veins which have already conferred such great commercial value on that district of Michigan. In their present state, it is difficult to realize the conception that these copper regions were ever ransacked for their mineral treasures, or explored by any other but the stray hunter of the forest, until the commencement of regular mining operations in very recent years.

Landing at Eagle River, I made my way some miles into tho country, through dense forest, over a road, in some parts of rough corduroy, and in others traversing the forest in its gradual ascent, over the irregular exposed surface of the copper-bearing trap. Our track at length lay through a gorge, covered with immense masses of trap and crumbling debris, amid which pine, and the black oak and other hard-wood, had contrived to find a sufficient soil for taking root and growing to their full proportions; while here and there the eye lighted upon some giant pine overthrown by the wind, and turning up its great roots grasping the severed masses of the rounded trap in their convolutions, like the gravel clutched from the ocean's bed in the hands of a drowned seaman. On the summit of the ridge the trap rock rises into a range of cliffs, which, judging by the eye, I should suppose cannot be less than two hundred feet high, and in front of them is a sloping tail, the accumulated debris of ages, on which the trees have in some places attained to an immense size, notwithstanding the apparent poverty of the rocky soil.

In traversing this route the road lies in part along the banks of the Eagle River, and there, some four or five miles from its mouth, I had an opportunity of examining a beaver dam, flooding a part of the river banks, by means of the ingenious structure. No traces, however, gave the slighest indication to the passing traveller that the hand of man had ever wrought any changes on the aspect of a region characterised by features so singularly wild and desolate-looking as those described above. Beyond the cliffs, in a level bottom on the other side of the trap ridge, is the mining settlement of the Cliff Mine, one of the most important of all the mining works yet in operation in this region. The great extent of the works at the Cliff Mine is all the more surprising to the visitor, after finding his way to them through a region where it might seem that human foot had never trod.

I descended the perpendicular shaft by means of ladders, to a depth of sixty fathoms, and explored various of the levels; passing in some cases literally through tunnels made in the solid copper. The very richness and abundance of the metal proves indeed a cause of diminution of the profits arising from working it. I witnessed the laborious process of chiselling out masses from the solid lump, of a size sufficiently small to admit of their being taken to the surface, and transported through such a tract as I have described to the shores of Lake Superior. The floor of the level was strewed with the copper shavings struck off in the effort to detach them, and the extreme ductility of the pure native copper was pointed out to me as a cause which precluded the application of any other force than that of slow and persevering manual labor for separating it from the parent mass. I saw also some beautiful specimens of silver, in a matrix of crystalline quartz, obtained from this mine, and the copper of this district is stated to contain on an average about 3·10 per cent. of silver. One mass of copper quarried from the Cliff Mine has been estimated to weigh eighty tons. It was sufficiently detached from its rocky matrix without injuring its original formation, to admit of its dimensions being obtained with considerable accuracy, and it was found to measure fifty feet long, six feet deep, with an average of about six inches in thickness. The total yield of this mine amounted during the past year to sixteen hundred tons of copper, a quantity exceeding, by nearly five hundred tons, the combined product of the other copper mines—eleven in number—of Keweenaw Point, and surpassing by a still greater amount the yield of the Minnesota Mine, the richest of all the works now in operation in the neighboring district of Ontonagon.

At the Cliff Mine some specimens of the ancient copper tools of the native metallurgists are preserved, but it is to the westward of the Keweenaw Peninsula, that the most remarkable traces of the aboriginal miner's operations are seen. The copper-bearing trap rock, after crossing the Keweenaw Lake, is traced onward in a southwesterly direction till it crosses the Ontonagon River about twelve miles from its mouth; and at an elevation of upwards of three hundred feet above the Lake. At this place the edges of the copper veins appear to crop out in various places, exposing the metal in irregular patches over a considerable extent of country. Here, in the neighborhood of the Minnesota Mine, are traces of the ancient mining operations, consisting of extensive trenches, which prove that the works must have been carried on for a long period and by considerable numbers. These excavations are partially filled up, and so overgrown during the long interval between their first excavation and their observation by recent explorers, that they would scarcely attract the attention of a traveller unprepared to find such evidences of former industry and art. Nevertheless some of them measure from eighteen to twenty feet in depth, and in one of them a detached mass of native copper, weighing nearly six tons, was found resting on an artificial cradle of black-oak, partially preserved by immersion in the water with which the deserted trenches had been filled, in the first long era after its desertion. This large mass had evidently been thus disposed preparatory to an attempt at removing it entire. It appeared to have been raised several feet by means of wedges, and then abandoned on account of its unmanageable weight; and probably portions had afterwards been detached from it, as its surface bore abundant traces of the rude stone implements with which the old miners seem to have chiefly wrought.

The stone hammers, or mauls, by which these ancient workers in metal carried on their operations, consist for the most part of oblong water-worn stones, weighing from ten to twenty pounds. Around the centre of these a groove has been artificially wrought, for the purpose of fastening a handle or withe of some kind, with which to wield them. Some of the specimens that I saw were worn and fractured as if from frequent use; many are found broken, and they are met with in such abundance in the neighborhood of the ancient Ontonagon diggings, that a deep well was pointed out to me, constructed, as I was assured, almost entirely of the stone hammers picked up in its immediate vicinity. I was greatly struck with the close resemblance traceable between these rude mauls of the ancient miners of Ontonagon and some which I have seen obtained from ancient copper workings discovered in North Wales.

In a communication made to the British Archæological Institute by the Hon. William Owen Stanley, in 1850,* he gives an account of an ancient working broken into at the copper mines of Llandudno, near the the Great Orme's Head, Caernarvonshire. In this were found mining implements, consisting of chisels, or picks of bronze, and a number of stone mauls of various sizes, described as weighing from about 2 lbs. to 40 lbs., rudely fashioned, having been all, as their appearance suggested, used for breaking, pounding, or detaching the ore from the rock, and pertaining, it may be presumed, to a period anterior to the Roman occupation of Britain. These primitive implements are stated to be similar to the water-worn stones found on the sea-beach at Pen-Mawr, from which very probably those most suitable for the purpose might have been selected. Mr. Stanley also describes others precisely of the same character, and corresponding exactly with those found on the shores of Lake Superior, which had been met with in ancient workings in Anglesea. Were we, therefore, disposed to generalize, as some of the archæologists of this continent are prone to do, from such analogies, we might trace in this correspondence between the ancient mining implements of Lake Superior and of North Wales, a confirmation of the supposed colonization of America, in the twelfth century, by Madoc, the son of Owen Gwynnedd, king of North Wales, who, according to the Welsh chroniclers, having been forced by civil commotions to leave his native country, set sail with a small fleet in 1170, and directing his course westward, landed, after a voyage of some weeks, in a country

* Archæological Journal, vol. vii, p. 68.

inhabited by a strange race of beings, but producing in abundance the necessaries of life. Leaving behind him a colony of settlers, Prince Madoc, according to the same authorities, returned to Wales, equipped a larger fleet, and again set sail for the new regions of the West; but neither he nor any of his followers were ever more heard of. The general story has nothing improbable in it. If a small colony of Welshmen effected a settlement on the shores of America at that early date, their fate would be like that of the still earlier Scandinavian colonists of Vinland.* But the resemblance between the primitive Welsh and American mining tools, can be regarded as nothing more than evidences of the corresponding operations of the human mind, when placed under similar circumstances, with the same limited means. It supplies an argument, which, if pressed to all its remotest bearings, might rather seem to furnish proof of the unity of the human race, than any direct relations leading to a correspondence in the arts of such widely severed portions of the common family. It might, indeed, in some sense, be fitly classed among the instinctive, rather than the imitative operations of human ingenuity when called into action to accomplish similar purposes—instinctive operations akin to those to which alone we can refer such resemblances as that between the nest of the American blue-bird and the English thrush; and which in like manner, from the first rude arts of the primitive savage, produces the bone-lance, or the flint arrow-head, wherein we trace the same type, whether we look for them in the British barrow of ante-Christian times, or among the recent productions of the Polynesian or Red Indian artificer.

The evidences of ancient mining operations in the Ontonagon district have been observed over an area of several miles in extent, and have evidently been abandoned for unknown centuries. A forest of primeval growth seems to cover the whole region, and the mind realizes with difficulty the conviction that, in the trenches traversed by the roots, and cumbered with the fallen trunks of giant trees, we have the indubitable proofs of an ancient race of miners having wrought for the same mineral treasures which are now once more attracting a population to the solitudes of the forest.

A writer, whose narrative Dr. Schoolcraft has embodied in his His-

* When the poet Southey made the adventures of the Welsh Prince the subject of an epic, the knowledge regarding even the older regions of this continent was sufficiently vague to sanction any theory, and he accordingly wrote in 1805, "Strong evidence has been adduced that Madoc reached America, and that his posterity exist there to this day, on the southern branches of the Missouri, retaining their complexion, their language, and in some degree their arts." Ten years later, however, the poet added a foot-note, to state, that these 'Welsh Indians" had been sought for in vain on all the branches of the Missouri, as well as elsewhere in all the explored regions of America.

tory of the Indian Tribes, remarks of the ancient mining excavations of this region: "The great antiquity of these works is unequivocally proven by the size of the timber now standing in the trenches. There must have been one generation of trees before the present since the mine was abandoned. How long they were wrought can only be conjectured by the slowness with which the miners must have advanced in such great excavations with the use of such rude instruments. The decayed trunks of full grown trees lie in the trenches. I saw a pine over three feet in diameter, that grew in a sink-hole on one of the veins, which had died and fallen down many years since." Above a mass of copper, detached and marked by the rude tools of the ancient miners, there was also noted a hemlock tree, the roots of which spread entirely over it, and a section of the trunk exposed two hundred and ninety annual rings of growth. An uncertain, yet considerable interval must be assumed to have intervened between the abandonment of those ancient works and their once more becoming a part of the wild forest wastes; and when this interval is added to our calculations, we are at once thrown beyond the era of Columbus in our search for a period to which to assign these singular relics of a lost civilization.

When, and by whom, then, were these works carried on? In the early part of the seventeenth century, when the wild regions around Lake Superior were first partially explored by Europeans, the Jesuit missionaries of Canada and others, they appear to have pertained to the Algonquin tribes. But the climate and soil of this region seem alike conclusive as to the improbability of the permanent settlement of any civilized race along the shores of Lake Superior. The soil is affirmed to be, for the most part, little adapted to agriculture, and the length and severity of the winter leave the modern miner entirely dependent on the accumulated stores laid up during the summer. This, therefore, may seem to justify the conclusion that the mining operations have been carried on intermittently by migratory workers, just as the modern Indians are known to explore the detritus and out-cropping veins at the present day, for the readily attainable fragments of the miskopewabik, or red iron, as they call it. But, although the native copper has probably never been altogether unknown to the Indian tribes of the continent, lying south and west of the great lakes, yet many evidences tend to prove an essential diversity of character and operations between the ancient and modern native metallurgists. The very name of *red iron* is clearly post-Columbian, and proves the disseverance of the links which should connect the ancient miners of Lake Superior, with the modern tribes who have found there their hunting grounds.

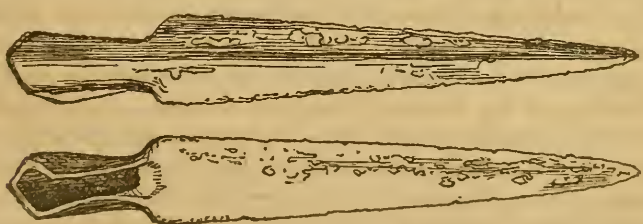
There was a period in the long-past epochs of America's unrecorded history, when the valleys of the Mississippi and the Ohio were occupied by a numerous and settled population, known to the modern Archæologist as the Race of the Mound-builders. Alike in physical conformation and in arts they approximated to the races of Central America, and differed from the Red Indians alone known to Europeans as the occupants, and by them familiarly styled the aborigines, of the whole northern regions of the American Continent south of the Arctic Circle. The Mound-builders were not, to all appearance, far advanced in civilization. Compared with the tribes of Central America, first visited by the Spaniards, their arts and social state were in an extremely rudimentary state. The contrast, however, is no less striking between the evidences of their settled condition, with the proofs of extensive co-operation which their numerous earth-works supply, and all that pertains to the nomade tribes which have been alone known to occupy the American forests during post-Columbian centuries.

The Mounds of the Mississippi Valley abound in copper ornaments and implements, proving the familiarity of their builders with the mineral wealth of the Lake regions; and to just such a race, with their imperfect mechanical skill, their partially developed arts, and their aptitude for continuous combined operations, would we ascribe, *a priori*, such ancient mining works as exist on the shores of Lake Superior, overshadowed with the forest-growth of centuries. The Mounds constructed by the Ancient brachycephalic Race are in like manner overgrown with the evidences of their long desertion; and the condition in which recent travellers have found the long-forgotten cities of Central America, may serve to show what even New York, and Washington, and Philadelphia; what Toronto, Montreal, and Quebec, would become after a very few centuries, if abandoned, like the desolate cities of Chichenitza or Uxmal, to the inextinguishable luxuriance of the American forest growth.

The history of the cities of Central America is known, and the date is well ascertained when the irruption of a new race extinguished their advancing civilization, and threw back into primitive barbarism the remnant of the ancient race which they failed to extirpate. It seems no illegitimate assumption to affirm of the Mound-builders of the Mississippi, and the ancient Miners of Lake Superior, in like manner, that some great catastrophe,—the intrusion it may be of the present Red Indian Race, or more probably the still deadlier influence of pestilence, such as in the seventeenth century, swept away the Messacheuseuks and Narragansetts of New England—appears to have abruptly arrested their labours, and to have restored the scenes of their industrious progression to the silence amid which the later forest-wilderness arose. It is not necessary to assume a very great antiquity for the era of this abortive American civilization. It has been a favourite theory with some, to trace analogies between the arts of Central America and those of Egypt's primitive civilization. But those who do so, forget that the era of Montezuma is known, and that to a past so recent as that we can assign so much of Aztec and Toltec art, that a very few more centuries, at most, may suffice to embrace the utmost that we know of. Assuredly nothing has been observed, as yet, pertaining either to the ethnology or the archæology of the new world, which may not be compatible with its first occupation by a human population subsequent to the Christian era. Much, however, may yet be brought to light, in reference to America's prehistoric centuries; and meanwhile it seems premature to affirm as Dr. Schoolcraft does of the Lake Superior basin: "There are no artificial mounds, embankments, or barrows in this basin, to denote that the country had been anciently inhabited; and when the inquiry is directed to that part of the continent which extends northward from its northern shores, this primitive character of the face of the country becomes still more striking. It is something to affirm that the mound-builders, whose works have filled the West with wonder,—quite unnecessary wonder,—had never extended their sway here. The country appears never to have been fought for, in ancient times, by a semi-civilized or even pseudo-barbaric race. There are but few darts or spear-heads. I have not traced remains of the incipient art of pottery, known to the Algonquin and other American stocks, beyond the Straits of St. Mary, which connects Lakes Huron and Superior; and am inclined to believe that they do not extend in that longitude beyond the latitude of 36° 30′. There is a fresh magnificence in the ample area of Lake Superior, which appears to gainsay the former existence and exercise by man, of any laws of mechanical or industrial power, beyond the canoe-frame and the war-club. And its storm-beaten and castellated rocks however imposing, give no proofs that the dust of human antiquity, in its artificial phases, has ever rested on them."

Observation has already disclosed in these northern regions the trenches of the ancient miners, who supplied to the mound-builders of the south the copper which they are proved to have so abundantly used; and the country has not yet been so thoroughly explored through all its vast unoccupied wildernesses, as to preclude the possibility that there yet may be discovered among the recesses of its forests, grave mounds of the ancient Brachycephalic race, whose physical characteristics seem clearly to prove that the race of the mound-builders of America and the red Indian tribes that succeeded to the forests are distinct.

The numerous ancient implements and weapons of copper already found in the mining regions of Lake Superior, entirely correspond with the other evidences of combined operation protracted over long periods of time, disclosed by the ancient Ontonagon mines; and concerning which no traditions of the present native tribes of the country indicate the slightest knowledge. At the Bigelow House at Ontonagon, I had an opportunity of examining an interesting collection of copper relics found, a few months before in the neighborhood. These consisted of three copper spear-heads, one about fourteen inches, and the others about twelve inches in length; and two singularily shaped copper gouges (?) about fourteen inches long, and two wide, the precise use of which it would be difficult to determine. It was my good fortune to make the acquaintance, while at Ontonagon, of Captain Peck, whose knowledge of the native languages, and residence for years among the red Indians, have given him good opportunities of judging of their habits and arts; and his idea of the copper gouges was that they were designed for cutting holes in the ice for fishing, according to a method still pursued by the Indians for obtaining their winter supply of Lake fish. A different and more probable opinion, however, was advanced by a practical miner, who stated that he had been among the first who opened some of the ancient diggings found at the Minnesota mine, and the copper gouges seemed exactly adapted to produce the singular tool-marks which had then excited his curiosity. Subjoined is a representation of one of the spear-heads, sketched from the original. Its form is singular,



the blade being three-sided like that of a bayonet. The socket has been formed by hammering out the lower part flat, and then turning it over partially at each side. Precisely such a mode of fitting the blade to receive a haft is common in the more primitive forms of bronze implements found in Britain and the north of Europe. In the pure copper spear-heads of Lake Superior, it may be assumed, as a confirmation of the conclusion suggested by numerous other copper relics of this continent, that the ancient miners and mound-builders were ignorant of the arts of welding and soldering, as well as of that of smelting the metallic ores. An indentation made in the inner side of the rude socket closely resembles the device adopted for the same purpose in the class of bronze implements of ancient Europe, known as *paalstaves;* its object evidently being to present a point of resistance to the haft. The European implements, however, are made of a metallic compound, and mostly cast, thus proving a knowledge of metallurgic arts far in advance of the old workers of the metallic treasures of Ontonagon, and the copper regions of Lake Superior.

I was informed by Captain Peck, that a fourth spear-head had been found along with the above. The whole were discovered buried in a bed of clay on the banks of the river Ontonagon, about a mile above its mouth, during the process of levelling it for the purposes of a brick field. Above the clay was an alluvial deposit of two feet of sand, and in this, and over the relics of the ancient copper workers, a pine tree had grown to full maturity. Its gigantic roots gave proof, in the estimation of those who witnessed their removal, of considerably more than a century's growth; while the present ordinary level of the river is such that it would require a rise of forty feet to make the deposit of sand beneath which they lay. It is possible, however, that the original deposition of the relics may have been made in an artificial excavation, above which the pine tree struck its roots in later times, for along with the implements there were also found fragments of copper, the remains, as it might seem, of the operations of the ancient manufacturers, by whose skill these, or similar weapons and tools, were wrought on the spot.

This locality has been celebrated for the traces of its mineral wealth from the earliest date of European exploration of the Lake Superior regions. Alexander Henry, in his "Travels and Adventures in Canada, and the Indian Territories," mentions his visiting the River Ontonagon, in August 1765. "At the mouth, was an Indian village; and at three leagues above, a fall, at the foot of which sturgeon were at this season so abundant, that a month's subsistence for a regiment could have been taken in a few hours. But—he adds—I found this river chiefly remarkable for the abundance of virgin copper which is on its banks and in its neighbourhood. The copper presented itself to the eye in masses of various weight. The Indians showed me one of twenty pounds. They were used to manufacture this metal into spoons and bracelets for themselves. In the perfect state in which they found it, it required nothing but to be beat into shape."* On a subsequent occasion, in the following year, Mr. Henry again visited the same region, "On my way," he says, "I encamped a second time at the mouth of the Ontonagon, and now took the opportunity of going ten miles up the river, with Indian guides. The object which I went most expressly to see, and to which I had the satisfaction of being led, was a mass of copper, of the weight, according to my estimate, of no less than five tons. Such was its pure and malleable state that with an axe I was able to cut off a portion weighing a hundred pounds." † This object, which thus attracted the adventurous European explorer nearly a century ago, has since acquired considerable celebrity, as one of the most prominent encouragements to the mining operations projected in the Ontonagon and surrounding districts. These notices, moreover, are interesting as showing to what extent the present race of Indians were accustomed to avail themselves of the mineral wealth of the great copper regions.

The details of another, and in some respects more interesting discovery, than that which was brought under my notice at Ontonagon, were communicated to me in reply to the inquiries made while there. This took place, at a still more recent date, at a locality lying to the east of Keweenaw Point, in the rich iron district of Marquette. There, not far from the mouth of the river Carp, in what appeared to be the ancient bed of the stream, and about ten feet above the present level of its channel, various weapons and implements of copper have been recently found. Large trees grew over this deposit also, and the evidences of a remote antiquity seemed not less obvious than in that of Ontonagon. The copper relics included knives, spear or lance-heads, and arrow-heads, some of which were ornamented with silver. One of the knives was described as made, with its handle, out of a single piece of copper. It measured altogether about seven inches long, of which the blade was nearly two-thirds of the entire length, and of an oval shape. It was ornamented with pieces of silver attached to it, and was inlaid with a strip of silver from point to haft. Along with these relics were also found numerous fragments, or chips and shavings of copper, some of which were such as, it was assumed, could only have been cut by a fine sharp tool; and the whole sufficed to indicate even more markedly than those at Ontonagon, that not

* Henry's Travels and Adventures, p. 194. New York, 1809.

† Ibid, p. 204.

only was the native copper wrought in ancient times in the Lake Superior Regions: but along its shores, and on the banks of its navigable rivers, there existed manufactories where the native artizan fashioned the metal into tools and weapons for war and the chase.

This would seem to be still further confirmed by the evidences of permanent settlement at some former period described as still visible at the mouth of the Carp river, where those relics of its ancient manufactures were found. The foundations of old structures are still clearly traceble. The outlines of the buildings can be made out by the ridges of clay remaining, and in places the ruined masonry seems to show where the hearth had stood. Such traces, I was assured, suffice to indicate that whole ranges of dwellings must have occupied the site, so that here unquestionably, at some remote period, there existed a settlement of considerable extent, and a town conveniently situated for commanding the Lake. The buildings must have been slight when compared with those which have left their mighty ruins amid the forests of Central America; but the traces which remain correspond with what might be expected of the Mound-builders of the Mississippi, and over their works has waved for unknown centuries the forest, which, by the age it lays claim to, suffices to divide that ancient and unknown past from the era of the new race of workers, who are now ransacking the mineral veins of the copper regions, and turning their metallic treasures to account for the aggrandisement of the intrusive Anglo-Saxon.

A lively interest is felt throughout the Copper regions in the relics of the ancient miners, and the modern occupants of their works manifest an intelligent appreciation of the uses of such antique remains as a means of throwing light on the history of former ages. I found a peculiar importance attached by the miners and others to the hardness of the wrought copper implements. This they contrasted, in more than one case, with the ductility of the chips and fragments of unwrought copper found along with them, as well as with the condition of the native copper when first brought from the mine, and maintained that it afforded proof of a knowledge acquired by the ancient metallurgist of some hardening process unknown to the modern copper-smith. It is well known that copper and bronze chisels are frequently found among the ancient relics of the Nile Valley, and that the paintings of Egypt exhibit her sculptors hewing out the colossal memnons of lime-stone and granite by means of yellow-coloured tools, which may fairly be assumed to be made of the copper wrought by the Egyptians in the mines of Maghara, near Sinai, so early as the reign of Suphis, the builder of the great pyramid. We know, moreover, that iron was equally unknown in Central America, and that by similar tools—untempered by the addition of tin, which the Egyptians early learned to mix with their copper,—the highly sculptured monuments of Mexico and Yucatan must have been wrought by native artists. I have had no opportunity of testing the real hardness of such tools, but I observed the edges of some of the ancient implements found at Ontonagon to be dinted, just as well-hammered copper would be, by a blow of unusual force; and it is not improbable, that when due opportunity for examining into this question is furnished, the art of the ancient metallurgist will be found to have amounted to no more than the inevitable hardening of the copper, consequent on the laborious plying of it with the oft repeated strokes of his stone hammer to bring it to the desired shape. The difference which this makes on the wrought copper is abundantly familiar to the copper-smith, and also to the engraver on copper, though it is less likely to be known to the miner, working with his keen iron tools only upon the virgin metal in its native ductile state.

It seems specially worthy of note that the evidences of various kinds thus adduced to prove the existence at some former period of a mining population in the copper regions of Lake Superior, seem also to indicate that their labours had come to an abrupt termination. Whether by some terrible devastating pestilence, like that which appears to have exterminated the native population of New England, immediately before the landing of the Pilgrim Fathers; or by the breaking out of war; or—as seems not less probable,—by the invasion of the mineral region by a new race, ignorant of all the arts of the ancient Mound-builders of the Mississippi, and of the Miners of Lake Superior: certain it is that the works have been abandoned, leaving the quarried metal, the laboriously wrought hammers, and the ingenious copper tools, just as they may have been left when the shadows of the evening told their long-forgotten owners that the labours of the day were at an end, but for which they never returned. Nor during the centuries which have elapsed since the forest reclaimed the deserted trenches for its own, does any trace seem to indicate that a native population again sought to avail themselves of their mineral treasures, beyond the manufacture of such scattered fragments as lay upon the surface. Such a rude manufacture is, however, traceable among the Indians, even far to the north of Lake Superior. Mr. Henry found the Christinaux of Lake Winipagon wearing bracelets of copper; and such employment of this metal—simple as its manufacture is—may, perhaps, prove to be the remnant of arts pertaining to a higher civilization, once widely diffused over this continent.

THE CANADIAN GEOLOGICAL SURVEY AND ITS DIRECTOR, SIR WILLIAM EDMOND LOGAN, Kt. F.R.S.

BY SANDFORD FLEMING, C. E.

Read before the Canadian Institute, February 23rd, 1856.

Previous to the two great Industrial Exhibitions at London, in 1851, and Paris in 1854, the world at large may be said to have been in total ignorance of Canada's resources. Many people indeed appear to have been scarcely cognizant of her geographical position on the surface of the globe. Even our enterprising neighbors of the United States were but partially aware of what the country was capable of producing; and each member of our own population was too much engaged with his own pursuits to have any defined idea of the character or productiveness of those districts remote from his own immediate neighborhood.

Within these five years, however, through the medium of the above mentioned sources, it has been shewn that, while in various branches of mechanism and manufactures, the mechanics and manufacturers of Canada are in some respects in advance, and in the generality of cases equal to those of other nations—and while Canadian agricultural products are admitted to be of the highest quality—Canada can produce an amount and variety of raw material, equal, in proportion to the extent of area, to any other country in the world.

For the superb collections of minerals, which appear to have been the theme of universal admiration on both occasions, the country is mainly indebted to the Geological Survey of the Province, and the unwearied exertions of its Director, on whom Her Majesty has recently conferred the merited honor of Knighthood. The fruits of his labors are only now beginning to be developed, and his untiring zeal, energy and disinterestedness, cannot be over-estimated; and, with these convictions, it is incumbent on the people of this Province to show that they fully appreciate the great benefits rendered to their country, by a unanimous expression of their approbation of Sir W. E. Logan's services as Director of the Geological Survey, and as one of their principal representatives in London and Paris.

It is scarcely possible, in a brief communication like the present, to convey an accurate idea of the labor and diligence with which Sir W. E. Logan has conducted the Geological Survey of Canada; but to impress the fact upon those who are little aware of the magnitude of his undertaking, it may be well to record as concisely as possible the results of the investigations carried on under his direction, and in doing so I may be permitted to add a few remarks on the position accorded to him by men of science both in Europe and America.

Previous to his engagement with the Canadian Government, the reputation of Mr. Logan (as we shall still call Sir William in referring to his past career,) stood deservedly high, although his merits were then only known and appreciated by the comparatively few scientific men with whom he had direct communication. At an early period he made a very valuable collection of the birds and insects common to Canada, included in which were many species previously unknown, which he subsequently presented to the Institution at Swansea, of which he was one of the founders, and a zealous promoter of its interests during his residence in that locality.

But it was in the field of geology that Mr. Logan was destined to bear a conspicuous part, and it was during his residence in South Wales, that he performed a work which has been declared by the first scientific men in Europe to be "unrivalled in its time, and never surpassed since." This great work was his Geological Map and Sections of the Glamorganshire Coal-field, the minuteness and accuracy of which were such, that when the Government Survey, under Sir Henry de la Beche, came to South Wales, not one single line drawn by Mr. Logan was found to be incorrect, and the whole was approved and published without alteration. Nor was this all:—the system Mr. Logan had pursued in following out the details of the coal-field was so vastly superior to any hitherto adopted, that the principle has been fully adopted by the British Survey. Mr. Logan's map may be said to be the model one of the whole collection. It ought to be borne in mind also, that at this time he was not employed as one of the geological staff, but simply as an amateur, and that —in the same spirit as so many of his Canadian observations have been carried out,—he generously presented the fruits of his labors, without fee or remuneration, to the British Government.

While engaged in the examination of the coal-formation, Mr. Logan contributed many interesting and valuable papers to the Geological Society of London, among which may be specially noticed one on the "Stigmaria beds" or "under clays" which accompany every coal-seam; as from the observations recorded then, the long disputed theory as to the origin of coal was finally set at rest, and the inferences it led to universally acknowledged. Another paper, contributed prior to his connexion with Canadian Geology, also deserves notice here, as it refers to a matter in which a portion of Canada is deeply interested. It is entitled: "On the effect of the *packing of the Ice* in the River St. Lawrence opposite the City of Montreal." The principles laid down in this latter paper appeared so indisputable to Mr. Stephenson, the eminent engineer, that he has been materially guided by it in reference to the construction and site of the great Victoria Bridge.

In 1842 the Canadian Legislature came to the determination of having the Province geologically explored, and it was in the same year that Mr. Logan—having been recommended most strongly by the leading geologists of Great Britain, from each of whom he received the most flattering testimonials—was applied to by Lord Stanley, then Secretary for the Colonies, to undertake the investigation. In the same year he proceeded to Canada, completed a preliminary examination, made arrangements with the Colonial Government and returned to Britain,—the whole expense of which visit he paid out of his own pocket,—and early in the following year (1843) he finally returned to Canada, accompanied by an assistant, to commence the investigation in earnest.

It was in 1842, also, that Mr. Logan examined and accomplished the measurement of the remarkable section of the coal measures at the South Joggins, in Nova Scotia: a work acknowledged to be one of the most important in American geology, as the key to the structure of the whole Eastern coal basin;—and which was published as an appendix to his Report of Progress in 1843.

The first grant of money made by the Canadian Legislature to carry out the proposed survey for two years, was only £1500 currency, so that it will be obvious it was only by the strictest economy that the salaries could be paid, and travelling and other expenses met; indeed, notwithstanding all the care possible, the necessary work could not be effected with this small grant, and, accordingly at the expiration of that time, Mr. Logan found himself out of pocket upwards of £800.

During the summer and autumn of 1843 Mr. Logan was employed in an examination of the coast of the Gaspé Peninsula, while he sent his assistant to make a section of the Upper Province, through the country lying between the Lakes Huron and Erie—one grand object of the expedition being to determine what the probabilities were of the existence of coal measures at either end of the Province. In 1844 both Geologists were occupied in exploring and completing a topographical survey of the Gaspé Peninsula, and in 1845, while the Director made a survey of the Ottawa River up to Lake Temiscameng, and of its tributary the Mattawau to Lake Nipissing—his Assistant continued the examination and topography in Gaspé. In 1845 the Legislature made a farther appropriation to the Survey of £2,000 currency per annum for five years, and the same was renewed in 1850 for five years more. In 1846 the Copper region of Lake Superior occupied the entire attention of the Survey; and since that time an immense amount of country has been examined in various parts of the Province, the greater portion of which being entirely wild and unknown, it was found necessary to survey topographically. Besides the geology,—much of it of the very highest economic importance,—which has been followed out on both sides of the St. Lawrence, both above and below Montreal, in the Eastern Townships, and in the region around the confluence of the Ottawa; the courses of all the main rivers of Lake Huron on the one side of the "Height of Land," and of the Ottawa on the other, have been traced and measured to their sources, the Lakes and principal features of the interior surveyed, and the elevation of every fall and rapid ascertained trigonometrically or by spirit level. Those surveys have since been mapped on a scale of an inch to a mile, with every particular noted thereon.

Moreover, a regular system of measurements has not been confined to the totally wild and unfrequented parts, but has been found absolutely necessary throughout nearly the whole of the settlements, in consequence of the numerous inaccuracies and omissions in the various township plans. Where a more accurate method could not be obtained, all the observations were connected by a registration of each step taken by the observer, the bearings from one point to another being taken by compass. And as an example of the amount of work accomplished by this means—Mr. Richardson (who has been employed as an explorer since 1845) in 1853 registered paces, in his note book, making a total distance during the season of upwards of 1000 miles. The results of this process have also been mapped on a scale of an inch to a mile, and have supplied, on many occasions, much material to fill up deficiencies, and correct discrepancies, on the old published maps.

The result of these investigations is already acknowledged to have been of incalculable benefit to science, as having most essentially thrown light, where there was much misapprehension before, on the whole of American Geology; and they have, moreover, beyond dispute, been productive of the most valuable information as regards the distribution of economic materials. While the position of such useful materials as *do* exist can be readily recognised by reference to the Geological map, in which the various formations are represented by different colors—those that *do not* exist, will be found wanting and, consequently, need not be looked for; such, for example, is the case with regard to Coal—a mineral not likely to be found among rocks recognised as belonging to the Silurian and Devonian epochs.

Having thus glanced over the Field operations of the Survey, let us shortly consider the means the Director has had at his disposal to accomplish what already has been done.

In 1843, Mr. Logan, accompanied by a single Indian with a bark canoe, made a thorough examination of the whole of the Gaspé Coast, counting every step he took from Cape Rosier to Port Daniel, besides making many pedestrian excursions into the interior—and collecting a large quantity of most valuable fossils and other specimens. And while he was thus employed his assistant, Mr. Alexander Murray—frequently entirely alone, and often in parts remote from all settlements—collected sufficient information to give a tolerably correct idea of the structure of the whole Western Peninsula. In 1844 and 1845, a triangulation was effected across the Gaspé Peninsula from Cape Chat to Bay Chaleur, a large portion of the range of the Notre Dame or Shick-Shock Mountains surveyed, most of the principal rivers measured, the geological character of the rocks ascertained, and specimens collected. This service was performed with a party consisting of only four Indians with two canoes. In making the survey of the Ottawa more assistance was found to be absolutely necessary, but, except in few instances, neither Mr. Logan nor Mr. Murray's party have exceeded the complement of *six* altogether—inclusive of four Indians and an assistant.

Since 1845, when the additional appropriation was granted, an explorer has been added to the staff whose labors have been incessant and of great value; but while fully admitting the greatly improved circumstances under which the survey was then placed, and the more extensive scale under which the operations were enabled to be carried on, it must be clear to any one at all acquainted with the nature of the service, and of the difficulties to be encountered in a perfectly new country, that the amount of work performed and reported upon never could have been accomplished but by the most indefatigable perseverance and continued application. Accuracy with Mr. Logan is everything—nothing is allowed with him to be of the slightest value that is not essentially correct. With regard to the office work, we have simply to refer to Mr. Logan's own answer before the Select Committee of the House of Assembly to question 73, on page 26 of the published Report, to show how his time is there employed:

Question 73, page 26 (referred to.)—"Each one on the Survey has so much to do connected with his own individual department, that all the general office work falls upon me. I keep all the accounts, and for that purpose a set of books by double entry, in which I enter no gross sums, with a reference to accounts, but everything in detail for easy and immediate reference if required, and I render an account to the Government with the same detail on the face of it; so that any one who chooses, either publicly or privately, to look at the account, can see at once how every penny has been spent. I used at first to make, with my own hands, four manuscript copies of the annual Report of Progress, often reaching more than one hundred printed pages—one copy for the Government, one for the House of Assembly, one for the Legislative Council, and one for the printer; but of late I have been forced to employ an amanuensis for part. The fittings of the Museum are scarcely yet completed; when they are I *must* employ additional aid, if it should cost me my whole salary. The accumulated materials of eleven years are to be classified and arranged."

Emulating the example of their chief, the assistants have also laboured with diligence and credit to themselves, and have undergone similar fatigue and hardship. In the Chemical Department Mr. Hunt has, since his connexion with the Survey, established a high reputation among the foremost ranks of the men of science both in Europe and America; whilst the others have acquired a fair proportion of merit by their contributions to the Geology and Geography of the Province.

It has frequently been urged by some that the proceedings of the Survey were too *scientific* and not *sufficiently practical*—that great attention has been paid to *fossils*, and to remote and comparatively Northern districts of country—while a partial attention only has been given to certain known Mineral districts, and the more densely settled and more available lands. In answer to this, let us take the concluding portion of Mr. Logan's reply to question 93, page 39 of the Report of the Select Committee.

Question 93, page 39.—"Thus, Economics lead to Science, and Science to Economics. The physical structure of the area examined is, of course, especially attended to, as it is by means of it that the range or distribution of useful materials, both discovered and to be discovered, can be made intelligible. A strict attention to Fossils is essential in ascertaining the physical structure. I have been told that some persons, observing how carefully attentive I endeavour to be to this evidence of sequence, have ignorantly supposed the means to be the end, and while erroneously giving me credit as an authority upon Fossils, have fancied Economics to be sacrificed to them. In their fossil darkness, they have mistaken my rush-light for a sun. I am not a naturalist. I do not describe fossils, but use them. They are geological friends who direct me in the way to what is valuable. If you wish information from a friend, it is not necessary that you go to him, impressed with the idea that he is a collection of bones peculiarly arranged, of muscles, arteries, nerves and skin, but you merely recognise his face, remember his name, and interrogate him to the necessary end. So it is with Fossils. To get the necessary information from them you must be able to recognise their aspect, and in order to state your authority you must give their names. Some tell of Coal; they are cosmopolites; while some give local intelligence of Gypsum, or Salt, or Building Stone, and so on. One of them whose family name is *Cythere*, but who is not yet specifically baptized, helped us last year to trace out upwards of fifty miles of Hydraulic Limestone."

In concluding these observations on the character of Mr. Logan's labors in conducting the Geological Survey, carried on as it has been with unusual earnestness and zeal, I cannot do better than refer to a quotation from the *London Quarterly Review*, October, 1854, which occurs in the Report of the Committee above named—and in doing so, express a hope that in this instance the old adage will not hold good, that "a Prophet has no honour in his own country," for, in fact and in spirit, Canada is Mr. Logan's country. He was at one time applied to by the East India Company to undertake an examination of their territory for Coal; a work for which, by his past investigations, he was peculiarly fitted. The field of research was new, and India was then attracting much more attention than Canada. The emoluments would have greatly exceeded those of his present office; his staff was to be ample, and of his own selection; unlimited aid was to be afforded by the Indian Government; and although he felt quite convinced that the investigation would lead to a very extended reputation, yet being influenced by a rooted attachment to this country, and feeling that he was in some degree pledged to it because he is a native Canadian, the munificent offer of the East India Company was not accepted. The quotation above referred to reads as follows:—"In Canada, there has been proceeding for some years one of the most extensive and important Geological Surveys now going on in the world. The enthusiasm and disinterestedness of a thoroughly qualified and judicious observer, Mr. Logan, whose name will ever stand high in the roll of votaries of his favourite science, have conferred upon this great work a wide-spread fame."

As I have already said, the services rendered to the Province by Sir W. E. Logan in London and Paris would alone suffice to entitle him to the unanimous acknowledgments of his country; may we hope that the Legislature will give substantial expression of its approbation, as well as of its appreciation, of the justly merited distinction which Her Majesty has conferred on the representative of Canadian science; and there is no manner, I feel assured, in which this could be done more acceptably to Sir W. E. Logan himself, and more creditably and lastingly beneficial to the Province, than in extending to the Survey increased support, and in placing at his disposal ample means to enable him to carry on this most important service to a successful termination. By such means the wealth and character of Canada will be equally advanced. Science will receive such valuable contributions as, we believe, no country, at so early a stage of its existence, has ever before rendered to it; while the practical returns will prove a hundred-fold in their additions to the material wealth and resources of the Province.

NOTES ON THE POPULATION OF NEW ENGLAND.

BY THE REV. A. CONSTABLE GEIKIE.

Read before the Canadian Institute, February 23rd, 1856.

On a recent visit to New England, I was led to pay some attention to a matter which has long interested me, viz, the supposed deterioration of the population of that country. My observations and the remarks of others, years ago, called my thoughts in this direction, and finally led me to examine such reliable statistical tables as were within my reach. The results of this investigation I shall now lay before the Institute. I state them with the belief that the people of New England are degencrating, and shall endeavour to prove the accuracy of this opinion.

The last Census of the United States was taken in 1850, and a compendium of this was published in 1854 by Mr. J. D. B. DeBow, Superintendent of the United States Census. From this I shall quote, and presume that its general reliability will not be questioned.

The first point I would notice is the proportion of births among the married inhabitants of Massachusetts, native and foreign. In page 122 of the Compendium are the following statements, contained in extracts from the letters of Dr. Jarvis to the Census Officc. I need only add, that I believe the writer to be one of three persons appointed by the Legislature of Massachusetts to draw up the report on the lunacy and idiocy of that State, and which was published in 1855, Dr. Jarvis having been really the compiler of it. His statements above referred to are as follows:—"In Massachusetts and in Boston, where we have the means of making the comparison, there is a much larger proportion both of marriages and births to the population of each kind, among the foreigners than among the natives, within three or four years. .... The marriages were in Massachusetts during the years 1849, 1850, and 1851, Americans 18,286, or 220 in 10,000 of their own race; foreigners, 7,414, or 450 in 10,000. This is 104, 5 per cent. excess of foreign over native ratio. .... The marriages in Boston in the three and a half years from July, 1849, to Deccmber 31st, 1852, were, Americans, 4,078, or 541 in 10,000 of their own race; foreign, 5,073 or 799 in 10,000. This is 84, 8 per cent. excess of foreign over native ratio." So much for the superior uxoriousness of the old world people; now for the results of the two sets of marriages. "The births," continues the Doctor, "were in Massachusetts in the three years 1849, 1850, and 1851, of American parents, 47,982, or

578 in 10,000 of their own race; foreign, 24,523, or 1491 in 10,000 of their own race;" a difference of a most significant character. "In Boston there were, Americans, 7,278, or 966 in 10,000, foreign, 13,032, or 2,053 in 10,000 in three years." He adds,—"These facts certainly show a much greater tendency to marriage, and a more rapid production among the foreign than among the native population here." He says on page 121—"foreigners generally intermarry with each other, so far as we have means of observation; there are comparatively few instances of natives and aliens uniting together; so few are there that they do not militate with the general rule. With the Irish especially, this rule is almost universal, and with all it will be safe to say that there are no more marriages of foreigners than there are foreign marriageable females, the exceptions are so rare as not to destroy any extensive calculations made in regard to it." Dr. Jarvis seeks to weaken the facts thus brought out, by intimating that the children of foreigners dying young are more numerous than those of the natives who die young, and that the rapid increase among the former may thus be partly accounted for. This, however, is not enough. The deaths must indeed be wonderfully frequent among the offspring of emigrants, if they can make 598 births in 10,000, equal to 1,491 in 10,000, or 966 in 10,000 equal to 2,053 in 10,000. The facts I believe must stand, the excess of births among the foreign over the native population indicating one of two things respecting the latter,—either that they are an enfeebled race, or addicted to practices which I will not name.

These figures confirm all my own observations. A large family is comparatively seldom met with in New England. Indeed, the absence of children altogether, appears to be a far commoner thing than any large number of them in a household. The remarks of the old people likewise sustain my view. Such can run over long lists of households, which, during the past generation, were like households at the present day in Britain, crowded with little people; and when they do so, they invariably note the difference between thirty or forty years since and the present time. I am now speaking chiefly of New England, of which Massachusetts is the best State; but the Census returns for the entire Union, show a general decrease, rather than an increase in the number of the young. The following abstract is taken from some remarks which I have already published on this subject:—Thus, "in 1830, there were, *in the whole Union*, a fraction over eighteen per cent. of males, and seventeen per cent. of females umder five years of age; while in 1850, there were under five years, only fourteen and rather more than a half per cent. of the former, and rather less than fifteen per cent. of the latter. In 1830, there were fourteen and a half per cent. of males under ten years, and the same number of females under ten years; in 1850, there were thirteen and a half per cent. of the former, and rather less than fourteen per cent. of the latter. This difference on the whole Union is striking enough, and confirmative of my opinions; but I am certain that if we had any such statistics as to the present number of children in New England, compared with forty years since, we would find the difference far more remarkable."

The second point in proof of the physical degeneracy of New England, is found in the prevalence of insanity and idiocy among its inhabitants.

Let us first look at the statements of the Census on this head, merely premising that, in so far as it is inaccurate, it is so because it understates the matter. From this source it would appear that in 1840, the ratio of white insane persons in Massachusetts was as 1 to 605; in 1850, it was as 1 to 403. In 1840, the ratio of white insane persons in Connecticut was as 1 to 606; in 1850, it was as 1 to 486. In 1840, the ratio of white insane persons in Maine was as 1 to 932; in 1850, it was as 1 to 514. In 1840, the ratio of white insane persons in Rhode Island was as 1 to 520; in 1850, it was as 1 to 449. In 1840, the ratio of white insane persons in Vermont was as 1 to 732; in 1850, it was as 1 to 366.

From these figures it is certain, either that mental disease is on the increase, or else that the Census of 1840 was singularly imperfect. Leaving this question, however, I shall now state, as by the Census of 1851, the ratio of insane and idiotic in the New England, as compared with some other States:

"Massachusetts had, in 1850, 1 insane or idiotic white person, for every 403 sane whites. That same year, the ratio of insane or idiotic whites, to sane whites, was—in Michigan, 1 to 1,242; in Mississippi, 1 to 1,227; in Missouri, 1 to 1,031. Connecticut had, in 1850, 1 insane or idiotic white for every 486 sane whites.—That same year, the ratio of insane or idiotic whites to sane whites was—in Columbia, 1 to 1,649; in Florida, 1 to 1,276; in Illinois, 1 to 1,417; in Iowa, 1 to 1,410. Maine had, in 1850, 1 insane or idiotic white for every 514 sane whites. That same year, the ratio of insane or idiotic whites was—in Arkansas, 1 to 995; in Louisiana, 1 to 1,022; in New York, 1 to 738. Rhode Island had, in 1850, 1 insane or idiotic white, for every 449 sane whites. That same year, the ratio of insane or idiotic whites, to sane whites, was—in Texas, 1 to 1,185; in Wisconsin, 1 to 2,087; in Minnesota, 1 to 3,019; in New Mexico, 1 to 1,118. In 1850, Vermont had 1 insane or idiotic white for every 366 sane whites. That same year, the ratio of insane or idiotic whites, to sane whites, was—in Oregon, 1 to 1,454; and in Utah, 1 to 1,888."

"In all the comparisons made, New England retains a fearful pre-eminence. In comparing her with some other old States, this is not quite so great. Take the following table:—

RATIO OF INSANE AND IDIOTIC, TO SANE, IN 1850.

Vermont	1 to 366.
Massachusetts	1 to 403.
Maine	1 to 514.
Connecticut	1 to 486.
Rhode Island	1 to 449.
New Hampshire	1 to 436.
Virginia	1 to 509.
N. Carolina	1 to 511.
Maryland	1 to 555.
S. Carolina	1 to 580.
Delaware	1 to 583.
Kentucky	1 to 588.
New Jersey	1 to 599.
Georgia	1 to 645.
Indiana	1 to 659.
Tennessee	1 to 666.
Pennsylvania	1 to 685.
Ohio	1 to 738.
Alabama	1 to 784."

Such are the indications of the Census. It may be supposed, however, that the returns in the New England States were more complete than those of the new settled countries. This is no doubt the case. Still, making every allowance, I cannot doubt but that there is far more cerebral disease in New England than in any other portion of the Union.

We shall now leave the Census tables, and turn to a more complete document, to wit "the Report on Insanity and Idiocy in Massachusetts, by the Commission on Lunacy, under the resolve of the Legislature in 1854." Respecting this authority it seems safe to say that, with regard to "accuracy, completeness and pertinence," it has never been surpassed. The means employed for procuring facts were most efficient, and the chances of error were as greatly reduced as it seems possible to have reduced them. The returns in the British Census for 1851 bear a poor comparison with the fullness of those contained in this Report. It refers to Massachusetts only; but as this is a type of all the other New England States, the facts established respecting it may be taken as a fair indication of the condition of the rest. These are peculiarly striking.

A careful separation of the insane and idiotic is kept up throughout this document. Of the former, Massachusetts contains a total of 2,632; of the latter, a total of 1,087: giving 3,719 as the sum of both classes. A distinction is again made of the mentally diseased among the native and the foreign population, which gives of native insane, 2,007, and of foreign insane, 625; of native idiotic, 1,043, and of foreign idiotic, 44. We have here data of the most reliable kind; but there are different ways of dealing with them. Thus the Commissioners, or rather Dr. Jarvis, in stating the comparative numbers of native and foreign demented, carefully keeps up the distinction hitherto followed, and by doing so shews that insanity is more common among the immigrants than among his own people. By this mode of reckoning he shews the ratio of insane among natives to be as 1 to 445, and the ratio of insane among foreigners to be as 1 to 368. The excess of lunacy among these strangers is unquestionable and noticeable, but it is neither a strange fact, nor an unaccountable one. Their trials explain all. The case is greatly altered, however, when he deals with idiocy. This same comparison shews that among the natives, the idiotic are as 1 to every 889, while among foreigners they are as 1 to every 7,931.

Were we anxious merely to prove great derangement in both classes, this mode of computation might suffice. But as we are anxious to discover the actual amount of mental disease existing amongst a particular class, in common with the writer on lunacy in the North American Review for January last, I cannot help deeming it unsatisfactory, to say no more. I believe that the New Englanders are degenerating, that every kind of mental disease is degeneracy, whether for convenience sake the species be styled lunacy or idiocy; and therefore must, and am entitled to conjoin both classes in order to reach the actual state of the case. The saneness of a country can only be decided on by knowing the *total* of the *unsaneness* found in it. I believe, therefore, that though the Commissioners gave peculiar prominence to the excess of foreign lunatics as compared with native, every one, themselves not excepted, will admit that, in an enquiry like that which I now indicate, we are fully entitled to lay aside their specific distinctions, and so speak of all the demented as comprehended under one genus.

When we do so, the apparent exemption of the natives from cerebral disease disappears at once, and most painful results become manifest. In 1854 the natives in Massachusetts amounted to 894,676, the foreigners to 230,000. The insane and idiotic among the former amounted in all to 3,050; the insane and idiotic among the latter amounted in all to 669. The application is now easy, and the result, that the mentally diseased among the foreigners are in the ratio of 1 to 367, while the mentally diseased among the natives are in the ratio of 1 to 295, giving a difference of 72 in favor of the immigrant population. This is the mode of reckoning adopted by the North American Reviewer, who says that the Report proves one or both of the following results—"either that insanity (using the word generically) is more prevalent in Massachusetts than anywhere else, or that its dimensions have been more accurately guaged."

The insanity then, among the native population in Massachusetts, is as 1 to 293; and that the reader may perceive the value of this ratio, I would state that, about the year 1838, the insane of England were reckoned as 1 to 1,000; in Wales as 1 to 800; in France as 1 to 1,000; in Prussia as 1 to 1,000; in Scotland as 1 to 574; in Norway as 1 to 551. The last Census of our Province gives for Lower Canada 1 in 513, and in Upper Canada 1 in 890. The British Census for 1851, gives the insane of Great Britain as 1 to 1,115, which, however, is probably under the mark.

Another proof and source of degeneracy in New England, is the prevalence of strumous diseases among its native inhabitants. I cannot indeed quote figures in reference to this matter. Every one, however, is aware of the fact that such diseases are alarmingly common. In Britain, people look with dread on such a taint. Among the Scottish peasantry it is almost unknown, and, generally throughout all Scotland, there prevails a fear of intermarrying with parties affected by it. As for the state of feeling in England I cannot confidently speak. I believe, however, that it resembles more or less that of the population north of the Tweed. In New England the case is far otherwise. In town or country, no one makes any secret of being afflicted with such diseases. Contrariwise, people tell you all about it, and discourse on the matter as if it were the measles which ailed them. Such affections seem to be so universal, that no delicacy is felt, or possible in the circumstances.

I need not go on to multiply proofs. People who visit New England will find them if they use their eyes. The men are for the most part lathe-like, angular, and sallow; their shoulders have a most jagged squareness, and their chests a hollowness equal to any which ever troubled Theodore Hook. Then one looks in vain for calf or hip. Such accessories seem by universal consent to have been discarded by the entire population, raising the tailor from the rank of a mechanic to that of a sculptor. When, again, we turn from the men to the women, we find equally striking proofs of degeneracy. Not only are their shoulders narrow to a most unnatural degree, but their chests likewise are hollow and contracted in a manner which helps to explain the marvellous prevalence of consumption among them. That they are pretty in mere girlhood is unquestionable, but in the slight form, blanched cheek, and flat bust, one sees only the beauty of decay. They are ever more and more becoming incompetent to be mothers of children, and I am assured that the number of deaths among young married females is quite remarkable. One looks in vain through any part of New England for the round, full, vigor of glorious health, which, everywhere in Old England, shows a population as replete with sturdy, vital energy, as at any period in the long story of our dear Mother-land.

I would, further, call attention to the portraits painted seventy years since, and those taken at the present day. These, if all else were wanting, demonstrate a great falling off.

The causes of all this seem to be as follows:

I. Climate, possibly, has much to do with it. Even in Canada the children are not so vigorous as their fathers.

II. The thing eaten, and the mode of eating, have much to do with it. Americans eat quantities of unwholesome food, and the bulk of the people never chew what they swallow.

III. The women abjure all out of door exercise.

IV. The men do the same.

V. They live in a perpetual state of excitement, such as no race on earth can endure, or were ever meant to endure.

VI. The population receives little accession of fresh blood, and blood relations frequently intermarry.

VII. It is alleged that vice has no small share in the work of destruction.

THE ABORIGINES OF AUSTRALIA.

BY JAMES BROWNE, TORONTO.

Read before the Canadian Institute, February 16th, 1856.

In the following paper I purpose attempting to give an account of the Aborigines of Australia, a subject not without interest to us as relating to a people situated in a remote portion of the British Empire, but on whom its civilization has produced no beneficent influences. On them it is effecting, even more rapidly than on the Aborigines of this continent, the fatal effects which appear inevitably to flow from the contact of savage with highly civilized life, and these notes accordingly refer to a people who are fast disappearing from the earth. Imperfect as they are, they may possess some value from the fact that they are in no degree derived from books, but embody the results of personal observations of the natives of Australia, concerning whom few among the numerous writers on the great southern region of British colonization appear to feel the slighest interest, or to have thought their habits and characteristics worthy of remark.

It was my fortune to pass the greater part of my boyhood at King George's Sound, a settlement on the western coast of Australia. There the Aborigines were my companions and playfellows, and thus the following account embodies facts which came under my own observation, or were related to me by the natives themselves. It narrates principally the result of my observations on those with whom I sojourned; but it may be added that the manners and customs of the Aborigines of the western, southern, and eastern coasts of Australia vary so little that a description of one may answer for all. Of those inhabiting the northern coast I could speak only from report. They are a still more savage race, with whom little intercourse has hitherto been held, and they appear to present a striking contrast in some respects to the natives of other regions of the Australian Continent.

Referring as I do to a people rapidly becoming extinct, it will not detract from any value these notes may possess, that they do not embody a description of Australia of the present time, with its wonderful gold fields, and its vast and multifarious population gathered seemingly from nearly every country of the known world; but they refer to Australia as it was twenty years since, when Melbourne and Port Philip were inhabited only by the savage, when South Australia, as a Colony, was unknown, and Western Australia was only beginning to be settled by the white man.

The entrance to the noble basin of Princess Royal Harbour, on which the town of Albany in Western Australia stands, is formed by two high and rocky hills about half a mile apart, and here, some twenty years since, on a bright morning in the month of May (which be it remembered is the depth of an Australian winter,) I obtained my first sight of the Aborigines of the Southern Continent. The first impression produced by a sight of the grinning native in the bow of the harbour master's boat—black as coal, but with a pair of keen sparkling eyes, and a row of teeth disproportionately prominent from the large size of his gaping mouth,—was that we were looking on a baboon or some strange creature of that new world, rather than on a human being. A short cloak of kangaroo skins, the invariable costume of the natives, as we afterwards found, was his only garment, reaching about half way down his thighs, and exposing the lower limbs, which were disproportionately small and shapeless. His arms were sinewy though lean, but as is invariably the case with the Australian savage, larger and better developed in proportion to his general figure, than the meagre shapeless lower limbs. He was, as I ascertained, about thirty years of age, but looked much older, of low stature and slight figure. His hair, which was thick and curly, grew far down over a low and poorly developed forehead. His eyes were small, deep-set and lively ; his nose delicate though somewhat flattened, and his mouth large and protruding. Such was Wan-e-war, the first of the Aborigines of Australia it was my fortune to see, and no unmeet type of his degraded and doomed race. We soon had further opportunities for observing the aboriginal owners of the land in which we proposed to sojourn.

Towards dark on the day of our landing, we heard a great shouting and jabbering amongst the natives, from which we were led to believe that they were preparing for some special festivities. The men were collected round their fires very busy in "getting themselves up,"—plastering their locks plentifully with a pomatum made of grease and red ochre, and beautifying their persons in a variety of other ways. All this preparation was for a corroberry or native dance, which they intended to have in honor of the arrival of the strangers. Accordingly, soon after dark, they assembled round the large fire kindled for the purpose near our dwelling, and the proceedings of the evening commenced. The cloaks of the dancers, instead of being thrown over the shoulders, as usually worn by them, were fastened round their middles, leaving their bodies completely bare, which, with their faces, were painted in the most grotesque manner with red ochre, and shining with grease. Some had bunches of feathers or flowers stuck in their hair, while others completed their head dress with the tail of the wild dog. One or two had a small bone of the kangaroo passed through a hole in the cartilage of the nose ; all carried their spears and wameras ; and as they thus stood gathered round the fire, which threw a vivid glare on their greasy and shining bodies, the effect was truly picturesque and savage.

Those who intended to take a part in the dance ranged themselves on one side of the fire ; on the other side sat the old men and the women and children. The corroberry commenced by the dancers breaking out into a sort of mournful chant, in which the old men and the women occasionally joined. The whole burden of the song consisted in the words "Yunger a bia, mati, mati," which they repeated over and over again, beginning in a loud and shrill tone, the voice gradually dying away as they proceeded, until at last so low and soft was it, as to be hardly distinguishable from the breeze which rustled amongst the bushes.

Whilst thus chanting the dancers remained in a bending posture, and kept time to their voices by lifting their feet with a sort of jerking step from the ground, and at the same time pulling the two long ends of their beards through their hands. Suddenly they would change their music into a loud "Haugh heigh, haugh heigh, haugh heigh," whilst they clashed their spears and wameras together, and stamped their feet with full force against the ground; then drawing themselves up with a sudden jerk, a loud and startling "Garra-wai" was shouted. Then again they would resume their first movement, but in double quick time, the whole rank now moving quickly up and down side-ways, shoulder to shoulder, now going round in a circle, and all to the same music, and with the same stamping steps.

Tiring of this, the sport was changed to the "Kangaroo dance." This dance is very similar to that already described, but with the difference—that, in the midst of the uproar, one of the men came bounding and jumping like a kangaroo between the dancers and the fire; this movement put a sudden stop to the dancing, and one of the party started off as if in pursuit of the game, the two then went through the whole proceeding of hunting down and spearing the kangaroo, which, being at length accomplished, they all once more joined in the dance, and in the midst of the uproar, the stamping of feet, the clashing together of spear and wamera, and their shouting and yelling, the fire died away, darkness covered the scene, and the entertainments of the evening were brought to a close. And thus also closed the first day of my sojourn in Western Australia.

The country in the immediate vicinity of King George's Sound, an arm of the sea on the western coast of Australia, is inhabited by four tribes of the Aborigines. These are the Murray, the Weal, the Cockatoo, and the Kincannup. In saying, however, that this part of Australia is inhabited but by four tribes, it may be necessary to explain that this distinction of people is altogether that of the natives themselves, and the four divisions here mentioned are applied to the relative position of that portion of the country occupied. Thus, for instance, all those natives inhabiting the country to the westward of Albany are called Murray men; those to the northward, Weal men, and those to the eastward, Cockatoo men. Each, therefore, although a distinct division, can hardly be looked upon as one single tribe, but rather as a combination of many small tribes, inhabiting a territory lying in a certain position.

The Murray tribe, the most numerous of all, occupies a territory exceeding in extent that of any of the rest; that is, the whole of the coast running some 300 miles from King George's Sound westward to the Murray River in the Swan River Colony.

The natives belonging to the Weal tribe wander over the country to the northward of Albany. They are, perhaps, not so numerous as the Murray tribe, but they are, I think, physically stronger, and of greater importance in the estimation of the aborigines generally.

The district of the Cockatoo tribe extends a considerable distance along the sea-coast to the eastward of Albany, and runs also from the coast far back into the interior.

The Kincannup tribe inhabits the country in the immediate vicinity of Albany. It is a small and weak tribe, and in comparison with the others, can hardly be looked upon as a distinct one. Kincannup is the native name for that district upon which the town of Albany stands. The natives who generally stayed in and about that settlement, style themselves, therefore, Kincannup men; but they may be regarded, I think, as merely a branch or family of the Weal tribe, those inhabiting the country to the northward of the Sound. Be this as it may, many causes have combined to extirpate the Kincannup people. The white man has driven the kangaroo from the native's grounds; he has therefore to depend principally upon the colonists for a scanty means of existence. These and other causes, which I shall notice hereafter, have rendered this tribe nearly extinct. When we left the colony, they could not probably muster more than from twenty to thirty souls.

Although of the same stock and possessing the same characteristics as a people, it is not difficult to distinguish the individuals of the different tribes by their general appearance, which corresponds in some measure with the nature of the country they inhabit. The men of the Murray tribe, for instance, are short, strong, and hardy looking fellows. Their country, lying on the coast, is scarcely more than a barren waste, with little shelter from the violent storms that sweep over the exposed shores of this part of Australia. From this cause, the kangaroo, which is almost the only animal food these people have, is not so plentiful in the district as farther in the interior, and thus from the insufficient supply of animal food, the people of this tribe do not present so robust an appearance as others more favourably located. This deficiency of animal food, however, is made up in a great measure, by the immense quantities of fish they are enabled to procure in the innumerable bays and inlets on their coast.

The Weal men again are a much finer and stronger race than those inhabiting the coast. They have the advantage of possessing a country lying deep in the interior,—for the most part thickly wooded,—well protected from the cold winds of winter,—and abounding in kangaroo and game of every description. Not being stinted, therefore, in their supply of animal food, they appear to be proportionably stronger and more robust.

Again the Cockatoo men are markedly distinct from either of those mentioned. They are generally tall and large-boned men, with high foreheads and aquiline noses. Their appearance indicates, indeed, a higher degree of intellect than their neighbors, over whom they have contrived to gain a strange and mysterious influence, which will be explained hereafter when referring to their superstitions.

As each tribe is distinct in appearance, so too is it noted for some one article or weapon, in the manufacture or use of which it is famous. The Murray man possesses the best wood for spears;—the Weal man is envied for his long, full, and beautiful kangaroo skin cloak, and also for his hammer of stone;—whilst the Cockatoo man excels in making and throwing that most eccentric and wonderful of all weapons, the boomerang or kilee.

I have already stated that each tribe occupies its own separate division of territory. The district thus occupied is again subdivided into vaguely defined portions, every family or individual of the tribe having its or his recognised tract of country. This property descends in the family, from one to another, and is considered in every way private property, and the proprietors of such are boastful and proud of their hunting grounds in proportion to their extent and nature.

But although thus appropriated, it is difficult to say in what the rights of ownership consist,—for agriculture is altogether unknown amongst them, and the various members of the tribe hunt indiscriminately over each other's grounds. The case, however, is somewhat different in regard to strangers, for should an enemy, or one of another tribe wilfully trespass on these grounds, such a liberty would be immediately noticed, and would in all probability lead to acts of violence and retaliation on both sides. And in this right of taking umbrage when convenient, and in making the subject a matter of quarrel, consist, I think, the sole advantages of proprietorship.

Although thus divided into tribes and families, yet nothing resembling a set form of government exists among the Australian Aborigines; nor have they either chief or ruler to guide or advise them.

Occasionally, however, they might be heard talking of some one great and distinguished individual, who, to judge from their manner of describing him, held a high and influential position in the tribe ; and this has induced many to believe that a sort of chieftainship was recognised amongst them. It was always found however, when the subject became thoroughly sifted, that this great personage had acquired his influence over his fellows, as perhaps an expert and ready spearsman, solely from being more bloodthirsty and domineering than his neighbors, and from having killed all,—men, women, and children,—who were unfortunate enough to fall under his anger. And thus knowing, from bitter experience, that to contradict so dangerous a character would be any thing but prudent, the respect paid to him by the rest of the tribe was altogether a matter of policy on their part, induced by fear, and not from his having any distinct right to dictate or command.

I have already stated that each tribe is celebrated for the manufacture of some weapon or other article. In order to exchange these different articles, as well as to have a sort of jollification and grand Kangaroo hunt, the different tribes assemble by appointment at a given spot at certain seasons of the year. The scenes here enacted are exciting and varied ; they generally begin in harmony and good fellowship, and end in quarrels and an angry dispersion.

The place of rendezvous is usually in a part of the country where the Kangaroo is plentiful, and in the vicinity of a small Lake. When all are collected, operations commence by the tribes forming an immense circle, having the lake for its centre. The hunters at first are a considerable distance from each other, and extend over a large tract of country. At a preconcerted time, they all gradually draw in towards the Lake, shouting and striking their spears and wameras together. The Kangaroos are thus driven from all quarters into the centre, where they find themselves blocked in and completely surrounded by the natives. The Kangaroos now make a general rush to escape, and a scene of confusion and noise ensues which baffles description. Spears, kilecs, and other weapons are thrown in from all sides, and immense numbers of the game are killed in their vain efforts to clear the boundary. Some in desperation take to the water, but these, being out of their element, are soon despatched. The natives return to their bivouac laden with spoil, and do nothing but eat, drink, dance, and sleep, until hunger again drives them forth for a further supply.

All would appear to be going off smoothly and amicably enough at these general assemblies of the various tribes, nevertheless, something most frequently occurs to put an unpleasant stop to these jovial proceedings. There is some old quarrel to be settled, some old sore to be healed, and thus the evil disposed contrive to get up disputes, or to recall wrongs still unsettled and unrevenged. Each party has his friends and relatives about him, who feel themselves called upon to take a part in the matter, and thus the whole camp gets involved in a general quarrel. From wrangling, matters proceed to blows,—the wamera is seen to flourish in the air,—spears begin to fly about; pierced legs and broken heads are the consequence, and the parties separate vowing vengeance against each other.

These fights however rarely prove fatal to any one, for the belligerent parties generally contrive to make a great noise without doing much damage, beyond perhaps one or two wounded legs and a broken head or so, which are looked upon as mere trifles. It is absurd, indeed to witness an affair of this kind. It commences by one of the men jumping up and throwing down his spear somewhere near his opponent, who immediately springs to his feet to revenge the insult. The encampment is immediately in an uproar, and the friends of both rush to hold the combatants. Thus secured the foaming warriors tug and struggle away at a fearful rate, and show great indignation at being prevented, by their unkind friends, from totally exterminating each other; they are careful, however, not to exert themselves to such an extent as to prevent their being held without much difficulty. But other relatives or friends soon appear for the purpose of taking part with the combatants, these in like manner are held by other friends; until at last the whole party are either holding or being held. And thus, giving vent to their feelings in abuse and threats, they gradually calm down from pure exhaustion, and having arrived at this stage, they promise to lay aside their weapons for the time being; they are then released, and return sulkily to their huts, to repeat, probably, the same farce the next day.

The reader must not come to the conclusion, however, from the description of such a scene, that the natives of this part of the world never kill each other. Far from it. When one of the tribe dies, either from natural causes or otherwise, the nearest relation of the deceased is expected to take the life of one of another tribe; they, in their turn, retaliate in the same manner; they are, therefore, in a continual state of dread and warfare. But it is not open warfare; by treachery alone is it carried on, and often does the Australian meet his death from the hands of him he receives as a friend at his fire. Cunningly disguising his base intention, and watching until slumber seals the eyes of all around, the enemy will drive his spear deep into the breast of his victim and then plunging into the woods, return to his tribe, proudly boasting of his crafty deed. Or silently prowling about in search of an oportunity of revenge, he will, probably, come upon the wigwam at a time when the husband is away hunting, and the wives and children are dozing around the fire, unconscious of all danger. Silently and serpent like, the blood-seeker nears his prey, then springing into their midst, drives his spear into all that are unable to escape.

The principal, if not indeed the only, food of the Australian, is that procured in the chase. His life, therefore, is necessarily a wandering one, ever moving, as the scarcity of food, or other circumstances may dictate. Policy has also no inconsiderable share in producing these frequent changes. For in thus roving over the country the Nomades render it a more difficult matter for their prowling enemies to mark their encampment; and to take advantage of an unguarded moment to wreak their vengence. These changes also tend to free them from smaller, but hardly less disagreeable neighbors, which always increase at a prodigious rate, around a spot inhabited for any length of time by a people totally void of everything like cleanliness. Thus influenced by the exigencies of the moment, on breaking up the establishment they may, perhaps, move off for miles from the old position; or they may erect their new wigwams within sight of the old ones. As these huts, however, are of the most simple description, and can be finished in a workmanlike manner in a very short time,—their household furniture, too, being of the smallest quantity known in the economy of house-keeping,—no very great inconvenience is experienced in these constant movements. Their huts are chiefly formed of long grass, rushes, the bark and branches of trees. Each one is sufficiently large to admit of two or three persons curling themselves up inside like so many hedgehogs. Their shape is that of an arch, the highest part of them being about three feet from the ground, with the front completely open, and sloping down gradually in the rear. To give a better idea of one of these establishments, imagine a bowl or tea cup, turned with the bottom upwards and then cut down through the centre, each half will be a minature model of an Australian mansion. At all seasons, summer and winter this is their only shelter; with but a small fire in front, men, women, and children, each one coiled up in the cloak of kangaroo skins, sleep through storm and tempest, and set all weather at defiance. In their ordinary mode of living, and when in their own district, the tribe is usually broken up into small parties or families, each party forming an encampment, of some six or eight of these wigwams. It is seldom that the tribe musters except when about to leave its own territory for a distant part of the country, or when some mighty question, having reference, perhaps to a general expedition against another tribe, has to be discussed and planned.

During the summer months the tribes of the interior generally make towards the sea coast for the purpose of enjoying a feast on the various kinds of fish which are there to be obtained. They have several methods of proceeding in this sport, but that usually adopted is for the whole of the natives in the neighborhood to assemble together near some shoal or sand bank, which at low water is left covered with but a few inches of water. Early in the fine mornings of summer, just as the sun breaks forth, these sand banks may be seen sparkling with innumerable fish which seem to frolic about in sportive glee, now darting along and chasing each other with the speed of an arrow; now flinging themselves far out of the water as if to exhibit their bright armour in the shining rays of the sun. But man, the universal enemy of creation, has to satisfy the cravings of nature; he also is up and stirring, and cannot permit so tempting an opportunity to pass, and so calling to his companions they all pull armfuls of branches from the trees and then hurry to the beach intent upon the sport. The attack is commenced by erecting a sort of weir with the branches and twigs; this is made in a semicircular form with one end touching the beach and the other towards the edge of the shoal. The whole party now wade into the water and spread themselves over the shoal at some distance apart from each other, then gradually drawing in toward the open side of the weir, their splashing and noise cause the fish to rush into the snare laid for them. Thus entrapped, spears pour in from every point, each man trying to outdo his neighbour in shrieking, kicking, and splashing; here some may be seen probing right and left with their spears within the weir, there others are skipping through the shoal water in chase of runaways who have managed to dart through or over the bounds, and thus in a short space of time an immense supply of food is secured. It is astonishing indeed to see the quantities of fish taken in this manner. These fishing parties may number perhaps some forty or fifty men, and it is no unusual thing to see each one come off with as many fish as he can well stagger under. When I add, however, that it is not uncommon to see upwards of five cwt. of a fish called the skipjack taken in a single haul of the seine, what I have related will excite less surprise.

On the approach of winter the tribes draw off from the coast into the interior of the country, where, encamped in the depth of the forest, they lie sheltered from the severe storms with which the Australian shores are then visited. The fact of the kangaroo, their principal source of sustenance also seeking the shelter of the interior at this season, has, of course great influence in attracting them from the coast. I have already endeavoured to describe their mode of capturing this animal when the tribes are mustered in force. When hunting individually, which is the ordinary method, the hunter sallies forth alone, without even a dog, and armed with only one or two spears and his wamera. He is not long in coming upon the track of the game he is seeking. This he follows up, sometimes for miles, with a sharpness of vision and noiselessness of movement which to the white observer is extraordinary; but he is now gaining on the prize, and symptoms of its close vicinity are evident; with breathless caution and with spear poised, he gradually advances upon his victim, taking advantage of every stump or bush to cover his approach; at length a glimpse of the game is gained, which may be quietly grazing, or perchance enjoying a siesta under cover of some thicket unconscious of danger; a sharp and whizzing sound in the air is all the notice it gets, and the next moment it lies transfixed with the spear.

The clothing of these people consists of but one garment, a cloak made of the skins of the kangaroo. This cloak which is worn by both sexes, they contrive to make serve for all weathers and seasons. The usual manner of wearing it is with the fur next to the body; but when exposed to heavy rains it is reversed and the fur turned outside in order to allow the wet to run off without penetrating the skin. During the warmer summer months and when roving in the woods away from the settlements, even this is generally dispensed with; they then wander about unencumbered and free of all restraint as far as artificial covering is concerned, and but seldom use their cloak except merely to wrap about them when sleeping around their fires, to protect them from the dew and cold night air.

The men also wear round their waists, under the cloak, a fine string made of the fur of the opossum, about as thick as common grey worsted, which it much resembles in appearance. This is wound about them in innumerable folds, until it forms a belt about as thick as a man's wrist. When suffering from want of food, which is often the case, this belt is drawn tightly round the body, and by thus compressing the stomach, it tends to alleviate, for a time, the cravings of hunger. It also serves as a depot for their kilees, stone tomahawks, knives, or any thing else that they may wish to carry about them.

On my first landing amongst the savages of Australia on the beach at Albany, I observed that some of the men had small bones, or pieces of wood, passed through a hole in the cartilage of the nose. These I afterwards learned were persons of some consideration in the tribe, men of distinction, who sported this conspicuous badge with no small degree of ostentation. The hole is pierced through the nose when the individual is young, and for the following purpose. The tribe wish to communicate with the neighboring tribes on some particular subject, or to send a complimentary message of peace and goodwill to those around them. The chosen messenger is a boy between 12 and 15 years of age; but before starting on his embassage, it is necessary that the individual thus honored undergo the operation of having his nose bored. This is performed with a small bone of the kangaroo, sharpened and made almost red hot, which being forced through the cartilage just below the nostrils is there allowed to remain until the wound heals. But in the mean time the boy proceeds on his mission, and as long as the wound remains unhealed his person is held sacred, and he is treated with the greatest friendship and respect wherever he makes his appearance. On starting he is accompanied by one or two of his relatives or friends as far as the next tribe, in whose charge he is left;—remaining some short time with these, he is passed on to the next tribe in the same way; and so on until all the tribes have been visited, when he is returned to his people in like manner from tribe to tribe. By this time the hole in the nose is pretty well healed, but the bone, or something else of the kind, continues to be worn by way of ornament and as a mark of distinguished services. The same description of ornament is mentioned by Cook as existing amongst the South Sea Islanders, and to it our sailors gave the not inappropriate designation of "sprit-sail yard." It would appear, indeed, that this barbarous fashion of disfiguring the body, in order to decorate it in some such way, is common to many nations. The aborigines of Australia, and the South Sea Islanders have their "sprit-sail yard," others have their nose-ring, whilst the negress of Africa, and the refined and intellectual female of Europe, have their ears pierced to receive the not less becoming and useful ear-ring. But whether it be the bone in the nose of the Australian, or the ring in the ear of the English woman, the custom is the same, and equally civilized or equally barbarous.

In speaking of ornamentation I have to mention another and no less barbarous method of the Australians for beautifying their persons. I allude to the custom amongst the men of lacerating their bodies in order to produce long welts or protrusions of the skin. This is done with a sharp stone or flint, and the incisions are made on the breast, shoulders, and upper part of the arms; they vary in length and thickness, some being about an inch long and raised the thickness of a straw, others perhaps three inches in length and as thick as one's finger. The operation to produce these marks consists simply in cutting the part quickly but slightly with the sharp point of the stone; the blood is allowed to dry on the wound, but the welts soon appear and never diminish in size through life.

From the scantiness of an Australian's wardrobe, he is prevented from exhibiting his taste or expending his vanity in a variety of costume, he consequently falls back to the one course left open to him, that of painting his body and decorating his head. The greater part of the time he devotes to his toilet is altogether taken up in plastering his uncut hair with a thick cement made of red ochre and grease. A diversity of style is adopted in its dressing; some have the head covered with quantities of small and shining red ringlets, some have it bound around with cord, and then covered with a solid mass of stiff and clay-like pomatum, giving the head quite an Asiatic appearance; this is generally surmounted by a bunch of feathers from the emu or cockatoo, or by the tail of the wild dog, and sometimes encircled with a wreath of flowers. Others, again, have innumerable small lumps of clay appended to the ends of the hair, which keep up a rattling accompaniment to the movements of the wearer.

But of all outward adornments the beard is the one most coveted and prized. Indeed, this appendage to the visage appears to be a youthful Australian's highest ambition, and its primary symptoms are regarded by each stripling much in the same light as, amongst us, the school-boy looks on his assumed induction to the honors and privileges of manhood. To the Australian, throughout life, the beard is an object of great pride and care, and the affectionate manner in which it is ever caressed and stroked, evinces the satisfaction felt in its bushy charms. Nor is it merely as an adornment to the outward man that a beard is so much an object of solicitude; there are also certain rights attached to it, not the least important of which is, that no man can get married until in the possession of one, nor is he allowed to kill an emu. In their combats, too, no inconsiderable part is assigned to the beard in producing an effect, and it is next to impossible to make an impression in an affair of this kind without such an accompaniment; then, with its long ends gathered up into the mouth, and there held firmly between the lips—with feet stamping, eyes starting from their sockets, and every muscle of the body quivering with savage rage, it may easily be imagined that the whole appearance of the Australian warrior is ferocious in the extreme.

Thus far I have attempted to give some slight idea of the men of this race. It is now time that something were said of the other sex; and I wish much it were in my power to draw a more pleasing picture of this portion of the Australian population. No where else is it possible to meet with more miserable and degraded specimens of humanity than the women of Australia. Naturally small in stature, from starvation their bodies and limbs appear shrunken to a degree sometimes frightful to coutemplate ; and were it not for the glare of the eye, the generality of them would look more like mummied skeletons, from which the soul had parted company for months, than beings possessed of life.

Every bone in the frame is visible—the shapeless arms and legs seemingly destitute of muscle—the sunken eye and hollow cheek—all tend to form a picture of wretchedness which beggars description. And, as if their natural unsightliness were not sufficiently startling, their faces, and heads, from which the hair is cut quite close, are generally covered with scars and scratches, either the tokens of the chastisement of an enraged spouse, or the effects of violence committed on themselves in manifestation of their sorrow for the untimely departure of a child, or some one of their numerous relations or friends; and when, upon these still bleeding wounds, chalk and charcoal are smeared, it can readily be imagined how revolting is the spectacle presented to view.

The dress of the female, like that of the men, consists solely of a Kangaroo skin cloak ; but to this is added a large bag, made of the same material, and which hangs at the back by a strap crossing the shoulders. In this bag is generally deposited the smallest child, along with any other portable articles it can hold. For the purpose of digging up roots, upon which they in great measure subsist, the women are armed with a long stout stick, formed into a blunt point at one end. Whatever labor has to be performed in their domestic arrangements devolves entirely upon them. They are the Architects and Artificers in erecting the family mansion. In their journeyings they carry the extra spears and other weapons of the men, in addition generally to one or two children, and perhaps also a young dog. In this plight they are to be seen toiling along under a load seemingly sufficient to bring the frail bodies of the unfortunate creatures to the ground.

Polygamy to the fullest extent is an Australian Institution ; the man is allowed to have as many wives as he can manage to take care of, or can possibly beg, steal, or otherwise obtain. There is nothing like a marriage ceremony in any case, a simple bestowal on the part of the girl's father, or other guardian, concludes the transaction. As soon as a female child is born, nay, sometimes for years before that event, she is promised to some one of the tribe, without reference to his age, although his years may exceed those of her own father. She remains with her parents until old enough to be able, in some manner, to shift for herself, when she is transferred to the care of her future husband, under whose protection she is then brought up. But as this, in most cases, is too long a process to go through, the method usually adopted by the Australian native to obtain wives is that of seizing the first favorable opportunity of running off with those of another. It is absolutely necessary to the Australian that the stock of wives on hand should always be considerable, as the whole domestic labour devolves on them, and consequently on their number depend the comforts of his wigwam and fire. The practice of eloping with each other's wives, is so much a matter of course that it furnishes an additional reason for maintaining a large female establishment in order to provide against these frequent contingencies, so that one or two of the number can abscond, without any great degree of anxiety or discomfort being experienced by the deserted one, until the number can again be completed by his helping himself in like manner from the establishment of some of his neighbors.

But although the women are treated by the men with savage brutality, although from the birth to the grave theirs is a life of misery and privation, they, nevertheless, are not deficient in those keen feelings which are the characteristics of the sex in all lands. Their affection for their offspring is strikingly evident on all occasions, and it is sometimes painful to hear the wailing of the bereaved mother as through the long night she sorrows over the loss of her infant. Nor are these feelings less intense in other respects. One might imagine, to judge at least from the manner in which the poor wretches are neglected by their lords, that if any thing like feeling existed on their parts for their partners, it would be that of supreme indifference. The reverse, however, is the case, and in those general mêlées, which so often disturb the peace of the encampment, they are not slow in entering into the spirit of the affair, and raising their voices to vindicate the honor of their belligerent spouses. Absurd to a degree is a scene of this kind. Sitting around their fires, within sight of the combatants, they gradually join in the excitement around them; tauntingly and sneeringly they speak of the insignificant deeds, and contemptible efforts of the opponents of their respective husbands. Suddenly one will spring to her feet, and begin to strut up and down, flourishing her long stick over her head, her cloak thrown back and fluttering out like the tail of an angry cat; in this beligerent state she continues to move about, singing at the same time some sarcastic and insulting words. Irritated and excited by such proceedings, another now starts up with a bound, and in like manner commences to strut, sing, and flourish her stick,—and thus working themselves up to the required pitch of anger, they gradually approach each other until within striking range, when the war of words being changed for a more forcible one of sticks, the engagement becomes warm, and broken heads and bloody faces are the result.

Such is the Australian in life, let us now reverse the picture and view him in death.

In the midst of a tall forest, some four or five wigwams are clustered together, the thread like wreaths of smoke ascending from the small fires alone indicating the spot. In one of these huts lies the emaciated form of a savage, the limbs drawn up to the smallest possible compass under the scanty cloak. Sitting around are the wives and children of the dying man, watching in silence for death to take possesion of his prize. Other women belonging to the camp are also sitting about. One or two men alone remain; these are perhaps sleeping, or quietly sharpening their spears. All is silent, the hard breathing and the convulsive sounds in the throat of the dying man are alone audible, even these gradually cease and the soul has fled.

As soon as the fact is known the wives and children and all those gathered round the body set up a dreadful and startling cry. The women in particular send up a most piteous lamentation, and tear their heads and faces until they are frightfully smeared and disfigured with blood. The male relatives of the deceased also scratch their noses, but do not mutilate themselves to the same extent as the women. But no time is lost in making preparations for the interment of the corpse. On the spot where he drew his last breath is the grave sunk, a shallow and circular hole scooped out, barely deep enough to keep the body below the level of the earth; into this the still warm corpse, wrapped in its cloak, and with the knees bent up to the mouth, is placed, lying on its side; the earth is then thrown lightly and scantily over it; that thrown over the corpse however, is not the earth which has been scooped out of the grave, for that is allowed to remain in a heap on one side, but is cut away from the oposite side. The spear, wamera, and other weapons lately used by the deceased, are now placed upon the grave, and after making a small fire near the feet, the grave and camp are deserted by all, and, far removed from the spot, a new encampment is formed, from which the mournful wailings of the women may be heard floating down on the wind night after night.

On the evening of the death, the wives and relatives of the deceased smear the scars on their heads and faces with white chalk, and on the following day with charcoal, after that again with white chalk, which is allowed to remain on until the wounds are healed. After death the name of the departed is never uttered, and should there be another native with the same name he immediately assumes a new one.

It would appear, however, that the mode of interment differs in some cases; for being on one occasion with an exploring party some ninety miles from the settlement, we came upon three or four native graves, in which it was evident that the bodies had been laid at full length as the graves were long and narrow, presenting indeed much the appearance of our own.

In a letter received from a brother at Perth on the Swan River, in describing the Aborigines of that part of the country, he gives the following account of a death scene:

"Understanding that the native Wattup had died from the effects of a spear wound in the thigh, which he had received about five weeks before, I went up to see the body. I was directed to the spot by the cries of the women, and the scene that presented itself there was very striking, and differing from any that you ever witnessed at King George's Sound. The corpse was stretched out under a large gum tree, and closely around it, an old man and a number of women were crouched on their heels. At times they bent over the body, uttering a mournful chant, and addressing it, apparently in affectionate terms; then again they would burst forth in loud lamentations, tearing their faces and hair, and exhibiting every token of the most violent sorrow; maintaining, however, throughout a regular cadence. Three or four yards from these, sat an old man, probably the father of the deceased, resting his head on his knees in silence. His wife sat beside him with her arms thrown over his shoulders, crying most piteously, and calling (as I understood it) on the dead man to return to her. One or two elderly men stood at a short distance leaning on their spears, attentively watching the proceedings. No other men were present but those I have mentioned; the rest appeared to be collected at the foot of Mount Eliza, where they were holding a noisy deliberation, concerning, I suppose some scheme of revenge. I had not time to remain until the termination of the ceremony, but just as I was leaving, two men came up from Mount Eliza, armed with their spears, and evidently prepared for some conflict,—after exchanging a few words, the mourning party broke up—the men going off to the Council of War, leaving the corpse in charge of the females. In the evening a number of the natives bivouaced on our premises, where they had a Corroberry."

Of the many strange facts that come before us in studying this people, perhaps none is more extraordinary than the paucity of weapons and implements in use amongst them; and still more so is the fact that they are probably the only savages on the face of the earth, inhabiting the sea coasts, who have no means of aquatic transport, and are unacquainted with the art of swimming. When we examine their coast and find it dotted with innumerable Islands or indented with Inlets swarming with fish, we are more struck with this peculiar feature in the habits of the Aborigines of the western, southern, and eastern coasts of Australia. Turn in what direction we will, we find all other savage people excelling in these arts. The New Zealander and the South Sea Islander are noted for the beauty and size of their War Canoes; and men, women and children appear as much at home when diving and swimming about in the sea as any seal or walrus. Again, the Indians of this vast Continent, from the Arctic regions to Florida, are skilful and daring navigators in their bark and other canoes. Let us even visit the northern coast of Australia itself, and we find the Aborigines, much more savage it is true than those I am describing, but at the same time furnished with Canoes and catamaraus, or sallying forth even upon rough logs of wood, and quite indifferent whether their bark carries them through the surf, or parts company with them in the attempt, so fearless and expert are they in the water. How is it, then, that those inhabiting the opposite coasts should be thus deficient in arts that instinct itself should force them to acquire? This peculiar feature in their economy, strange as it may appear, will help us, I think, to trace their origin, and that too to a people eminently maritime in their habits. I allude to the Malays.

The proximity of the Malay Islands, and the fact of immense fleets of Malay prows having visited the Northern coast of Australia annually from time immemorial, in search of the Trepang for the Chinese Market, will go far to bear out this opinion. It may not be improbable, therefore, that some of these people were thrown by shipwreck, or other accident, on this coast, or upon one of the Islands on the other side of Torris' Straits, and that thus the North was the first portion of Australia peopled. The race, gradually increasing, spread through the interior of this vast Continent. In their approach to the western and southern shores they necessarily passed over an extensive inland region, without doubt perfectly destitute of Rivers or Lakes of any magnitude. When, therefore, ages after, they had extended to the opposite coasts, they had lost the knowledge of every art connected with water, and were unable to make use of or appreciate the advantages which lay before them on the sea shore. Whilst upon this subject I may mention that I have seen, in the settlement of Albany, natives who had never before gazed on the sea. In thus treating the subject, however, I am merely venturing an opinion; it may be correct, or the reverse.

The extent of the knowledge of the Arts and Sciences existing amongst the Australians may be gaged by their weapons and implements. These are the spear, the wamera or throwing stick, and the kilee or boomerang; a stone hammer or tomahawk, a short and heavy club or stick, and a rude description of stone-edged knife.

The spear is merely a straight rod some nine feet in length, as thick as an ordinary walking stick, rather smaller at one end than the other. The sharp and needle like point, at the heaviest end, is hardened in the fire. Rather more than an inch from the point of some is fixed a neat wooden barb of about two inches in length. Others again have small and sharp pieces of quartz, fastened in gum, extending some six or eight inches from the point. This latter description of spear is dreaded by the natives much more than the barbed one, as its sharp and uneven edge lacerates the flesh dreadfully, besides leaving pieces of the stone in the wound. The wound inflicted by the barbed spear, is hardly less severe, and, unless the spear-head be driven directly through the part struck, is dangerous in the extreme, for the barb once getting buried in the flesh, it is impossible to withdraw it, and the only chance of extrication is to force the whole through the limb: a process, however painful, by no means uncommon.

The trees from which the spears are made, seldom exceed the thickness required, and are found growing in great abundance in the swamps and marshy grounds; the wood is of a hard and dark description, and after being in use for some time assumes the appearance of mahogany.

The spear is thrown by means of the wamera or throwing stick, which is a flat piece of wood hardly thicker than the cover of a book, some two feet in length, about four inches in breadth in the centre, and gradually decreasing in width, and running to a point at either extremity. At the end held in the hand is a lump of hard resinous substance, obtained from the Grass Tree, which prevents the wamera slipping from the grasp when throwing from it the spear; at the other point is fixed a little piece of stick, about an inch in length, forming a sort of hook, and which fits into a shallow hole at the small end of the spear. When fixed for throwing, the spear runs along the length of the Wamera, and passes through the fore-finger and thumb, which, from the manner in which the Wamera is held, are left free for that purpose. The spear is therefore hurled from the wamera somewhat on the same principle as a stone from a sling, and, is sent with much greater force than if merely thrown from the hand. In the use of these weapons the natives exhibit surprising dexterity; it is seldom indeed they fail to transfix their object within a distance of fifty or sixty yards. The wamera is made of a very hard wood, a coarse grained and heavy mahogany, which generally obtains a good polish after being a short time in use.

The wamera never leaves the hand of the native; when his spears are exhausted he makes use of it in close combat, as a sword or battle axe, and its sharp and hard edges lay open gashes in the heads of the combatants hardly less severe than those produced by the sabre of a heavy Dragoon.

But of all weapons the Australian kilee or boomerang is the most wonderful. Its form is nearly that of a crescent. It is made from the crooked limb of a tree curved naturally in the form required,—this is nicely scraped down, and made flat on one side and slightly convex on the other; its size is about fifteen inches from point to point, and nearly two inches in width. Its course through the air is eccentric and very varied, greatly depending upon the skill with which it is thrown. Some have more command over the weapon than others, and an experienced thrower can almost make it take any direction he may please. He will throw it with all his force against the ground, some ten or twelve feet in front of him, when it will rebound, and taking a circular course, will fall at an immense distance to his right or left. Again he will dash it to the earth in the same manner, and it will ascend from it with the speed of an arrow, until almost out of sight, when, remaining poised some instants in the air, it will return with fearful velocity and fall probably some distance behind the thrower. It is used thus in killing birds. For instance; a flight of Cockatoos is seen approaching; the native waits patiently until the birds are nearly over his head, he then throws the kilee in the way I have described in front of the flight; the kilee returning, after having risen a certain height, meets the birds in their course and thus knocks several of them down.

The boomerang is the most dangerous weapon used by the Australian. Its course through the air is so swift that it is with difficulty one can follow it with the eye, and its ever varying movements render it nearly impossible to get out of its way;—it is the only weapon that the natives themselves find a difficulty in avoiding; those who fancy themselves quite safe, and clear of its manœuvres, are not unfrequently the ones hit, and it is no unusual thing to see the native, from whose hands the weapon has sped, obliged to throw himself on the ground, to avoid being struck by it on its return.

The tomahawk or hammer is a rude and shapeless piece of stone fastened on in the centre with the gum of the grass tree to a slight wooden handle; its principal use is to notch the smooth trunks of trees, just sufficient to insert the great toe in, to enable the native to ascend after the oppossum and other small animals.

The only other article is a short heavy stick, rather thicker at one end than the other, and about eighteen inches in length; it is used for throwing at short distances, and it also forms a weapon by no means contemptible when wielded in the hand as a club.

The quickness of vision and dexterity exhibited by the Australian savage in avoiding the different weapons, are truly astonishing. This is particularly the case as regards the spear; so much so, indeed, that it seldom occurs that one is struck by it, if he be at all prepared for the assault. Five or six spears will be thrown at a man in rapid succession, and, without moving from the spot, he will escape them all by a slight bend of the body. From his childhood, practising with the spear and boomerang is the principal pastime of the Australian, and for hours together, mere infants may be seen amusing themselves by throwing their tiny weapons at each other.

A REVIEW OF THE TRILOBITES: THEIR CHARACTERS AND CLASSIFICATION.

PART I.

BY E. J. CHAPMAN,

PROFESSOR OF MINERALOGY AND GEOLOGY, UNIVERSITY COLLEGE, TORONTO.

Read before the Canadian Institute, February 23rd, 1856.

Amongst the fossil forms met with in our Canadian rocks, or, indeed, in the palæozoic strata generally, few can compete in interest with the Trilobites. We may cite as some of the more salient points which impart to the study of these extinct crustaceans an attraction of no ordinary kind—the early date of their creation, and the immeasurable periods that have rolled away since their total obliteration as living types. And, again, the wide geographical range of certain species; their varied forms; and, perhaps, as a further incentive to their study, the very obscurity with which, in part, their history is still surrounded. In the present sketch, it is proposed to consider our subject under the following heads:—The general organization of the Trilobites; their probable habits and affinities; their geological relations; and their classification.

1. *General characters.* Viewed both transversely and longitudinally, the trilobite presents a tripartite form. Transversely, we have the head, the body or thorax, and the abdomen, or so-called tail. Longitudinally, the form becomes three-lobed, by the presence of two linear depressions or furrows, extending in general, almost from one extremity of the animal to the other. Occasionally, however, as in the genus *Homalonotus* for example, these longitudinal furrows are but very slighty developed.

We will consider separately the structural characters of the head, the thorax, and the abdomen: or rather of the crustaceous integuments by which the back of these parts was defended; for of the internal conformation of the trilobites, our knowledge is almost entirely conjectural.

2. The anterior portion of the trilobite is covered by a single shield composed of several united pieces. To this shield the term of *buckler* or *head-shield* is commonly applied. The middle division, formed by the anterior prolongation of the two longitudinal furrows mentioned above, is called the *glabella.* In some species the glabella is very strongly pronounced, whilst in others it is scarcely raised above the general level of the head-shield. It is usually lobed or furrowed by short transverse grooves, or variously embossed; although occasionally quite smooth and simple. In some species again, it narrows towards the summit, whilst in others it expands. The separate pieces of which the head-shield is composed, are united by distinct sutures: a character peculiar, amongst crustaceans, to the trilobites. This, as suggested by BARRANDE, probably facilitated the periodic casting of the shell. One of these sutural lines, the great or *facial suture*, is of considerable importance as a classification element. In the majority of instances, it passes on each side of the head-shield, from the angles (*calymene*), or from the lateral or lower border (*phacops, asaphus*) along the inner margin of the compound eyes (where these exist), and either surrounds the glabella, or terminates beyond the anterior margin of the shield. In the latter case, it is said to be open above. The buckler or head-shield is thus divided into three pieces; the middle piece, including the glabella and the "fixed cheeks" or parts between the glabella and facial suture; and the side pieces, or ordinary cheeks. The latter are very commonly wanting in trilobite specimens, or are found separated from the other portions of the

head. The facial suture is, however, in some cases entirely marginal, and hence not apparent on the surface of the shield, as in the genus *Trinucleus*. According to its direction, consequently, the trilobites might be arranged in four groups: 1.—with the facial suture terminating at the base of the head-shield; 2.—at the angles; 3.—at the sides; and 4.—with the suture marginal. A classification of this kind, however, if carried out too exclusively, would tend, as founded on a single structural peculiarity, to various groupings and separations of a more or less artificial character.

The eyes, when present, are situated on each side of the buckler in the line of the facial suture, where this, at least, occurs upon the surface. They are sessile, but more or less elevated above the immediate surrounding parts; and either compound after one of two types, or pseudo-compound: consisting in the latter case of simple stemmata in merely approximate union, as in the genus *Harpes*. The compound eyes in the family of the *Phacopsidæ* are covered by the common cephalic test, but this is pierced with numerous small apertures through which the transparent cornea projects.* This forms the *reticulated* eye, properly so-named. In the other families possessing compound eyes, the cephalic test gives place around the eye to a common cornea, which exhibits, in comparison with the eyes of the *Phacopsidæ*, a very delicate reticulation The reticulated appearance is caused by the underlying facets.

Many species appear to have been entirely destitute of eyes, properly so-called; but it may be questioned whether this deficiency, at least in certain cases, was not compensated by the presence of isolated ocelli, destroyed more or less by the process of fossilization, or perhaps obliterated by age—as in some existing crustaceans—during the lifetime of the animal. In the modern *limulus*, a crustacean type having certain characters in common with the trilobites, a pair of ocelli accompany the compound eyes. Indications of ocelli are, I believe, actually traceable in some of the apparently eyeless trilobites. Two small median points or tubercles, which may perhaps be legitimately attributed to ocelli, occur, for instance, on the glabella of many specimens of *Trinucleus concentricus*. On the other hand, it is well known, that amongst some of the marine parasitic crustacea, to which again the trilobites are in a measure related, only the males

* BARRANDE. Owing to the incompleteness of most specimens, it is rarely that these characters can be observed. If the eye, however, be at all preserved, a common magnifying glass will show a remarkable difference between the strongly-facetted phacopsidæ, and the more delicately reticulated forms. It may not, perhaps, be useless to add, that the aid of the lens is almost invariably required for the proper observation of the facial sutures and other structural details.

are provided with eyes; whilst amongst others, as stated above, these organs become obliterated by age.

The buckler of the trilobite does not terminate immediately at the upper margin or sides, but bends over as in the limulus or apus, and thus forms the margin of an under shield. Directly beneath its termination on this under side of the head, and exactly facing the glabella, is situated a peculiarly shaped organ, called from its general characters and presumed function, the *hypostoma* or *labrum*. With the exception of a second piece, the *epistoma*, found only in a few rare examples, it constitutes all that is known respecting the mouth-organs. In its general form, the labrum somewhat resembles a pointed or rounded glabella, with its attached base, placed in a reversed position, or with the narrower end downwards. From its resemblance to the labrum of the apus, it has been inferred that these creatures were carnivorous: a view sustained by other considerations.

3. The body or thorax of the trilobite is made up of a number of separate rings or segments. By the two longitudinal furrows already mentioned, each segment is divided into three parts: the middle part, called the *rachis* or *axis*, and the sides or *pleuræ*. It is still uncertain whether the pleuræ form a continuous portion of the axis, or whether they are united to it by suture. Basing our observations on those species which have the longitudinal furrows but slightly developed, we might naturally infer the former. In most specimens, if not in all, the shell is certainly continuous. Single, disjointed segments are constantly met with; their three-curved outline is one of the most common markings on the weathered surface of trilobitic rocks. The central rings are sometimes furnished with short spines. The pleuræ also frequently terminate in spines; and they are either grooved in the direction of their length—*id est*, from the axis outwards—or otherwise raised in the same direction into a narrow plait or band. The former modification constitutes BARRANDE's *Type de la plèvre à sillon:* the latter his *Type de la plèvre à bourrelet.* The character in question is brought prominently forward by BARRANDE* as a classification element, and PICTET has also adopted it in the last edition of his "Palæontologie;" but its employment as a leading character, appears to me, for reasons stated in the sequel, to be open to many objections. The well-known power of rolling themselves up into a ball, possessed to a certain extent by probably all trilobites, and by many in an eminent degree, was chiefly due to the mobility of these thoracic segments. Further reference will be made, how-

* See the Appendix to this paper, at the close of Part II.

ever, to this property when discussing the affinities of the trilobites. In the absolute number of their body-segments, a considerable difference is exhibited by different species. In fully developed forms, omitting the still doubtful *agnostidæ*, the number varies from five to twenty-eight. Several palæontologists—more especially QUENSTEDT and BURMEISTER—have placed great stress on the relative numbers of these segments: making the character indeed, the basis of their classifications.* That the character is one of considerable value, is undoubtedly true; but its application is beset with much difficulty, since the able researches of BARRANDE have shewn that, in most, if not in all species, the number of the rings, although constant in the adult form, varies with the earlier age of the individual. He has thus traced the metamorphoses of one species (*Sao hirsuta*) from its embryonic condition with merely a head and caudal shield visible, up to its full development, in which successive rings are added to both thorax and abdomen, until, in the former alone, their number amounts to seventeen. The adult form in this small species is frequently under an inch in length.

4. The caudal shield, to which the term of *pygidium* is also applied, consists, like the head-shield or buckler, of a single piece. This, however, as shewn by its divisional markings, is evidently made up of consolidated or united segments. With certain special exceptions, we here recognize, as in the thorax, a middle portion—the caudal axis, tail-rachis, &c.; and sides, or pleuræ. The segment lines in these divisions are often strongly marked, but always undivided, unless at the ends of the pleuræ. In some species the pygidium is very small; in others well developed. The axis also is in some species continued far down, or almost to the extremity of the shield; whilst in others it is extremely short. Occasionally the shield terminates in a point or spine, or is furnished with various spine-like processes. The ends too of the caudal pleuræ are sometimes free, sometimes merged in a continuous limb. According to BARRANDE, the more developed the pygidium, the higher the developement of the animal—in substantiation of which it is pointed out, that in the trilobitic forms of earliest occurrence, this organ is comparatively small; whilst in those of the higher rocks, the contrary is generally the case. To this, however, there are many exceptions; witness, for example, the *Ogygia Minnesotensis* (Dikelocephalus of Owen) of the Potsdam sandstone on the one hand, and the *Harpes macrocephalus* of the Devonian series on the other.

* See the Appendix.

In order to assist the general reader in following the above descriptions, an outline figure with accompanying explanation is annexed.

G—glabella.

E E—eyes.

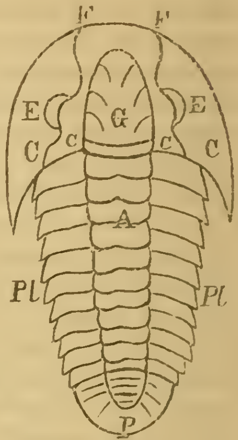
F F—facial suture [see § 2 above.]

C C—cheeks; c c—fixed cheeks.

A—body axis.

Pl. Pl.—pleuræ.

P—pygidium.



5. *Probable habits and affinities.*— Much is here unavoidably conjectural: for the habits and affinities of these extinct forms of life are veiled, to a great extent, in an almost impenetrable obscurity. The following are, perhaps, the only really undebateable points connected with the inquiry. First, the trilobites were marine crustaceans. Their evidently articulated structure and the character of their shelly covering, combined with the compound eyes, which so many of them exhibit, and with their geological conditions of occurrence, are sufficient to establish this. The possession of compound eyes would alone serve to separate them from the oscabrions or chitons, with which they were at one time placed by LATREILLE and other observers. Secondly, the trilobites were gregarious, living in vast communities—as proved by the abundance of their remains in areas of often very limited extent. From this, it has been imagined by the well-known naturalist MacLeay, that they adhered in masses one upon another, after the manner of many of the sedentary mollusks; but the large compound eyes, the ornamented and frequently spine-bearing shells, and the symmetrical habitus, are broadly opposed to this view. Thirdly, feet were either absent, or, if ever present, were of a more or less rudimentary, soft and perishable nature. No traces of these organs, nor of antennæ, have yet been found: although from time to time imaginary discoveries of such have been announced.* Fourthly, the trilobites were able, to a cer-

* See more especially plate 2 in Castelnau's Essai sur le Système Silurien de l'Amérique Septentrionale: 1843.

tain extent at least, to roll themselves up into a ball. This property amongst crustaceans, is shared by the terrestrial *oniscidæ*, and by several marine genera; notably by *sphæroma*, a genus of small isopodous crustaceans inhabiting the Baltic, the Mediterranean, and other seas. These marine isopods possess, however, peculiar swimming appendages attached to their caudal extremity: a contrivance of which the trilobite was apparently destitute.

In accordance with the views of BURMEISTER, the place usually assigned to the trilobites at the present day, is amongst the phyllopods: or, at least, in the section branchiopoda. With certain probabilities in favor of this distribution, there are yet many considerations against it. A more or less constant motion of the branchial feet would seem to be almost essential to the economy of the branchiopods; but, in the case of the trilobites, a function of this kind can hardly be reconciled with the rolled up condition in which so many of them are found. If, as may be reasonably inferred, this condition were assumed as a protection under the influence of fear, it would probably be retained by the animal for a considerable time. Amongst existing branchiopods, not one appears to have the power of thus contracting itself into a ball; whereas, amongst the isopods, both terrestrial and marine, the property is almost universal. The shell again, in branchiopodous crustaceans, if present at all, is delicate and fragile, and scarcely to be compared in any way with that of the trilobites. Finally, the minute size—and size may be here legitimately considered as a not unimportant element in the inquiry—the minute and often microscopic dimensions of the branchiopods, together with their general conditions of existence, offer further points of dissimilarity. The trilobites were certainly as nearly allied to the isopods as to the branchiopods; and, at the same time, they had certain strong analogies, if not homologies, with the limuli: in the position and aspect of the large compound eyes, for instance; in many characters of the shell; and to a certain extent in size, and possibly in mode of life. It seems advisable, therefore, to keep them as a distinct order, and so to frame the classification of the crustacea generally, as to shew their relations to the isopods and phyllopods on the one hand, and to the limuli or xiphosura on the other. The chief difficulty is in the collocation of the latter order. To place the limuli with the suctorial parasitic crustacea, according to a still frequently adopted system, is manifestly in opposition to all natural analogies. And, again, if we place them at the end of the class, as a distinct subdivision, their typical relations become altogether lost. Is this, moreover, their proper place? Are not the limuli far more nearly related than any one of the ordinary entomostracous orders to the decapods? The grand distinction is the well-known character of the mouth-organs. But may we not consider the six pairs of oral feet in the one, to represent an earlier typical condition of the six pairs of foot-jaws in the other? With all their points of difference, at least, a transition from the limuli to the decapods, may certainly be conceived with far less violence to nature, than one between the last-named group and the phyllopods or other entomostraca. On this view, a distribution of the crustacean orders may be arrived at, as shewn in the annexed table. A combined vertical and horizontal reading of the table brings out the affinities of these orders in accordance with the principles discussed above.

	I. Malacostraca.	
1. Decapoda. 2. Stomapoda.	3. Amphipoda. 5. Isopoda.	4. Lœmodipoda.
	II.	
6. Xiphosura.	7. Trilobita.	
	III. Entomostraca.	
	8. Phyllopoda. 9. Lophyropoda. 11. Cirrhopoda.	10. Siphonostoma.

We have yet to consider a few other points of inquiry appertaining to this portion of our subject. These are embraced in the following questions:—First, were the trilobites inhabitants of littoral or of deep-sea zones; and secondly, were they of sedentary or of active habits—and if the latter, what were their means of locomotion? For the satisfactory determination of these questions, our data are far from complete. Analogy, and the fact of a very general occurrence in ripple-marked shales and other rocks indicative of a littoral origin, would seem to denote a shelving coast-line, or, at least, a moderate depth of water, as the ancient habitat of the trilobite. Trilobites are found, however, and not unfrequently, in limestone deposits, associated with brachiopods and other forms usually referred to deep-sea types. But the brachiopods are now well-known to range from extreme depths up to the very tide-line: and hence their presence in trilobitic rocks, does not speak against the littoral origin of such deposits. In many instances, it is evident, that the palæozoic limestones, as those of other ages, were derived more or less directly from coral reefs; and these reefs may have afforded shelter to many trilobites. Along the inner edge of the great barrier reef of north-eastern Australia for example, where in many places a depth of no more than ten or twelve fathoms exists, different species of both brachiopods and crustaceans are often met with.

Whilst some observers imagine the trilobites to have been more or less sedentary, others contend that they must have been in constant motion—swimming, back downwards, at or near the surface of the sea. The truth lies probably between the two. As already pointed out, the presence of eyes is a strong argument against a sedentary existence, and the rolled up condition of body (so commonly witnessed) speaks equally, on the other hand, against a state of constant motion. It is difficult to conceive that these extinct forms could have been endowed with strong swimming powers, for no traces, even under the most favorable circumstances for preservation, of floating appendages have been met with; and their branchial feet, allowing such to have been present, could not have constituted swimming organs of any force. The unequally balanced extremities of many species, although in part perhaps compensated by the downward extension of the genal angles of the head-shield, is also an obstacle to the satisfactory adoption of this view. At the same time, it should be observed, that their shell, from its general thinness, must have been comparatively light; and the flattened form of body conducive to a certain degree of buoyancy. A slight movement of the flexible thorax and caudal extremity probably formed a sufficient propelling power for the animal's wants. When alarmed, the contraction of the body would enable it to sink with ease into deeper water; and in its power of adhering by its under side to rocks and to the sea-bottom generally, it possessed a further means of defence against its enemies. By this power of adhesion, moreover, individuals may have been carried on floating bodies over a wide range of coast or across open seas, and thus have given rise to colonies in localities far distant from their normal centres. In this manner the extended geographica limits of certain species may perhaps be accounted for.

Little can be suggested with any certainty respecting the food of the trilobite; but by comparison with existing crustaceans, and from the form of the labrum, it may be inferred that these creatures were carnivorous. Soft-bodied radiata, the coral polyp, decaying matter drifted into sheltered bays—such may have formed, in part at least, the sustenance of the trilobite. A further insight into this question might be obtained, could we trace out the compensating agents in Nature's economy, which served to replace the trilobites after these had passed away.

6. *Geological relations.* The trilobites appear to have been called into existence almost at the earliest dawn of animal life. They die out at the base of the great carboniferous formation, and thus belong entirely to the earlier and middle portions of the palæozoic age. The separate species offer, with few exceptions, admirable test-forms for the various subdivisions of the Silurian and Devonian groups Even the genera are in many instances restricted to comparatively narrow limits in their upward range. Thus, the genus *Trinucleus* is unknown above the deposits which mark the limit of the lower Silurians. *Asaphus*, *Illœnus*, *Paradoxides*, follow the same law; but other generic forms, *Calymene*, *Phacops*, &c., pass upwards, although as a rule with different species, into the higher Silurian and Devonian periods. *Phillipsia*, very rare in earlier groups, becomes, in the Lower Carboniferous, almost the only remaining type of the class. But these characteristics will be found in full under our enumeration of the more common species belonging to each genus. At present, let us briefly glance at the geological relations of the Crustacea generally.

The decapods comprise three well-marked groups:—the brachyura, anomoura, and macroura. The brachyura, or short-tailed decapods, the highest group, are first met with in the Cretaceous rocks; the anomoura in the Jurassic; and the macroura in the Carboniferous. The entire order is on the increase.

The stomapods are scarcely known in the fossil state. A single species has been met with in the upper tertiaries of Monte Bolca, and a few doubtful forms in the Jurassic and Devonian strata.

The amphipods and the læmodipods are also rare in the fossil condition. The only certain examples are from tertiary beds.

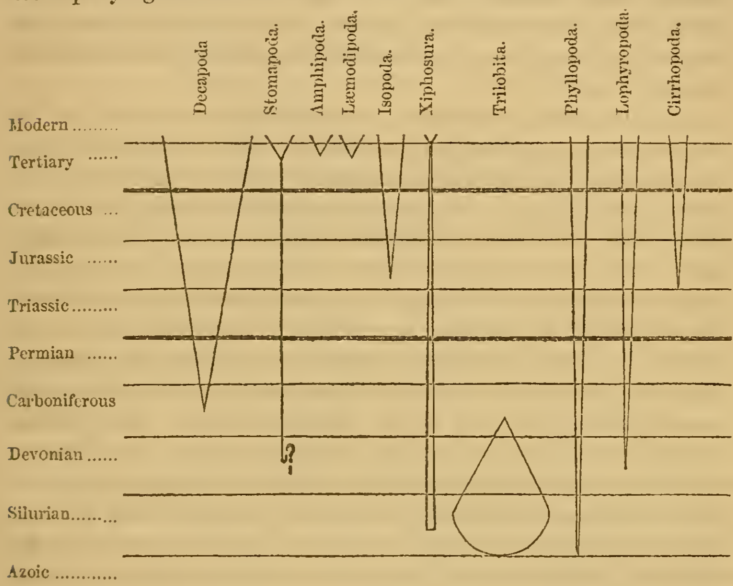
The marine isopods exhibit fossil examples from the Jurassic formations, upwards. Terrestrial species occur only in amber.

The xiphosures—including the pterygotus in this order—date from the upper Silurian. They are on the decline.

The trilobites appear at the base of the Silurian formations, and die out in the lower Carboniferous. They constitute the only order of crustaceans of which we have no living representatives.

The phyllopods appear also at the base of the Silurians. The lophyropods (cyprids, &c.) follow the same law. The cirrhopods commence their existence with the lias—at least, if the doubtful bostrichopus be excluded from the group. Of the siphonostoma, no fossil representatives are known.

These geological relations are presented at a single view in the accompanying scheme:—*



7. *Classification.* The arrangement of the trilobites in natural groups is beset with considerable difficulty. This arises in part from e fragmentary condition in which so many species are commonly met with; and partly from our still imperfect knowledge of the true value of the various organization characters on which we are obliged to base our collocations. Owing to the first source of error, it has often happened that distinct types have been formed into a single species; whilst on the other hand, imperfect specimens of one and the same species have been referred to even different genera. A sys-

* All the fossiliferous rocks below the Devonian group are here included in the term Silurian. The Lophyropoda should be drawn down to the lowest horizontal line.

tem of classification very commonly adopted, is founded on the number of the thoracic segments or body-rings. This was first proposed by Professor Quenstedt, of Tubingen, in 1837. Of the importance of this character there can be no doubt, more especially when we take into consideration its constancy throughout one entire group of crustaceans (the malacostraca), and the results of BARRANDE's researches, shewing its definite nature with respect to *adult* trilobitic forms. It can only be looked upon, however, as possessing a specific value; for there are several well-known types which differ from one another in the number of the body-rings, but which can be readily shewn to be generically alike. Hence, by the adoption of this system, without regard to other characters, many unnatural separations necessarily arise.

In BARRANDE's classification, the trilobites are arranged in two sections, each comprising various families. These sections are founded respectively on the presence of raised or furrowed pleuræ, a character often of difficult recognition even in perfect specimens (*illænus nileus*), and one that appears at the best to be of questionable value. The divisions founded upon it, like all indeed based upon a single character, break through many natural analogies, and place in distant parts of the system, forms which are evidently akin to one another. A single example may suffice to corroborate this assertion. Respecting the existence of a close relationship between *phacops* and *ceraurus*, there can be, I think, but one opinion. The peculiar direction of the facial suture; the anterior expansion of the glabella; the (at least in normal cases) eleven thoracic segments—and other characters—render this sufficiently evident. But in BARRANDE's system, the two are placed widely apart. At the same time it is not intended to deny that *ceraurus* is also related to *acidaspis* (with which it is placed by BARRANDE). It holds undoubtedly a middle place between *phacops* and this latter genus, and such is the order in which it occurs in the classification given below; whereas, by adopting BARRANDE's subdivisions, various unrelated genera would necessarily intervene. Between *bronteus* and *illænus* again, evidently allied types if regard be paid to all their characters, a wide separation occurs in BARRANDE's system.

In the classification now proposed, the trilobites (omitting the agnosti) are arranged in thirteen families. Some of these divisions might be thought perhaps, on a first consideration of the subject, to possess simply a generic value; but their adoption as true families may be sustained, I believe, on really satisfactory grounds. If certain of them exhibit but few genera at present, that need be no obstacle to their assumption, because new forms are being constantly brought to light; and, by widening out the genera as here done, ample space is left for the reception of these new comers, and both generic and specific distinctions rendered far more rigorous and minute. In a linear system of arrangement, like that necessarily employed, it is extremely difficult, if not indeed impossible, to convey a just idea of the relations of these families to one another. An attempt to effect this has been made, however, in the following distribution, in which, with certain unavoidable exceptions, each family will be seen to form a natural transition from that which precedes to that which follows it. The weakest point in the connexion, occurs perhaps between the second family and the third.

ILLŒNIDÆ.
  BRONTIDÆ.
  LICHASIDÆ.
  ACIDASPIDÆ.
  CERAURIDÆ.
    PHACOPSIDÆ.
  TRINUCLIDÆ.
ASAPHIDÆ.
  PROETIDÆ.
    CALYMENIDÆ.
  HARPESIDÆ.
  OLENIDÆ.
  PARADOXIDÆ.

Here the stream of affinity flows from the *asaphidæ* in an upward and downward direction. Thus, through the genus *stygina*, the *asaphidæ* connect with the *trinuclidæ*. These latter have certain affinities with some of the *phacopsidæ*, and the *asaphidæ* and *phacopsidæ* are still nearer related. The *cerauridæ* and *phacopsidæ*, again, have the same number of body-rings, the same expanding character of the glabella, the same facial sutures. With *acidaspidæ* and *lichasidæ*, the *cerauridæ* have also much in common. *Brontidæ* are but slightly related to the family below them in the list, but in both the tail-rachis is very small, and the pygidium itself of a peculiar character. The *illœnidæ* and the *brontidæ* are closely related by the large buckler and pygidium, the slightly-developed tail-rachis, and the normal number of body-rings, with other characters to be pointed out in the sequel.

On the other hand, the *proetidæ* form a transition group between the *asaphidæ* and the *calymenidæ*, whilst these families are also more or less immediately related by the genus *homalonotus*. Between the last family and the *harpesidæ* and *olenidæ* there might appear, at first sight, to be few connecting points; but we have here the same general tapering form of body, the gradually diminishing pygidium, the increasing segments, and the contracted glabella. The genus *cyphaspis* (usually placed with the *proetidæ*) is undoubtedly related to each of these three types. Finally, the *olenidæ* and *paradoxidæ* have so much in common, that in general they are united into a single family. The opposite character, however, of the glabella (and of the buckler generally) should keep them distinct. If, indeed, it could have been so contrived without breaking through other relations, the *paradoxidæ* would have been placed higher in the series; for I think it will be found that *paradoxides* is related to the genus *Phacops*, much in the same way as *harpes* or *olenus* is related to *calymene*. A certain transition, at least, is presented through the genus remopleurides, with its largely-developed buckler and glabella, its eleven thoracic segments, and its dwarfed and modified pygidium.

Although, when viewed in the manner just pointed out, the above arrangement indicates to a certain extent the relations existing between the families adjacent to one another in the series, it is yet in other respects confessedly of an imperfect character. It is obvious, however, that such must necessarily be the case, where it is attempted to shew these natural transitions in a purely linear system of arrangement. Thus, in the above method, the *asaphidæ*, required as a transition group, are placed in a central position, unavoidably remote from their allied forms, the *illænidæ*. But where complicated relations exist, it is impossible for all to be met in a satisfactory manner in any linear distribution of the kind.

Four type-forms appear to hold a prominent place amongst the trilobites, and indeed, when considered in all their modifications, to constitute centres of classification, as it were, around which the other types may be at least conveniently if not naturally grouped. Admitting this, we obtain the distribution exhibited in the following table:—

Illœnians.	Asaphians.	Calymenians.	Phacopsians.
Illœnidæ.	Asaphidæ.	Calymenidæ.	Phacopsidæ.
Brontidæ.	Trinuclidæ.	Harpesidæ.	Ceraurid æ.
	Proetidæ.	Olenidæ.	Lichasidæ.
			Acidaspidæ.
			Paradoxidæ.

Phacops and *calymene* are frequently placed together as members of the same family, but it cannot be too strongly insisted on, that their characters are essentially distinct. Amongst those of a constant value, we may cite—the number of the body-rings; eleven in the one form, thirteen in the other. Secondly, the conformation of the glabella: large and expanding in *phacops*; comparatively small and contracted anteriorly in *calymene.* Thirdly, the direction of the facial suture. Fourthly, the character of the eyes—and so on. Besides which *phacops* (or its kindred genus *dalmannia*) is most intimately connected with *ceraurus*—the character of the glabella, the facial suture, the number of the body rings, are the same in each—a form with which *calymene* has certainly no relations. Hence the two may be legitimately placed apart: each as the type-form of a special group.

In PART II. a brief analysis of the more important genera and species belonging to these families will be given: shewing more fully the connecting points between the various groups, and the data on which the above arrangement is chiefly founded. In order, however, to render the present PART complete within itself, a rapid enumeration of the essential characteristics of each family is here appended:

Illænidæ—Buckler and pygidium large and smooth. Caudal axis scarcely developed. Glabella feebly raised; simple. Eyes far apart. Body-rings 5–10.

Brontidæ—Buckler and pygidium large; the latter with fan-like furrows and very short axis. Glabella slightly raised, furrowed. Eyes far apart. Body-rings 10.

Asaphidæ—Buckler and pygidium large; the latter with well-developed axis, and usually with striated limb. Glabella simple (or slightly furrowed). Eyes tolerably near together. Body-rings 8.

Trinuclidæ—Buckler large, horned; generally with perforated limb. Glabella oval, strongly pronounced. Pygidium of medium size. Body-rings 5–6.

Proetidæ—Buckler and pygidium of good size; the former bordered, the latter with well-developed axis. Glabella large, smooth (rarely furrowed.) Body-rings 8–12.

Calymenidæ—Buckler bordered, without horns. Glabella furrowed & smooth, narrowing anteriorly. Facial suture terminating at the angles of the buckler. Pygidium and its axis well-developed. Body-rings 13.

Harpesidæ—Buckler large, crescented, with perforated limb. Glabella narrowing anteriorly. Pygidium small. Body-rings 25–26.

Olenidæ—Buckler of moderate size, but comparatively short. Glabella small, narrowing anteriorly. Facial suture terminating at the lower margin of the buckler. Body-rings 12–17. Pleuræ spined. Pygidium small.

Phacopsidæ—Buckler and pygidium generally large; the latter with well-developed axis, often terminating in a spine. Glabella lobed or pustulated, widening anteriorly. Facial suture terminating at the sides of the buckler, about on a level with the eyes: these latter very visibly reticulated. Body-rings 11–12. Pleuræ rounded or spined.

Ceraurīdæ—Buckler large, horned. Pygidium with short axis, and with horns or spines. Glabella widening above, furrowed. Facial suture and body-rings as in Phacopsidæ.

Lichasidæ—Buckler broad, but short and somewhat pointed. Glabella prominently oval, with several accessory lobes. Facial suture terminating at the lower margin of the buckler. Pygidium with short axis, and denticulated or spined limb. Body-rings 11.

Acidaspidæ—Glabella in separate lobes, strongly pronounced. Buckler broad, and somewhat short. Pygidium small, or of moderate size with short axis, and spined or denticulated limb. Body-rings 8–10. Pleuræ spined. Entire shell more or less ornamented.

Paradoxidæ—Buckler large, horned. Glabella well-developed, widening above. Pygidium very small. Body-rings 11–20.

Appendix.—*Agnosti.* Small inconspicuous forms, exhibiting in general a couple of nearly similar shields (buckler and pygidium) separated by two or three thoracic segments. When more fully studied, the *agnosti* will be found, probably, to comprise a distinct group, embracing several families.

ON THE REDUCTION OF THE GENERAL EQUATION OF THE SECOND DEGREE IN PLANE CO-ORDINATE GEOMETRY.

BY J. B. CHERRIMAN, M. A. CANTAB.

PROFESSOR OF NATURAL PHILOSOPHY, UNIVERSITY COLLEGE, TORONTO.

Read before the Canadian Institute, January 2d, 1856.

The general equation of the second degree in plane rectangular co-ordinates, under the form

$ax^2 + 2\,cxy + by^2 + 2\,dx + 2ey + f = 0$, where a is essentially positive, and where the quantity

$$\left\{ (a+b)^2 - 4\,(ab - c^2) \right\}^{\frac{1}{2}}$$

will be denoted by m, can always be made identical with the equation

$$(x-h)^2+(y-k)^2=\epsilon^2(x\cos\theta+y\sin\theta-p)^2:$$

for this latter is an equation of the second degree with all its terms complete, and containing the requisite number of arbitrary constants.

Since the left-hand member of this equation is the square of the distance between the points (x, y) and (h, k), ϵ is a constant, and the other factor of the right-hand member is the square of the distance of the point (h, k) from the line $x\cos\theta+y\sin\theta-p=0$, it follows that the general equation of the second degree expresses the locus of a point whose distance from a fixed point (real or imaginary) is always proportional to its distance from a fixed, real or imaginary, straight line.

Adopting the usual nomenclature, the point (h, k) is a *focus*, ϵ is the *excentricity*, and the fixed line $x\cos\theta+y\sin\theta-p=0$ is a *directrix*.

Multiplying the first equation by an arbitrary quantity (λ); arranging the second equation by powers of the variables, and then equating corresponding coefficients, we obtain the six following equations from which to determine the six unknowns, $\epsilon, h, k, \lambda, \theta, p$;

$$\lambda a = 1-\epsilon^2\cos^2\theta \quad \text{——} \quad (1)$$
$$\lambda b = 1-\epsilon^2\sin^2\theta \quad \text{——} \quad (2)$$
$$\lambda c = -\epsilon^2\sin\theta\cos\theta \quad \text{——} \quad (3)$$
$$-\lambda d = h-p\epsilon^2\cos\theta \quad \text{——} \quad (4)$$
$$-\lambda e = k-p\epsilon^2\sin\theta \quad \text{——} \quad (5)$$
$$\lambda f = h^2+k^2-p^2\epsilon^2 \quad \text{——} \quad (6)$$

By taking (1) × (2) — (3)², we obtain

$$\lambda^2(ab-c^2)=1-\epsilon^2 \quad \text{——} \quad (7)$$

Hence, according as $ab-c^2$ is positive, zero, or negative, ϵ is less than, equal to, or greater than 1, corresponding respectively to the three varieties of the *ellipse, parabola, and hyperbola.*

Also from (1) + (2) we obtain

$$\lambda(a+b)=2-\epsilon^2 \quad (8)$$

and then (8)² — (7) × 4 gives

$$\lambda^2\left\{(a+b)^2-4(ab-c^2)\right\}=\epsilon^4$$

or, substituting m,

$$\lambda m=\epsilon^2$$

from which, by substitution in (8), we have

$$\epsilon^2=\frac{2m}{a+b+m} \quad \text{——} \quad (9)$$

In this expression for the excentricity, m may bear either sign (+ or —), but we observe that when, as in the ellipse, $ab - c^2$ is positive, which requires a and b to have the same sign, and therefore (since a is essentially positive) $a+b$ to be positive, m is less than $a+b$, and the negative value of m makes ϵ impossible. So also in the parabola, where $ab - c^2 = 0$, the positive value of m gives $\epsilon = 1$, while the negative value makes ϵ infinite.

Hence in the ellipse and parabola, the positive value of m must be taken: but in the hyperbola, where $ab - c^2$ is negative, either sign gives possible values to ϵ, one of them referring (as will afterwards appear) to the hyperbola, and the other to its conjugate, and the two values are evidently connected by the relation

$$\frac{1}{\epsilon_1^2} + \frac{1}{\epsilon_2^2} = 1.$$

It will be shewn in the sequel how to discriminate between them. We have now

$$\lambda = \frac{\epsilon^2}{m} = \frac{2}{a+b+m};$$

and substituting for λ and ϵ^2 in (1), (2), (3), we find

$$2\cos^2\theta = \frac{2}{\epsilon^2} - \frac{2\lambda a}{\epsilon^2} = 1 + \frac{a+b}{m} - \frac{2a}{m}$$

$$= 1 - \frac{a-b}{m}$$

$$2\sin^2\theta = 1 + \frac{a-b}{m}$$

$$\sin\theta\cos\theta = -\frac{c}{m}.$$

Of the four values for θ determined by either of the first two equations (m bearing a determinate sign) the third equation will shew which of the pairs, namely, θ and $\pi + \theta$, or $\pi - \theta$ and $2\pi - \theta$, is to be selected, and it is then indifferent which of the angles in that pair we take, due regard being had to the direction in which p is to be drawn from the origin as indicated by its sign; for, the change of θ into $\pi + \theta$ in our original equation only changes the sign of p, and we thus obtain in both cases the same determinate position for the directrix.

There remain now the equations (4), (5), (6), from which to complete the determination by finding p, h, and k. Eliminating h and k from these equations, we have

$$p^2 + \frac{2p\lambda}{1-\epsilon^2}(d\cos\theta + e\sin\theta) - \frac{\lambda(d^2+e^2)}{\epsilon^2(1-\epsilon^2)} \frac{\lambda f}{} = 0$$

From this we perceive that there are two and only two *directrices* corresponding to these two values of p, (for θ is restricted to one of two values differing by 180° which, as before noted, only changes the sign of p, and gives for each value the same line), which are also parallel, and to each of which corresponds a single *focus*, given by the corresponding values of h, k, from equations (4) and (5)*.

These values of p may however in particular cases either coincide, or be both imaginary, or one or both may be infinite or indeterminate: it will however be more simple to deduce from our equations the ordinary constants of the curve, which may be effected as follows:

The equation to a directrix being

$$x \cos \theta + y \sin \theta - p = 0,$$

that to a line drawn through the corresponding focus at right angles to the directrix will be

$$\frac{x-h}{\cos \theta} = \frac{y-k}{\sin \theta}.$$

The length of the perpendicular dropped on this from the origin is

$$h \sin \theta - k \cos \theta$$

which by virtue of (4) and (5) is equal to

$$\lambda \, (d \sin \theta - e \cos \theta)$$

or, denoting this by K,

$$K = \tfrac{1}{2} \frac{a+b-m}{ab-c^2} \, (d \sin \theta - e \cos \theta).$$

This expression being the same whichever focus be taken, it follows that the line thus determined (the 'transverse axis') passes through both foci and is at right angles to both directrices; and, from the mode of generation, the curve must be symmetrical with regard to it.

The curve is also plainly symmetrical with regard to a line parallel to both directrices and midway between them: the length of the perpendicular dropped from the origin upon this line (the 'conjugate axis') is the semi-sum of the values of p: calling this H we have from the equation for p,

$$H = -\frac{\lambda}{1-\epsilon^2} \, (d \cos \theta + e \sin \theta)$$

$$= -\tfrac{1}{2} \frac{a+b+m}{ab-c^2} \, (d \cos \theta + e \sin \theta),$$

Projecting H and K upon the axes of x and y successively, we obtain the co-ordinates (x', y') of the intersection of these two lines

* These values are as follows

$$p = -\tfrac{1}{2} \cdot \frac{a+b+m}{ab-c^2} \left[-(d \cos \theta + e \sin \theta) \pm \left\{ \frac{1}{m} (ae^2 + bd^2 - 2cde - \overline{ab-c^2}.f) \right\}^{\frac{1}{2}} \right]$$

$$h = \frac{1}{ab-c^2} \left[-(bd-ce) \pm \tfrac{1}{2} \left\{ 2(m-a+b) \, (ae^2 + bd^2 - 2cde - \overline{ab-c^2}.f) \right\}^{\frac{1}{2}} \right]$$

and a similar expression for k by interchanging a and b, d and e. A discussion of them would lead to the same results obtained more simply in the text.

(the 'transverse' and 'conjugate' axes), a point about which the curve is symmetrical, or the 'centre.' Thus

$$x' = H\cos\theta - K\sin\theta$$

$$= -\frac{1}{2(ab-c^2)}\left\{\begin{array}{l}(a+b+m)(d\cos^2\theta+e\sin\theta\cos\theta)\\ +(a+b-m)(d\sin^2\theta-e\cos\theta\sin\theta)\end{array}\right\}$$

$$= -\frac{1}{2(ab-c^2)}\left\{(a+b)d+md\left(-\frac{a-b}{m}\right)+2me\left(-\frac{c}{m}\right)\right\}$$

$$\left.\begin{array}{l} = \dfrac{ce-bd}{ab-c^2}. \\ y' = \dfrac{cd-ae}{ab-c^2}. \end{array}\right\}\ldots\ldots\ldots\ldots(10)$$

which are the usual expressions.

To find the points in which the curve is cut by the transverse axis, whose equation is

$$\frac{x-h}{\cos\theta} = \frac{y-k}{\sin\theta} = r;$$

substitute these values of x and y in the original equation, and we obtain

$$r^2 = \epsilon^2(h\cos\theta + k\sin\theta - r - p)^2$$

and the two values of r are expressed by

$$\frac{\epsilon}{\pm - \epsilon}(h\cos\theta + k\sin\theta - p).$$

The difference of these values is the part of the transverse axis intercepted by the curve: calling this length $2A$ we have

$$A^2 = \frac{\epsilon^2}{(1-\epsilon^2)^2}(h\cos\theta + k\sin\theta - p)^2 \ldots\ldots\ldots (11)$$

now (4) $\times \cos\theta$ + (5) $\times \sin\theta$ gives

$$h\cos\theta + k\sin\theta - p\epsilon^2 = -\lambda(d\cos\theta + e\sin\theta)\ldots(12)$$

and $(4)^2 + (5)^2 - (6)$ gives

$$-2p\epsilon^2(h\cos\theta + k\sin\theta) + p^2\epsilon^2(1+\epsilon^2) = \lambda^2(d^2+e^2) - \lambda f\ldots(13)$$

Hence by means of $(12)^2 \times \epsilon^2 + (13) \times (1-\epsilon^2)$ we have

$$\epsilon^2(h\cos\theta + k\sin\theta - p)^2$$

$$= \lambda^2\left\{\epsilon^2(d\cos\theta + e\sin\theta)^2 + (1-\epsilon^2)\left(d^2+e^2-\frac{f}{\lambda}\right)\right\}$$

$$= \lambda^2\left\{d^2(1-\epsilon^2\sin^2\theta) + e^2(1-\epsilon^2\cos^2\theta) + 2de\epsilon^2\sin\theta\cos\theta - \frac{1-\epsilon^2}{\lambda}f\right\}$$

$$= \lambda^2\left\{\lambda bd^2 + \lambda ae^2 - 2\lambda cde - \frac{1-\epsilon^2}{\lambda}f\right\}$$

$$= \lambda^3\left\{ae^2 + bd^2 - 2cde - (ab-c^2)f\right\}$$

and, hence,

$$A^2 = \tfrac{1}{2}\frac{a+b+m}{(ab-c^2)^2}\left\{ae^2+bd^2-2cde-(ab-c^2)f\right\}$$

Again, observing that the semi-sum of the values of r above found is the distance between the focus and centre, and that this semi-sum is $\frac{\epsilon^2}{1-\epsilon^2}$ $(h \cos\theta + k \sin\theta - p)$ and therefore $= A\epsilon$, by (11), we may write for the co-ordinates of the centre,

$$h + A\epsilon \cos\theta, \; k + A\epsilon \sin\theta :$$

and the equation to the 'conjugate' axis becomes

$$(x - h - A\epsilon \cos\theta) \cos\theta + (y - k - A\epsilon \sin\theta) \sin\theta = 0.$$

To find the points where the curve is cut by this axis, we combine this equation, or

$$\frac{x - h - A\epsilon \cos\theta}{\sin\theta} = \frac{y - k - A\epsilon \sin\theta}{-\cos\theta} = r,$$

with the equation to the curve,

$$(x - h)^2 + (y - k)^2 = \epsilon^2 (x \cos\theta + y \sin\theta - p)^2 :$$

substituting for x, y in terms of r, we obtain

$$(r \sin\theta + A\epsilon \cos\theta)^2 + (-r \cos\theta + A\epsilon \sin\theta)^2$$

$$= \epsilon^2 (A\epsilon + h \cos\theta + k \sin\theta - p)^2 = \epsilon^2 (A\epsilon + \frac{1-\epsilon^2}{\epsilon} A)^2,$$

or,

$$r^2 + A^2\epsilon^2 = A^2.$$

giving two points, which are real in the ellipse, and imaginary in the hyperbola. Hence denoting the intercepted part of the conjugate axis by $2B$, we have

$$B^2 = A^2 (1 - \epsilon^2)$$

$$= \frac{1}{2} \frac{a+b-m}{(ab-c_2)^2} \left\{ ae^2 + bd^2 - 2cde - (ab - c^2) f \right\}^*.$$

We may now go on to discuss the varieties of form which the curve may assume for particular relations among the constants.

I. In the elliptic class, where $ab - c^2$ is positive.

Here m is always to be taken with the positive sign, and $(a+b+m)$, and $(a+b-m)$ are both finite and positive, and A and B are therefore either both real or both imaginary; also they may vanish together, but neither of them can become infinite except by passing into the parabolic class.

Also ab being greater than c^2, $ae^2 + bd^2 - 2cde$ is always positive, and therefore if f be negative, the curve is always real: if f be positive, the curve is real or wholly imaginary according as $ae^2 + bd^2 - 2cde$ is greater or less than $(ab - c^2) f$.

If $ae^2 + bd^2 - 2cde = (ab - c^2) f$, then A and B both vanish, and the curve is reduced to a point whose co-ordinates are given by (10) and

* The value of B might have been deduced from that of A by changing the sign of m also K might have been deduced from H by changing the sign of m, and writing $(\frac{\pi}{2} + \theta)$ for θ. This might have been inferred from consideration of the imaginary directrices

which is always real and finite. The curve in this case resolves into two imaginary straight lines which have a real point of intersection.

If $A=B$, which requires $m=0$, and therefore $a=b$, and $c=0$, the curve becomes a circle, the co-ordinates of the centre reducing to $\left(-\frac{d}{a}, -\frac{e}{a}\right)$, and the square of its radius being $\frac{1}{a^2}(d^2+e^2-af)$. As before, this reduces to a point if d^2+e^2-af vanish, and is wholly imaginary if d^2+e^2-af be negative.

II. In the hyperbolic class, where $ab-c^2$ is negative.

Here either sign of m is admissible; $(a+b-m)$ and $(a+b+m)$ are both finite but of different signs, and of the two quantities A and B, one is real and the other imaginary: the curve is therefore always real, and *we must take that sign for m which renders A real and B imaginary;* the other sign having reference to the 'conjugate' hyperbola: that is, m must be taken of the same sign as the quantity $ae^2+bd^2-2cde-(ab-c^2)f$. As in the previous class, A and B may vanish together, but neither can vanish separately, nor can they become infinite except by passing into the parabola. When they both vanish, which will be when

$$ae^2+bd-2cde-(ab-c^2)f=0.$$

the curve is reduced to two real straight lines, whose intersection is given by (10), and which are equally inclined to the transverse axis (whose direction remains determinate): in this case, both foci and centre coincide with this point, and both directrices coincide with the direction of the conjugate axis: hence from the mode of generation, the angle of inclination of each of these lines to the transverse axis is $\sec^{-1}\epsilon$ or $\tan^{-1}\left\{\frac{m-a-b}{m+a+b}\right\}^{\frac{1}{2}}$, that sign of m being taken, which makes this quantity real.

If $A=B\sqrt{-1}$, which requires $a=-b$, the hyperbola is known as the 'equilateral.'

III. In the parabolic class, where $ab-c^2=0$.

This may be treated as the limiting case of the foregoing classes. Here $m=a+b$, A becomes infinite, and B takes the form $\frac{0}{0}$ but is really also infinite (since $\frac{a+b-m}{(ab-c^2)^2}=-\frac{4}{ab-c^2}\ \frac{1}{a+b+m}$) unless at the same time $ae^2+bd^2-2cde=0$.

Since $ab=c^2$, this requires $ae^2=bd^2$ and therefore $bd=ce$ and $ae=cd$, and then

$$\begin{aligned}ae^2+bd^2-2cde&=ae^2-cde\\&=ae^2-\frac{c^2e^2}{b}\end{aligned}$$

$$=\frac{e^2}{b}\,(ab-c^2)$$

and therefore

$$B^2=\frac{1}{a+b}\left(\frac{e^2}{b}-f\right)$$
$$=\frac{e^2-bf}{c^2+b^2}\quad\text{or}\quad\frac{d^2-af}{c^2+a^2}$$

In this case the curve reduces to two parallel straight lines, parallel to and equidistant from the transverse axis (which still remains determinate in position), the distance between them being double the foregoing value of B.

If $e^2=bf$ (which is the same as $d^2=af$), these two lines coalesce into the transverse axis, and if e^2-bf be negative, they are imaginary.

In general, however, for the parabola, the elements obtained in the ellipse and hyperbola are insufficient when the co-ordinates of the centre become infinite: the original equations (1)……(6) admit however in this case of easy solution. For, since $ab-c^2=0$, we have $m=a+b$, $\epsilon^2=1$, $\lambda=\frac{1}{a+b}$, and the equations become

$$\sin^2\theta=\frac{a}{a+b},\ \sin\theta\cos\theta=\frac{-c}{a+b}$$
$$-\lambda d=h-p\cos\theta \qquad (4)$$
$$-\lambda e=k-p\sin\theta \qquad (5)$$
$$\lambda f=h^2+k^2-p^2 \qquad (6)$$

from which we obtain at once by simple equations

$$p=\frac{1}{2(a+b)}\,\frac{d^2+e^2-(a+b)f}{d\cos\theta+e\sin\theta}$$
$$h=\frac{1}{2(a+b)}\,\frac{c(e^2-d^2)+2ade-(a+b)cf}{cd-ae}$$
$$k=\frac{1}{2(a+b)}\,\frac{c(d^2-e^2)+2bde-(a+b)cf}{ce-bd}$$

If we draw a line through the focus parallel to the directrix, the portion intercepted by the curve is double the distance of the focus from the directrix, as is evident from the mode of generation.

If we call this portion L (the 'latus rectum'), we have

$$\tfrac{1}{2}L=h\cos\theta+k\sin\theta-p$$
$$=\lambda(d\cos\theta+e\sin\theta),\ \text{by (4) and (5).}$$

Hence

$$\tfrac{1}{4}L^2=\frac{1}{(a+b)^3}\left\{ae^2+bd^2-2cde\right\}$$
$$=\frac{1}{(a+b)^2}\,\frac{abe^2+b^2d^2-2bcde}{ab+b^2}=\frac{1}{(a+b)^2}\,\frac{(bd-ce)^2}{c^2+b^2}$$

We will now proceed to recapitulate the values of the elements necessary and sufficient for the determination of the curve in the general cases.

For the ellipse and hyperbola, the co-ordinates of the centre are

$$x = \frac{ce-bd}{ab-c^2}, \quad y = \frac{cd-ae}{ab-c^2};$$

the semi-axes, transverse and conjugate, are given by the values

$$A^2 = \tfrac{1}{2} \frac{a+b+m}{(ab-c^2)^2} \left\{ ae^2+bd^2-2cde-(ab-c^2)f \right\}$$

$$B^2 = \tfrac{1}{2} \frac{a+b-m}{(ab-c^2)^2} \left\{ \ldots\ldots\ldots\ldots\ldots\ldots \right\}$$

In the ellipse $ab-c^2$ is positive, and m is always to be taken positive: in the hyperbola $ab-c^2$ is negative, and m must be taken of the same sign as the quantity within the $\{-\}$.

The inclination (θ) of the transverse axis to the axis of x is then given without ambiguity by the equations.

$$2\cos^2\theta = 1 - \frac{a-b}{m}. \quad \sin\theta\cos\theta = -\frac{c}{m},$$

θ being measured by revolution from the positive part of the axis of x to that of y.

In the parabola, $ab-c^2=0$; the co-ordinates of the focus are

$$h = \frac{1}{2(a+b)} \quad \frac{c(e^2-d^2)+2ade-(a+b)cf}{cd-ae}$$

$$k = \frac{1}{2(a+b)} \quad \frac{c(d^2-e^2)+2bde-(a+b)\,cf}{ce-bd}$$

The position of the directrix is given by the angle θ made by its normal with the positive part of the axis of x (θ being measured by revolution towards that of y) and the length p of this normal, including sign as indicating a direct or backward measurement from the origin. These are given without ambiguity by the equations

$$\sin^2\theta = \frac{a}{a+b}, \quad \sin\theta\cos\theta = \frac{-c}{a+b},$$

$$p = \frac{1}{2\,(a+b)} \cdot \frac{d^2+e^2-(a+b)f}{d\cos\theta+e\sin\theta}.$$

These elements are sufficient to determine the position and dimensions of the curve as well as the direction towards which its concavity is turned;* but the latus-rectum L is also given directly by the value

$$\tfrac{1}{4} L^2 = \frac{1}{(a+b)^2} \cdot \frac{(bd-ce)^2}{b^2+c^2}.$$

In particular cases, the ellipse may degenerate into a point, or be wholly imaginary; the hyperbola may degenerate into two intersecting

* In the ordinary methods of reduction, this direction is undetermined.

straight lines; both curves have for their limiting form the parabola, which itself may degenerate into two parallel straight lines, or into a single straight line, or be wholly imaginary.

REVIEWS.

Chemical Method, Notation, Classification, and Nomenclature. By Auguste Laurent, formerly Professor of Chemistry at the Faculty of Sciences of Bordeaux, &c. Translated by William Odling, M.B., F.C.S., Professor of Practical Chemistry and Natural Philosophy at Guy's Hospital. London: Printed for the Cavendish Society by Harrison & Sons. 1855.

Modern Chemistry can boast of few more persevering and successful cultivators than the late Auguste Laurent, who occupied so prominent a position among the most distinguished chemists of France. Not only did he enrich the science with the discovery, we might almost say, of an infinity of new and interesting compounds, but he was led during their investigation to propose theories respecting their formation and constitution, which, although, most fiercely combatted on their promulgation, and for a long period by no means generally received, have during the last few years attracted a large share of attention, and have been, at least in part, almost universally adopted.

Dumas first put forward the idea of substitution, or rather of the law which regulates it, but it was Laurent who first pointed out the real value of the discovery, and immensely extended the theory. While the greatest credit must be allowed to the many eminent chemists whose labors in organic chemistry are daily enriching the science with most interesting discoveries, it cannot be denied that in many cases they are but following in the path opened by the investigations of Laurent.

The career of the celebrated French chemist is peculiarly interesting as connected with the history of chemistry and of chemical polemics, for his publications drew down upon him the ponderous and gigantic learning of Berzelius, and the acute and cutting irony of the belligerent Liebig. Some of the most learned, but at the same time most polemical papers of the celebrated chemist of Giessen, arose from his discussions with Laurent. Many who have watched the progress of chemistry during the last twenty years will well remember the doubt, not to say ridicule, with which many of Laurent's assertions were received, both in France and Germany, but they will also confess that many of our present theories and assumptions are but echoes of what we once were taught to consider absurd. Chemistry is essentially progressive, and a science of facts; theories and views, founded on a comparatively small number of facts, must necessarily receive alteration when new facts, bearing on these theories, are discovered. We should scarcely be willing to adopt Williamson's explanation of the nature of ether and of its formation, were it not for the discovery of the compound ethers; the discovery of the compound anhydrous acids has led to some remarkable changes in our theories respecting the organic acids generally.

Liebig more than once quizzed Laurent about his spirit of prophecy, but was in himself a remarkable instance of a *true prophet*, having predicted in 1839 the existence and properties of the compound ammonias, which were discovered in 1849 by Wurtz.

The idea of the dualistic nature of the vegetable alkaloids, maintained by several of the older chemists, seems to be entirely refuted, for we can scarcely believe that the composition of the natural products can be different from that of the artificial ones which they so closely resemble. It is not at all extraordinary that those who commenced the study of chemistry when that science was almost in its infancy, and when all organic relations were compared to inorganic, should have been induced to extend to the one department, the dualistic theory so generally adopted in the other; every man has his own peculiar hobby, swears by his own side of the shield, and is very unwilling to admit the arguments of others. For long years the conflict raged among chemists of the different schools, but at the present day there seems to be a fusion between the opposing factions, while portions of the compound radical theory are conceded to be erroneous, parts of the Laurentian hypotheses, and of those of the newer French school, are willingly adopted.

Laurent's papers are diffused through so large a number of journals, and his views have been so imperfectly represented in most manuals of chemistry, that the publication of this excellent translation of his last work (on which he was engaged, as Biot says, even when in the grasp of death,) will prove an exceedingly acceptable addition to the library of every chemist.

Laurent alludes to most of the attacks which have at different times been made upon his theories and researches by Berzelius, Liebig, Wöhler and others, and with no feeble pen makes a fierce onslaught upon the dualistic hypothesis. However ingenious his propositions with regard to chemical nomenclature, we cannot conceive that they will ever be generally adopted; nitronaphthase and nitronaphthise are by no means preferable to nitro, binitro, and trinitro-naphthalide, for when we once assume that the numerical prefix shall indicate the number of equivalents of hydrogen, replaced by $N\ O^4$ the words nitro, binitro, and trinitro, indicate three numbers much more directly and distinctly than the a, e and i in the final syllable of the Laurentian names. In the present work we meet with an overwhelming mass of new names with which it is sincerely to be hoped chemical nomenclature (already sufficiently confused) will not be deluged. Aplones, Diamerones, Dianhydes, Anames, Anoses, Aziles, Aleses, Alcinyles, Metoyles, Rhizonyles, Diameraies, Synehteres, Dixerides, Udolides, &c., &c., *ad infinitum.* But these are euphonious compared with Gmelin's designations of which the following may serve as specimens: Alan, Alen, Ofun, Apuk, Patakplatek, Patanafintalkanafin, and last, but not least, for simple Alum, Atolantelminojafinweso!!

The work is of such a nature as scarcely to allow of any extracts, but we have appended a note in which Laurent explains the difference between his and Dumas' ideas respecting substitution, which were by many considered to be identical.

"The notion of substitutions, if we understand thereby, as we ought to understand, the replacement of chlorine, by bromine, iodine, and fluorine, or the replacement of silver, by copper, iron, or potassium, is as ancient as are the ideas of Richter and Wenzel upon the decomposition of salts. We have known for a long time that the single bodies displace one another mutually from their combinations, most generally by exchanging equivalent for equivalent, but not unfrequently in a different manner.

We have known that chlorine, by its action upon certain organic substances, as cyanhydric acid, essence of bitter almonds, wax, &c., expels a certain number of atoms of hydrogen, which are replaced by an equal number of atoms of chlorine. We have known that oxygen sometimes comports itself in a similiar manner, and also, that in some bodies the hydrogen set free is not replaced by its equivalent of chlorine.

Two questions present themselves: 1°. Can we know *à priori*, whether the hydrogen set free, will or will not be replaced by its equivalent of chlorine, and how much of it may be liberated without substitution? 2°. What becomes of the chlorine in the new chloro-compounds; what function does it fulfil; of what nature are the compounds into which it enters, either by an equivalent, or a non-equivalent substitution?

These two questions are, we perceive, altogether independent of each other. We might discover the law presiding over substitutions, without knowing what takes place within the chloro-compounds, and *vice versâ.*

Dumas confined himself to the first question, and under the name of the theory of substitutions (he himself remarked that he ought to have said *law* of substitutions) he announced the two following propositions:

1°. *When we treat an organic substance by chlorine, bromine, iodine, or oxygen, these bodies generally set free hydrogen, and for one equivalent of hydrogen liberated, there is retained in the compound one equivalent of chlorine, bromine, iodine, or oxygen.*

2°. *If a part of the hydrogen of the organic substance exists in the state of water (as in alcohol), it will be set free by the chlorine or oxygen, without substitution.*

The law is precise, and void of ambiguity: I do not purpose to inquire whether or not it is correct (*vide* what I have said concerning chlorine and oxygen substitutions in this and the preceding chapter respectively). All that I have to say is, that I have not adopted this law, and that I have myself formulated certain propositions which are altogether different, and are applicable almost solely, to the hydrocarbons. I then have nothing whatever to claim in the above *law* of substitutions. It belongs entirely to Dumas.

With regard to the second question, Dumas never concerned himself with it, unless indeed, after I had done so. It is this subject that I have for a long time had in view in my researches (*vide* my opinion thereon in this chapter); it is in reference to it, that I have advanced the following proposition: *when there is* EQUIVALENT *substitution of chlorine or bromine for hydrogen, the chlorine actually takes the* PLACE *that was occupied by the hydrogen, and to a certain degree, fulfils the functions thereof, consequently the chloro compound must be analogous with the compound from which it was derived.*

Thus there is but little analogy between my opinion, my propositions—and the law of Dumas. Here is the reply of this illustrious chemist to Berzelius, by whom he had been rendered somewhat responsible for my extravagances. 'Berzelius attributes to me, an opinion precisely contrary to that which I have always maintained, namely, that the chlorine in this case* takes THE PLACE of the hydrogen. I have never said anything of the kind, neither can anything of the kind be deduced from the opinions I have put forward with regard to this order of facts. To represent me as saying that hydrogen is replaced by chlorine, which fulfils the same functions, is to attribute to me an opinion against which I protest most strongly, as it is opposed to all that I have written upon these matters. The law of substitutions is an empiric law and nothing more; it expresses a relation between the hydrogen expelled, and the chlorine retained. I am not responsible for the gross exaggeration with which Laurent has invested my theory; his analyses moreover do not merit any confidence.'

Dumas and I made use of the same word substitution, from which circumstance arose much of the confusion that prevails on this subject. This confusion was still further augmented, by our employment of special terminations in *ase*, *ese*, and *ise*, &c., terminations *conceived by Dumas* as expressive of the relation between the number of hydrogen atoms liberated, and the number of other atoms retained, but *employed by me* to indicate that the chloro-compound *in the case of an equivalent substitution*, must still preserve the constitution of the original substance.

Thus Dumus represented the constitution of essence of canella by this formula: $C^{18}H^{14}O^2+H^2$; that of chloride of cinnamyl by this: $C^{18}H^{14}O^2+Cl^2$; and the *composition* of chlorocinnose (=the hydride—$4H^2+4Cl^2$) by $C^{18}H^8Cl^8O^2$, observing that he called the body *chlorocinnose provisonally*, inasmuch as he did not know how to represent its molecular constitution, nor with what body to compare it.

My opinion was very different. If I had considered essence of canella as forming a unique molecule $C^{18}H^{16}O^2$, and had named it cinnamyl, I should have called the

* "I had just made the chlorhydate of chloretherise, and an acetate of chloromethylene. I maintained that the first body had the same constitution as Dutch liquid, and that in the second, the atoms were disposed exactly as in the acetate of methylene. It was in reference to this opinion, that Berzelius chose to render Dumas responsible for my errors."

chloro-compound, *chlorocinnose.* If I had regarded the essence as a hydride $C^{18}H^{14}O^{2}+H^{2}$, I should have named the chloro-compound *chloride of chlorocinnise* $C^{18}H^{8}Cl^{6}O^{2}+Cl^{2}$; If I had considered the essence as a hydrate of cinnamyl $C^{18}H^{14}O+H^{2}O$, I should have called the chloro-compound *hydrate of chlorocinnose*, &c., &c.

Thus despite the similitude of the terminations, despite the same values ascribed to the same vowels by Dumas and myself, there is not any analogy between the ideas which these two nomenclatures represent, excepting, that they both express the quantity of hydrogen set free, and the quantity of chlorine fixed.

I will adduce the following examples, to show the absolute difference that exists between my opinion and that of Dumas.

Dumas represented alcohol by $C^{4}H^{8}+H^{4}O^{2}$, and acetic acid by $C^{4}H^{6}O^{3}+H^{2}O$ and nevertheless saw a case of substitution in the conversion of the first into the second:

$$\text{Alcohol}-2H^{2}+2O=\text{acetic acid.}$$

Since at that time, Dumas maintained that alcohol contained 2 atoms of water, while acetic acid contained only one, it is clear that in his law of substitutions, he considered only the ratio between the hydrogen liberated, and the chlorine or oxygen fixed, without pretending that the primitive and the derived body, belonged to the *same type.*

This is rendered still more evident by the following examples, which Dumas brought forward in support of his law:

$$\text{Alcohol}\quad -4\,H^{2}+4O=\text{formic acid,}$$
$$\text{Acetic acid}\ -2\,H^{2}+2O=\quad\text{"}\qquad\text{"}$$

It is certain that Dumas, notwithstanding the equivalent substitution, did not consider alcohol, acetic acid, and formic acid, as belonging to the same type.

It was some considerable time after this, when he had discovered the chloracetic acid, that he adopted my opinion concerning the functions of chlorine in substitution compounds, which view he extended so as include oxygen, although I had myself ceased to apply it to this last body."

We strongly recommend this valuable work to the attentive perusal of all interested in the higher departments of theoretical chemistry.

H. C.

A Treatise on Analytical Statics, with numerous examples. By J. Todhunter, M. A., Fellow and Assistant Tutor of St. John's College, Cambridge. Cambridge: Macmillan & Co., 1853.

In a review of Mr. Todhunter's *Analytical Statics,* which appeared in a late number of the *Canadian Journal,** we pointed out what appeared to us a fallacy in Poisson's proof of the Parallelogram of Forces. Since that review was written we have discovered that the defect lies in a much smaller compass, and may be remedied in much fewer words, than we at first imagined: though Poisson's own wording certainly leaves his reasoning open to the objection laid against it.

We may remind our readers, that Poisson, in the first place, shews

* Ante, Reviews. No. 1, p. 63.

that if $2x$ be the angle between two equal forces, P, and R their resultant, we may write

$$R = Pf(x);$$

and that if $2z$ be the angle between another pair of equal forces, we shall have

$$f(x)\ f(z) = f(x+z) + f(x-z) \ \dots\dots\dots \ (1)$$

and it is from this functional equation that the solution of the problem is to be derived. He notices that the assumption $f(x) = 2\cos cx$ satisfies this equation, and asserts that it is the *only* solution: an assertion which is true only if it be understood that c may be either a possible or an impossible quantity, and which, even with this modification his reasoning does not establish. What he does attempt to shew is this, that if the particular assumption $f(x) = 2\cos x$ is verified in two cases it must be true generally. That it is true when $x = 0$ is apparent from the equation itself by putting $z = 0$: an appeal to mechanical considerations shews that it is also true when $x = 60°$. The proof, then, to which we objected starts from these data: that equation (1) holds: that $f(0) = 2\cos(0)$, and $f(60°) = 2\cos 60°$: and from these data he professes to shew that $f(x)$ *must* be equal to $2\cos x$ for *every* value of x. We objected to this, that the very same reasoning might be employed to shew that $f(x)$ must be equal to $2\cos 5x$: and we inferred that the reasoning must therefore be defective, and that the defect could be remedied only by a fresh appeal to mechanical considerations. In effect it is not difficult to point out where this appeal becomes necessary. He first shews that if the relation $f(x) = 2\cos x$ is verified when $x=a$ it will also be true when x is any multiple of a: he, then, has to shew that it will also be true when x is equal to a divided by any power of 2. This is *not* generally true: it is true in the particular problem we are solving: but as far as the data go this is not the case. In order to make the proof hold generally, it would be necessary to add the words, "provided that we know from independent sources that $f\left(\frac{a}{2^r}\right)$ is of the same sign as $\cos\frac{a}{2^r}$". Thus starting with the known fact that $f(a) = 2\cos a$, he arrives at the equation

$$\left\{f\left(\frac{a}{2}\right)\right\}^2 = 2\cos a + 2$$

whence he at once infers that

$$f\left(\frac{a}{2}\right) = 2\cos\frac{a}{2},$$

taking the upper sign in the ambiguity on extracting the root: in doing which *generally* he is obviously not justified; and the same remark will apply to all the succeeding steps, unless the additional condition which we have indicated be introduced. This condition really is introduced in the question before us, by mechanical considerations—by the assumption, in fact, that the direction of the resultant of two forces necessarily lies in the angle contained by the directions of the forces themselves. From this it will follow that so long as x is not greater than 90°, $f(x)$ is positive: so that a standing for 60°, it will follow that $f(\frac{a}{2^r})$ and $\cos(\frac{a}{2^r})$ being both necessarily positive will have the same sign. Thus for example we should get from the data

$$\left\{f(30°)\right\}^2 = 4\cos^2 30$$

$$\text{or } f(30°) = \pm 2\cos 30$$

and the mechanical considerations justify us in taking the upper sign. And it is easily seen that though it is true that $f(60°) = 2\cos(5 \times 60°)$, yet when the additional mechanical considerations are taken in the above proof will *not* serve to shew generally that $f(x) = 2\cos 5x$. In fact, if these considerations are fairly introduced, the proof becomes perfectly unexceptionable.

G. C. I.

NOTE ON

*Poisson's Proof of the Parallelogram of Forces.**

The general functional equation, from which Poisson obtains his solution by an indirect process, may be treated *directly* as follows:

The equation is

$$f(x)f(z) = f(x+z) + f(x-z).$$

If we expand in ascending powers of z, by Maclaurin and Taylor's theorems, we obtain

$$f(x)\left\{f(0) + f'(0)z + f''(0)\frac{z^2}{1.2} + \ldots\ldots\right\}$$
$$= 2f(x) + 2f''(x)\frac{z^2}{1.2} + \ldots\ldots$$

Equating corresponding coefficients of z, we have

$$f(x)f(0) = 2f(x);$$

which is satisfied either by $f(x) = 0$, or $f(0) = 2$.

Confining our attention at present to the latter solution only, and proceeding to equate coefficients, we find $f'(0) = 0$, and all the succeeding derivatives of an odd order also vanish. Also we have

$$2f''(x) = f''(0)f(x);$$

* Vide No. 1, Reviews, "*A Treatise on Analytical Statics*," &c., *ante*, p. 63.

and by further proceeding we shall only obtain the same result as by integrating this equation at once. Writing, then, $2c^2$ for $f''(0)$, c being any arbitrary constant, real or imaginary, we have

$$f''(x) - c^2 f(x) = 0,$$

the known integral of which is

$$f(x) = a\epsilon^{cx} + b\epsilon^{-cx}.$$

To determine a and b, we have

$$2 = f(0) = a + b$$
$$0 = f'(0) = a - b$$

and therefore $a = 1$, $b = 1$, and

$$f(x) = \epsilon^{cx} + \epsilon^{-cx}.$$

Combining this with our former solution $f(x) = 0$, we have for the complete solution,

$$f(x) = \tfrac{1}{2}\left\{ 1 + (-1)^n \right\}(\epsilon^{cx} + \epsilon^{-cx}).$$

where n is an integer, and c any real or imaginary constant. Of this there are four, and only four, forms which make $f(x)$ real, namely,

(1), n odd,...... $f(x) = 0$;
(2), n even, $c = 0$,...... $f(x) = 2$;
(3), ... c real,...... $f(x) = \epsilon^{cx} + \epsilon^{-cx}$;
(4), ... c an imaginary of the form $c\sqrt{-1}$ by which we may replace it...... $f(x) = 2\cos cx$; and from these we have to select by mechanical considerations the particular one which belongs to the case proposed. Now (1) and (2) are plainly inadmissible, and so also is (3) since it makes $f(x)$ increase indefinitely with x; hence (4) is the one to be selected. To determine the value of c, we observe that $f(x)$, by the mechanical axiom, is always positive between $x = 0$ and $x = \frac{\pi}{2}$; therefore $\cos cx$ must be always positive between these limits, and c cannot therefore be greater than 1. Also $\cos\frac{c\pi}{2} = 0$, for the resultant vanishes when $x = \frac{\pi}{2}$, hence we must have $c = 1$, and our required solution is $f(x) = 2\cos x$.

J. B. C.

The Pilgrimage, and other Poems. By the Earl of Ellesmere. *With Illustrations.* London: Murray, 1856.

We are tempted to notice this handsomely illustrated addition to those literary productions of "Royal and Noble Authors," catalogued by the Earl of Orford in 1758, mainly by a special mark of distinction it has received from an American critic, which we are disposed to regard as a curiosity in the way of Republican criticism! The New York *Monthly Trade Gazette* for April thus prefaces a borrowed notice, under the heading A 'NOBLE' POET. "The London *Literary Gazette* reviews a recent volume of poems from the pen of the Earl of Ellesmere—*or perhaps from that of his Secretary, as is more likely;* English noblemen having frequently been detected in trickery of that kind. The *Gazette*, however, appears to receive the work as the genuine offspring of the Earl—although the artful manner in which it qualifies its opinion in the second sentence would seem to leave a doubt on this head;* as if it meant by damning the work with qualifying praise to leave a loop-hole through which to escape the charge of having been caught, in case one of less noble (!) blood should yet be found to be the father of the work. Those who are acquainted with the reprehensible practices of English noblemen in this respect, and the servile character of English critics, will need no explanation of this paragraph."

This, it must be owned, is a very pretty little sample of literary criticism, adapted to the latitude of New York; where, it is plain, whatever other republicanisms may be in vogue, there is to be no Republic of Letters tolerated. The rank taken by Francis Leveson Gower is not among the foremost in the literary guild, literature having manifestly been with him only a pleasant pastime,—but his name is no novelty among the authors of England, and this discovery of the anonymous Secretary, of "less noble blood," stowed away in some secret garret of Bridgewater House to manufacture verse for him, should be looked after for the next edition of the "Curiosities of Literature." The present edition of Lord Ellesmere's poems introduces to the reader various new pieces including "Blue Beard," a burlesque tragedy, published for the first time, though not unknown by repute. The verse is generally characterized by a pleasant gracefulness and elegance, though certainly exhibiting no such unwonted force, or striking originality, as to suggest to ordinary minds the impossibility of an Earl being capable of the feat, without having recourse to those "reprehensible practices of English noblemen," so cleverly detected by the Broadway critic.

A stanza or two will suffice to give some idea of the Earl's poetical powers. "The Pilgrimage," from which the main title of the volume is derived, as well as others of the author's larger poems, are written in

* "Lord Ellesmere's poems deserve republication in the handsome form in which they appear in this illustrated edition. Correct taste and good feeling are charcteristic of his writings, compensating largely for the want of striking originality or unusual power in his poetry."—*Literary Gazette.*

the same stanza as "Childe Harold," but they will not otherwise stand comparison with the work of that noble poet, whose "Hours of Idleness," were criticised to such good purpose by the "Scotch Reviewers." An extract or two from the Edinburgh article for January 1808, we should have thought would better have answered our New York critic's purpose—with only a very slight adaptation,—than the "servile" article he borrowed from the London *Gazette.* "He certainly," says the older Reviewer, in reference to the presumptuous lordling then taken to task, "does allude frequently to his family and ancestors—sometimes in poetry, sometimes in notes; and while giving up his claim on the score of rank, takes care to remember us of Dr. Johnson's saying, that 'when a nobleman appears as an author his merit should be handsomely acknowledged.'" And then how much better would the following passage, from the same anti-aristocratic Reviewer's pen, have served as an introduction to the Earl's stanzas than the faint praise of English critics. Who knows but it might have provoked the Earl into setting that invaluable anonymous Secretarial genius of his to work on an ENGLISH BARDS AND YANKEE REVIEWERS! "We must beg leave seriously to assure Lord [Ellesmere] that the mere rhyming of the final syllable, even when accompanied by the presence of a certain number of feet,—nay although (which does not always happen) those feet should scan regularly, and have been all counted accurately on the fingers,—is not the whole art of poetry. We would entreat him to believe that a certain portion of liveliness, somewhat of fancy, is necessary to constitute a poem, and that a poem of fancy in the present day, to be read, must contain at least one thought, either in a little degree different from the ideas of former writers, or differently expressed. We put it to his candour, whether there is anything so deserving the name of poetry in verses like the following:"—and here should follow the sample of stanzas, which, however, we take not from the volume under review,—if indeed ours be not rather the review of a review,—but from a popular selection, culled years ago, as pieces, by various authors, worthy of special note, and before the writer of these pleasing reminiscences of his own Arabian Nights' Entertainments which "The Pilgrimage" supplies, had gone the unpardonable length of becoming an Earl!

Round yonder watch-fire's blaze the muleteers
In circle close.—The leader of the throng,
Fluent and fast, to never sated ears
The tale recites, or chants the Arab song,—
Wild stanzas, strange adventures. Loud and long

The applause resounds, as each invented sleight
Of magic art, or fate of Afrite strong
By Genii quelled in preternatural fight,
Fills, as the story rolls, each breast with fresh delight.

He little thinks, the tale he loves to tell,
Which cheats his willing comrades of their rest,
Through many a midnight hour defrauds as well,
In foreign garb and other language dressed,
Of slumber's boon the children of the West;
How many a sad or vacant mind, the page,
With the same legendary lore impressed,
Has cheered, assuaged life's ills through every stage,
Given youth one smile the more, one wrinkle snatched from age.

For not alone beneath the palm-tree's shade
Amid the nargilé's ascending cloud,
Does Eastern fiction dwell, or Scherezade
Dispense her favours to the listening crowd.
All ranks, all nations at her shrine have bowed;
The pictured forms her lively pencil drew
Please in all climes alike; and statesmen proud
In grave debate have owned her lessons true,
Finding that ancient lamps sometimes excel the new.

Far other task meanwhile for me delays
The needful gift of well-earned sleep's repose;
The beam that from my tremulous cresset plays,
Its light upon the sacred volume throws.
Oh! who in distant climes the rapture knows,
E'en on the spot of which the tale is told,
To mark where Tabor frowns or Jordan flows,
To feel at morn our steps shall print the mould,
Where Gideon pitched his camp or Sisera's chariot rolled!

Such rapture ours, when, on Esdraelon's plain,
Tabor in front and Jezreel left behind,
By Kishon's source we pitched. Oh! ne'er again
Shall joys, of power like these to fill the mind,
Rise in the civilized haunts of human kind.
How went I forth to watch the shivering ray
On Carmel's crest; to hear upon the wind
The jackal's howl; or rippling sounds betray
Where Kishon's ancient stream rolled on to Acre's bay.

How, to our tents when morning's moisture clung,
Our memory turned to that oracular dew
From the full fleece which pious Gideon wrung!
'Twas here perchance that Israel's champion knew
The sign which spoke his high commission true;
Down yonder vale perhaps, by Kishon's ford,

On towards the slumbering heathen's camp he drew
His chosen hundreds, silent—till the sword
Flashed to the frightened skies, of Gideon and the Lord.

from a piece entitled the "Military Execution," which appears, we believe, for the first time, in this new edition of Lord Ellesmere's poems, we select the concluding stanzas as all that our space will allow us to cull from a volume, which will form no discreditable addition to the works of the Royal and Noble Authors of England :

His kindred are not near
The fatal knell to hear,
They can but weep the deed when 'tis done ;
They would shriek, and wail, and pray :
It is well for him to-day
That his friends are far away—
All but one.

Yes, in his mute despair,
The faithful hound is there,
He has reached his master's side with a spring ;
To the hand which reared and fed,
Till its ebbing pulse has fled,
Till that hand is cold and dead,
He will cling.

What art, or lure, or wile,
That one can now beguile
From the side of his master and friend?
He has gnawed his cord in twain ;
To the arm which strives in vain
To repel him, he will strain,
To the end.

The tear drop who can blame?
Though it dim the veteran's aim,
And each breast along the line heave the sigh.
But 'twere cruel now to save ;
And together in that grave,
The faithful and the brave,
Let them lie.

Few, we think, will deny that there are traits of force and pathos in these lines ; and others of like character—though with more of grace and refinement of thought than any strongly marked individual characteristic or striking originality,—are to be found scattered through the volume, to which the noble author, in imitation of Rogers, has striven to give additional attraction and value by the supplementary aid of artistic illustration.

D. W.

SCIENTIFIC AND LITERARY NOTES.

GEOLOGY AND MINERALOGY.

THE WOLLASTON MEDAL.

At the Aniversary meeting of the Geological Society of London on the 17th of last February, the president, Mr. Hamilton, placed the Wollaston medal in the hands of Sir Roderick Murchison for transmission to our provincial geologist, Sir W. E. Logan. This additional honor, the highest in the power of the Geological Society to confer, must be gratifying to all who wish well to Canada. We are glad to learn that, in accordance with the principles embodied in Mr. Langton's late report, sufficient means will now be placed at Sir William Logan's disposal, to enable him to carry on our Canadian survey with undiminished success. The projected palæontological publications under the partial superintendance of Professor James Hall, whose assistance in this department, Sir William has been so fortunate as to secure, will add still more, if possible, to the reputation already acquired by the Survey in European circles.

ORIGIN OF THE CARBONATE OF IRON OF THE COAL MEASURES.

At a late meeting of the Boston Society of Natural History, Prof. W. B. Rogers communicated some interesting observations on the probable origin of the ironstone bands and nodules of the coal measures. Assuming that the actual amount of iron in a given thickness of the coal-bearing rocks is not in excess of that present in an equal thickness of the permian or other sandstone strata, Professor Rogers adopts the conclusion, that the originally diffused sesquioxide of iron was converted into the proto-carbonate by the conjoint action of carburetted hydrogen and carbonic acid evolved from the intermixed vegetable matters. And, secondly, that by solution in percolating waters charged with this carbonic acid, the process of segregation into bands and nodules, or the deposition of the ironstone above impermeable layers, was more or less readily effected.

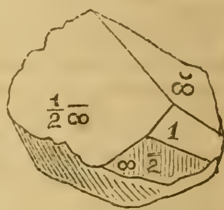
FOSSIL MUSK OX.

The existing musk ox—*Bos* or *Bubalus moschatus*—it is well known, is a denizen of the inhospitable regions of our American continent, north of the parallel 60°. Fossil remains of this species occur however in the Post-tertiaries of various parts of Europe, and in Siberia. A well characterised cranium, the first British example, was discovered at the close of last year in a gravel bed at Maidenhead in Berkshire, England. Professor Owen in describing the fossil specimen at a meeting of the Geological Society, first offered his reasons for regarding the so-called musk-ox, as having been unnecessarily separated from the buffaloes, and then gave an account of the few fossil skulls of the musk-buffalo yet known—viz, those figured by Pallas, Ozeretskowsky, and Cuvier. A comparison was then made of the fossil remains with recent crania; and, although the skulls somewhat differ in a few points, especially in the relative curvatures of the horn-cores, yet the author was led to conclude that, as far the materials for comparison at his command would serve, the differences between the fossil and recent musk buffaloes are not of specific value; that the *Bubalus moschatus* of the Arctic regions, with its now restricted range, is the slightly modified descendant of the old companion of the mammoth and the Tichorine rhinoceros, which, with them enjoyed a much wider range, both in latitude and longitude, over lands that now form three divisions or continents of the northern hemisphere; and that the circumstances which have brought about the probably gradual extinction of the northern rhinoceros and elephant, have not yet effected that of the contemporary species of Arctic buffalo.

GRAPHITE IN METEORIC STONES.

An analysis of the meteorites which fell at Mezœ-madaras in Transylvania on the 24th of September 1852, has been communicated to the Philosophical Magazine by Professor Wœhler and Dr. Atkinson. The analysis shews the presence of nickeliferous iron (Ni 7·4, and Co 0·25 p.c.) iron pyrites, chrome-iron, schreibersite? olivine, augite, labradorite, and graphite. The latter is of some interest; for although previously announced, and on more than one occasion, the presence of graphite in meteoric stones has been held in doubt by many observers.

WOLFRAM.



The accompanying figure represents a crystallized specimen of Wolfram—(FeO, MnO) WO^3—discovered by the writer in a boulder on the west shore of "Chief's Island," Lake Couchiching, Canada West. The mass of the boulder consisted of gneiss, traversed by a vein of coarse granite, with red orthoclase, in which the specimen was found. Magnetic oxide of iron, in small granular pieces, was also present in the boulder.

Our specimen exhibits the same peculiarity of structure as that observable in the Schemnitz and other crystals. Apart from the proper cleavage directions, it may be readily subdivided parallel to the various planes. The plane 1 is a face of the fundamental octahedron; $\frac{1}{2}\bar{\infty}$, a face of the commonly-occurring macrodome; $\breve{\infty}$, one of the common brachydome; and $\infty\bar{2}$, a face of the prism (or vertical) series, exhibiting the usual striæ. Although the edges between these planes are sharply cut, and the planes themselves exceedingly bright, yet, owing to surface inequalities, no well-defined reflection is obtainable, and hence the measured angles are merely approximative. The following are the means of several measurements, taken under different conditions: $\frac{1}{2}\bar{\infty} : \breve{\infty}$ = 132° 40′; $\frac{1}{2}\bar{\infty}$: 1 = 148° 16′; $\breve{\infty}$: 1 = 142° 22′; $\frac{1}{2}\bar{\infty} : \bar{\infty}\bar{2}$ = 117° 6′; $\breve{\infty} : \infty 2$ = 104° 24′; 1 : $\infty\bar{2}$ 143° 18′.

Kerndt gives the following values for the ratios of the axes in Wolfram: $a : \bar{a}$ $\breve{a}$ = 0·8659 : 1 : 0·8134; with ∞: = 101° 45′, and $\breve{\infty} : \breve{\infty}$ (over the summit) consequently, 98° 13′ 17″. If the angles of our specimen be calculated from these values as a basis, we obtain the results exhibited in the following table.*

$\frac{1}{2}\bar{\infty} : \breve{\infty}$ = 131° 52′ 10″

$\frac{1}{2}\bar{\infty}$: 1 = 149° 20′ 30″

$\breve{\infty}$: 1 = 141° 10′ 30″

$\frac{1}{2}\bar{\infty} : \infty\bar{2}$ = 115° 48′

$\breve{\infty} : \infty\bar{2}$ = 104° 16′ 40″

Briethaupt subdivides Wolfram into two species: mangano-wolframit and ferro-wolframit. The first has a reddish-brown streak, with G = 6.98−7.17, and the formula 2 (FeO, WO^3) + 3 (MnO, WO^3). The second exhibits a blackish-brown streak, with stronger metallic lustre, and G = 7.3 – 7.5. Its formula shews: 4 (FeO, WO^3)+MnO, WO^3. Our specimen* is of the first kind. Breithaupt's angles for ∞ : ∞ and ∞̆ : ∞̆, differ considerably from both those of Gustav Rose and Kerndt; and the measurements given above tend to confirm these variations. Descloizeaux also, it must be remembered, obtained still other results, indicating seemingly a monoclinic crystallization. The character of the twin-crystals of Wolfram, however, (as pointedout by Naumann) and its relations to Tantalite (see Dana's Min. 4th edit. ii, 351, for angles), are opposed to this latter view.

Our specimen exhibits the following blowpipe reactions:—*Per se*, it fuses easily, and without intumescence or bubbling, into a dull iron-grey globule, the surface of which is scoriaceous rather than crystalline. The globule is not attractable by the magnet.

It dissolves readily in borax, producing before the OF a dark amethystine glass. Quickly cooled, after exposure to the R F, the glass is yellow. With a sufficient quantity of the assay, the surface of the bead may be enamelled (or rendered milk-white) by the flaming process.

It dissolves also readily in salt of phosphorus. A very small quantity renders the bead opaque, but no effect is produced by flaming.

With carbonate of soda, effervescence takes place, but a very small portion of the assay dissolves, so that no striking manganese reaction is produced. If, however, a minute quantity of borax be added, the greenish-blue enamel is at once obtained. On cooling, the fused mass shoots into crystals.

E. J. C.

CHEMISTRY.

NITRIC ACID.

Cavendish proved that nitrogen can be made to unite directly with oxygen by means of the electric spark, if the two gases be moist, and especially if an alkali be present, when a nitrate is formed. In other words, ozone (modified oxygen) is capable of uniting with nitrogen to form nitric acid. Houzeau shewed that nascent oxygen, from peroxide of barium and sulphuric acid, is capable of oxidizing ammonia, and of separating chlorine and iodine from its combinations behaving exactly like ozone. Cloez has shown that the oxygen and nitrogen of the air can be made to combine by the influence of porous bodies.

S. de Luca has obtained nitrate of potassa by passing moist ozonized air over potassium or potassa for several months. It appeared from some experiments, which require confirmation, that this change takes place more readily during the winter and at night than in summer and in the day time.

PHOSPHORUS.

E. Mitscherlich recommends the following process for the detection of phosphorus in cases of poisoning. The substance to be tested is mixed with sulphuric acid and water and distilled, the vapours are passed through a gas tube into a vertical cooling tube which is kept cold by passing through a vessel of water. If phosphorus be present, its vapours pass over with the water and produce a luminous

* These calculated angles may be of use to the student in the determination of broken or incomplete crystals. They are not given in any work—English, French, or German—within the writer's knowledge.—E. J. C.

appearance (visible in the dark) at the point where they enter the cooled part of the tube. This luminosity may be observed even when the mixture has been exposed to the air for a long time, one part in one hundred thousand of flour can be readily detected. The liquid which condenses contains small globules of phosphorus; one-third of a grain was detected thus in five ounces of material. When much phosphorus is present, phosphorous and phosphoric acids may be detected in the distillate, which is not the case if the acids themselves are subjected to distillation with sulphuric acid.

SILICA.

Ludwig has shown that hydrated silica, precipitated from its solution in potash by chloride of ammonium, obstinately retains traces of ammonia and potash, and is soluble in 10,000 parts of water. Also that by treatment of the silicate of potash with hydrochloric acid in excess, the whole of the alkali cannot be removed, but a portion remains, probably as an acid silicate. This even after calcination is somewhat soluble in water, in the proportion of one part of silica to 25,000 parts of water.

SILICIUM.

Wohler prepares silicium by fusing aluminum with an excess of the double fluoride of silicium and potassium in an ordinary crucible at a heat about that required for the fusion of silver. On breaking there is found in the midst of the fused salt a very brittle ingot of crystalline texture and dark iron colour. This appears to be the compound of silicium and aluminum observed by Deville, containing in this case a very large quantity of silicium in the state of graphite. According to the length of fusion it contains from 75 to 80 of silicium, which is easily obtained by treating the ingot with hydrochloric acid.

Deville has obtained silicium in measurable crystals by passing the vapour of chloride of silicium over aluminum heated to bright redness; the crystals thus formed are treated successively with nitro-hydrochloric acid, boiling hydrochloric acid, and fused bisulphate of soda. When the operation is not complete, siliciuret of aluminum is formed, containing 40 to 50 per cent. of silicium. In this operation the silicium being separated from the chloride is dissolved in the aluminum forming a solution, which when saturated allows the silicium to separate. It appears that boron may be obtained in the same manner, but is very difficult to purify. Carbon, not being soluble in aluminum, cannot be obtained in this way, but if pig iron be employed instead of aluminum the carbon is obtained in a form differing from graphite.

If fluoride of silicium be employed instead of chloride, beautiful crystals of fluoride of aluminum are obtained, having much resemblance to fluor spar. They are not acted upon by sulphuric, hydrofluoric or nitrofluoric acids; the same crystals can be obtained by treating calcined alumina with excess of hydrofluoric acid and heating to whiteness in a tube of platinum in a current of hydrogen.

SALT OF COBALT.

A. Stromeyer finds that the yellow salt obtained by Fisher on mixing a salt of cobalt with nitrite of potash, has not the formula given by St. Evre but the following: $Co^2 O^3, 2NO^3 + 3KO\ NO^3 + 2HO$. Its formation may be employed as a test for cobalt if not more than 300 parts of water be present to 1 part of Co O.

A triple salt is formed when lead is present. Stromeyer forms the nitrite of potash by fusing 101 parts of nitre in an iron pan and adding 208 parts of lead, constantly stirring. A yellow powder is soon formed, and the heat is raised to redness. Dissolve in water, precipitate oxide of lead by carbonic acid or by sulphuret of ammonium, evaporate, fuse, and redissolve.

ANTIMONIAL VERMILION.

Mathieu-Plessy has obtained a sulphide of antimony rivalling vermilion in its colour, by the action of a solution of hyposulphite of soda upon chloride of antimony, aided by heat.

SULPHATE OF SODA.

Marguerite prepares this salt by heating sulphate of lead with chloride of sodium, sulphate of soda and chloride of lead are formed, which latter is evaporated by the heat and condensed in a cooling apparatus. On being triturated and kept suspended in a solution of sulphate of magnesia or other soluble sulphate, it is reconverted into sulphate of lead; this can be effected with very little loss, and the original quantity of sulphate can be made to convert a large amount of the chloride of sodium.

Processes are also described for obtaining caustic soda and its carbonate directly from common salt, and sulpuric acid from sulphate of lime and other sulphates; but the methods do not appear to be very available.

CHEMICAL AFFINITY, ETC.

Calvert has shown that sulphate of baryta is not so insoluble in nitric acid as was supposed, its solubility being affected in a much higher degree by the bulk of the acid than by its strength, and that its non-formation in a mixture is influenced not only by the respective bulks of an acid of specific gravity 1.167, and the respective quality of salts employed, but that the relative quantity of matter put in presence has a decided influence on chemical affinity. These observations are of considerable importance as affecting quantitative determinations of baryta and sulphuric acid.

URANIUM.

Peligot has obtained this metal by acting on the proto-chloride with sodium or aluminum; it resembles nickel or iron in colour, acquires a yellowish tint from partial oxidation, burns brilliantly when heated, forming a black oxide, and possesses the remarkably high specific gravity of 18.4.

SANGUINARINE.

The principle contained in the Sanguinaria Canadensis has been supposed to be identical with Chelerythrine obtained from Chelidonium majus. The identity has been proved by Dr. Shiel.

HŒMATOIDINE.

Hœmatozine, the red colouring matter of the blood globules, is uncrystallizable, but when blood is effused into the tissues of an organism, microscopic crystals are formed in from four to twenty days; these were called Hœmatoidine by Virchow in 1847. (See Lehmann's Chemistry and Funke's supplementary plates, in publications of Cavendish Society.) M. Robin obtained three grammes of this substance in a crystalline form from a cyst of the liver. Its properties were investigated and its composition determined to be the same as Hœmatozine, with the substitution of one equivalent of water for the one equivalent of iron.

PHLORETINE.

Hlasiwetz has resolved this body by the action of potash, into *phloretic acid* and *phloroglucine*, a compound much resembling orcine. (See Chemical Gazette No. 321.)

ACETATE OF MAGNESIA.

Karl von Hauer has prepared this salt in a crystallized form although generally described as amorphous, and gives the formula Mg O, $\overline{\text{Ac}}$+4 H O. The salt loses 32.73 per cent of water after long heating. The formula requires 32.29. [In my note-book I find an (unpublished) analysis of a commercial crystallized acetate of magnesia, made in 1839 in Rammelsberg's laboratory.

The salt consisted of	Acetate of Magnesia	64.77
	Acetate of Potassa	2.65
	Water and loss	32.58
		100.00,

from which I deduced the same formula as Von Hauer. H. C.

NAPHTHALAMINE.

W. H. Perkin has examined the action of chloride of cyanogen upon naphthalamine (naphthalidine,) and has obtained a base analogous to melaniline, and various compounds resulting from the action of cyanogen upon it, similar to those derived from aniline.

NITHIALDINE.

Arppe has obtained a body having the formula $C^{12}H^{8}N^{2}S^{4}O$ by the action of sulphuretted hydrogen upon a solution of nitraniline saturated with ammonia; hyposulphite of ammonia is formed at the same time. Nithialdine does not seem to possess either basic or acid properties.

CAFFEINE.

Puccetti prepares caffeine from the inspissated extract of tea, by adding to the extract 2 oz. of finely powdered pearlash for every pound of tea, the mixture is well stirred, and when effervescence is over, is either dried into cakes, powdered, or is at once treated with alcohol for several days, the alcohol being often renewed; on evaporation a caffeine is obtained which can be readily purified by means of animal charcoal. In this manner he obtained 2.55 per cent. from Congou tea.

ANILIDES.

Arppe has examined the anilides of malic acid; the malanilide is converted by potash into tartanilide.

STIBAMYLE.

F. Berlé has examined the products of the action of potassium-antimony $Sb^{2}K$, upon iodide of amyle. He has prepared Stibtriamyle, Sb, $(C^{10}H^{11})^{3}$, its oxide, chloride, bromide, iodide, with two equivalents of oxygen, &c., and the compounds of nitric and sulphuric acids with the oxide, these bodies containing two equivalents of the acid. Several other compounds have also been obtained, resulting apparently from Stibbiamyle.

TAURINE.

Dr. A. Cloetta has found Inosite, uric acid, taurine, and leucine in the tissue of the lungs; Verdeil's Pulmonic acid seems to have been nothing but taurine.

ACETYLE.

H. Ritter prepares the protochloride of acetyle by acting upon glacial acetic acid with perchloride of phosphorus, the proto-bromide is obtained in the same way; during its formation a quantity of oxy-bromide of phosphorus is generated, which can be separated in a pure state. Gladstone's oxy-bromide was not pure. It is crystalline fuses at 113°F, boils at 383°F, spec. grav.=2,822.

ALCOHOL VAPOURS.

Reinsch has observed that a spiral of copper wire fastened on to the wick of a spirit lamp, remains incandescent for two or three minutes after the flame has been extinguished. If a small piece of coke be placed in the spiral, the incandescence continues, and if the coke be removed the wire still continues to glow having apparently acquired some peculiar property by contact with the coke.

ALLOXANIC ACID.

Staedeler prepares the lime salt by saturating the mother liquor from the preparation of alloxan with chalk, crystals are formed which may be readily separated from the excess of chalk by suspension. It is advisable to use a considerable excess of chalk, and to purify the crystals by solution in boiling water, &c. The acid can be obtained from the lead salt.

METHYLOTETRASULPHURIC ACID.

By the action of fuming sulphuric acid on acetonitryle, Buckton and Hoffmann have obtained sulphacetic acid and a new body to which they have given the above name. Its composition is C^2H^4, 4 SO^3; in the salts H^2 are replaced by M^2.

NEW METALLIC ALLOY.

Mr. François Joseph Auger has invented a new alloy, which is remarkable in its resemblance to gold, not changing colour by use, and being dense, malleable, ductile, homogeneous, and sonorous to a marked degree. The following is his process: In a crucible the patentee first melts 100 parts of good copper, to which, whilst in a state of perfect fusion, he adds 17 parts of zinc, 6 parts of magnesite or substance of a like nature, though possibly differing in name, 3.60 parts of ammonia or salts of ammonia, 1.80 parts of quicklime or other calx, and nine parts of crude tartar. The crucible is covered, and the whole is made to come to a complete state of fusion, when the metal may be be poured into moulds, or made into ingots. According to the ductility or shade of colour which may be desired in the metal, the proportions of the zinc and other added substances are varied. Tin may be substituted for zinc if the metal is sought to be more tenacious in character.

IMPROVED APPARATUS FOR PURIFYING AND CARBONISING GAS.

Mr. S. Rowlands, of Birmingham, has taken out a patent for a new mode of treating gas, consisting of a vessel or chamber, through which gas is made to pass, and brought into contact with a large surface of the liquid to the action of which it is intended to be subjected. In this chamber is a float of cork, or other light material, having a spiral channel, which gives it a slow rotary motion. When it is wished to impregnate coal gas with the vapour of naptha, the vessel is partly filled with the liquid, which is kept in a state of agitation by the rotation of the float as it sinks. Other carbonaceous fluids may be employed with like effect.

H. C.

MATHEMATICS AND NATURAL PHILOSOPHY.

NEW PLANET.

A new planet, of great brilliancy has been recently discovered by M. Chacornac, of the Paris Observatory.

THE COMET OF 1856.

M. Rabinet, an eminent French astronomer, and member of the Academy of Sciences, in an article recently published, has given some interesting details respecting the comet which is expected to make its appearance about the year 1856 :—"This comet is one of the grandest of which historians make mention. It was seen in the years 104, 392, 683, 975, 1264, and the last time in 1556. Astronomers agreed in predicting its return in 1848, but it failed to appear. Already the observatories began to be alarmed for the fate of the beautiful wandering star. Sir John himself had put a crape upon his telescope, when a learned calculator of Middleburg, M. Bomme, reassured the astronomical world of the continued existence of the venerable and magnificent comet. Disquieted, as all other astronomers were, by the non-arrival of the comet at the expected time, M. Bomme, aided by the preparatory labors of Mr. Hind, has revised all the calculations, and estimated all the actions of all the planets upon the comet for three hundred years of revolution,—the result of this patient labor gives the arrival of the comet in August, 1858, with an uncertainty of two years, more or less ; so that from 1856 to 1860 we may expect the great comet which was affirmed to be the cause of the abdication of the Emperor Charles V., in 1556."

COLORS SEEN THROUGH THE STEREOSCOPE.

At a recent meeting of the Manchester Photographic Society, Mr. Dancer read an interesting paper on the stereoscope and its application to photography. A practical discussion followed, in the course of which Mr. Sidebotham drew attention to the results produced by looking at two different colors through the stereoscope. Blue and yellow, he said, produced (to his sight) green ; red and green produced a dirty white ; a blue spot and red bars produced purple bars and white ; and the two colors that seemed most readily to combine were blue and red, producing a bright purple. Blue and yellow did not form a good green in the first instance, and required looking at a short time.—Mr. Dancer said that to some persons' sights different colours combined more easily than to other persons', to whom each colour seemed to predominate alternately ; and the eye, he thought required some education, as it was only by looking steadily that the colours were re-composed and the result seen —In one instance, Mr. Sidebotham stated that bars of different colors produced a check of one colour, the other being entirely lost ; and the solution of this singularity, it was suggested, might be arrived at by throwing the prismatic colors upon paper.

AMERICAN TELESCOPE.

The Telescope recently procured for the Observatory at Ann Arbor, Michigan, is the third in size in the world. The object glass is thirteen inches in diameter Few persons have a correct idea of the time, the toil and the skill requisite to prepare one of these glasses. First, there are the manufactures of the rough disks. A mass of glass weighing about 800 lbs. is melted together. When in a state of perfect fusion, the furnace is walled up, and the whole is left to cool gradually. The cooling process occupies some two months. By this process the glass is annealed.

Afterwards the furnace walls are removed. The entire mass is then fractured, the manner of doing this is a secret with the manufacturers; but it is accomplished in such a way that every piece is homogeneous in refractive power. The pieces are next softened by heat and pressed into moulds, giving disks of different sizes. The telescope-makers purchase these and grind them into the required thickness and lens form. Two separate disks, one of crown, and the other of flint glass, are necessary to form an object glass. One of these is concave, the other convex. It is by the union of the two that the object glass is made achromatic. The grinding is a slow and most difficult process as the utmost exactitude must be attained. First the edge is ground to enable the maker to see whether the glass is clear and without air bubbles. It not unfrequently happens that many disks have to be rejected. When a very superior glass is finished, it is of great value. The twelve-inch of the Cincinnati Observatory alone cost $6,000.—*Chicago Journal.*

CANADIAN INSTITUTE.

SESSION 1855–56.

FOURTH ORDINARY MEETING—*Saturday*, 19*th January*, 1856.

Professor BOVELL, M. D., Vice President, in the Chair.

The following gentlemen were elected Members:

VISCOUNT BURY, Toronto.
ALFRED ROACH, Esq., Toronto.
GEORGE DESBARATS, Esq., Toronto.
CAPT. ALEXANDER CREE MEIK, Toronto.
JOHN SHAW, Esq., Toronto.
JAMES FISKIN, Esq,, Toronto.

Junior Members:

Mr. CLARENCE MOBERLY, Toronto.
Mr. C. W. PATTERSON, Toronto.

On the motion of Professor Wilson, seconded by Sanford Fleming, Esq., it was resolved:

That the Canadian Institute knowing the persevering and valuable efforts which have been made by its first President, W. E. Logan, Esq., to bring the Geological resources of the country prominently forward, and observing with much satisfaction the honorable position in which Canada has been placed in England, and more recently in Paris, in a great measure through his endeavors: it is the opinion of this Institute that some acknowledgment of Mr. Logan's valuable services is richly due to him—and with that view it is resolved that the following gentlemen constitute a Special Committee to report at the next meeting, on the best manner in which the object should be carried out:—Messrs. G. W. Allan, F. W. Cumberland, and S. Fleming.

The donation was announced from the Hon. J. M. Brodhead, Washington, of the "United States Astronomical Expedition," vols. 1 and 2, quarto; and the thanks of the Institute were voted to the Donor.

The following Papers were read:

1. By the Rev. Professor Young, M. A., "Examination of Professor Ferrier's Theory of Knowing and Being."

2. By Professor Hind, M. A., "Communication from Major Lachlan, relative to a simultaneous system of meteorological observations throughout the Province, including a letter on the subject from Professor Henry, Secretary of the Smithsonian Institute."

On the motion of F. W. Cumberland, Esq., seconded by T. Henning, Esq., it was resolved:

That the communication of Major Lachlan be referred to the Editing Committee, with the request that if the same be published in the Journal, it may be accompanied by an explanatory statement of the present position of the subject in Canada, and the action hitherto taken in the matter by this Institute.

FIFTH ORDINARY MEETING—26*th January*, 1856.

G. W. ALLAN, Esq., President, in the Chair.

The following Gentlemen were elected Members:

GEORGE RYEBURN, Esq., Toronto.

F. W. JARVIS, Esq., Toronto.

I. F. TAYLOR, Jun., Esq., Toronto.

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

1. From George W. Moneypenny, Esq., Commissioner of Indian Affairs, U. S. per the Hon. J. M. Broadhead, of Washington:

"Schoolcraft's History of the Indians in the United States." Part 5th.

2. From the Rev. A. C. Geikie, of Toronto:

"Grammaire Raisonnée de la Langue Russe," by Ch. Ph. Reiff, St. Petersburg; 1828–29. 2 vols.

The President intimated that the Special Committee appointed to consider the most proper measures to be taken in acknowledgment of the public services of W. E. Logan, Esq., had the subject still under consideration, and would report to the Institute at its next meeting.

George William Allan, Esq., President, then read the Annual Address.

On the motion of the Rev. Thomas Schreiber, seconded by Oliver Mowat, Esq. Q. C., the thanks of the Institute were voted to the President for his Address, and ordered to be entered on the minutes.

Dr. Wilson presented the Report of the Committee to which was referred the Communication of Major Lachlan on the subject of a system of Meteorological Observations throughout the Province.

The Report having been read and adopted, was ordered to be printed in the Journal, along with Major Lachlan's communication.

The following Papers were then read:

1. By J. G. Hodgins, Esq., Deputy Superintendent of Schools:

"Memorandum on the steps which have been taken by the Educational Department to establish a system of Meteorological Stations throughout Upper Canada."

Resolved, That Mr. HODGINS' communication be printed along with the other papers relative to Meteorological Observations in Canada, and that it be accompanied by a reduced copy of an illustrative map exhibited by Mr. Hodgins.

2. By W. D. C. CAMPBELL, Esq., of Quebec.

"On a Method of Determining the Errors below 32° Ft. of Mercurial Thermometers which have been compared and corrected above the freezing point."

Ordered, That the thanks of the Institute be conveyed to Mr. Campbell for his communication.

3. By Professor Wilson, LL.D.:

"On the Traces of the Ancient Miners of Lake Superior."

SIXTH ORDINARY MEETING—*February 2d*, 1856.

G. W. Allan, Esq., President, in the Chair.

The following Gentlemen were elected Members:

W. R. Ross, Esq., Toronto.
J. R. Williams, Esq., Bond Head.
R. H. Brett, Esq., Toronto.
A. J. Pell, Esq., Toronto.
R. J. Griffith, Esq., Toronto.
R. S. Woods, Esq., Chatham.
John Glass, Esq., Toronto.
Hon. J. A. Macdonald, Toronto.

The donation from John Fisk Allen, Esq., of Salem, Mass., was announced, of his illustrated account of the *Victoria Regia*, or Great Water Lily of America.

Ordered, That the thanks of the Institute be conveyed to the donor for his valuable gift.

The President, on behalf of the Special Committee appointed with a view to some fitting recognition of the services rendered to Canada by W. E. Logan, Esq., the First President of the Canadian Institute, reported as follows:

REPORT.

The Special Committee appointed to consider the best means to be adopted to mark the sense the Institute entertain of the very valuable services rendered to Canada by W. E. Logan, Esq., both in his capacity of Provincial Geologist, and as Commissioner to the great Exhibitions of London and Paris, beg respectfully to recommend:

That immediately upon Mr. Logan's arrival in Canada, a communication be addressed to him by the Secretary on behalf of the Institute, requesting that he would be pleased to sit for his portrait, to be painted at the expense of the Institute, and hung up thereafter in their Hall: That as soon as possible after Mr. Logan's arrival in Toronto, a special general meeting should be convened, at which that gentleman should be invited to attend, to receive an address to be presented to him by the Institute, expressing the high sense they entertain of the services rendered by Mr. Logan to the cause of science generally, and more especially acknowledging the very great obligations all Canadians are under to him, for having by his untiring energy and perseverance in the discharge of his duties, as one of the Commissioners to the great Exhibitions of 1851 and 1855, contributed to make the mineral resources of Canada most widely and favorably known, both in England and on the Continent.

The Report was adopted, and remitted to the Council to carry out the recommendations contained therein, so soon as Mr. Logan shall arrive in Canada.

Mr. Pell intimated, in furtherance of the same object, that he would be happy to present to the Institute a frame for the contemplated portrait of its former President, so soon as it shall be completed.

The following Papers were then read:

1. By James Browne, Esq.

"Experiences in Australia; forming the first part of a series of Papers on the Aborigines of Australia."

2. By Professor Kingston, M. A.:

"Mean Meteorological results of Toronto for 1855."

MONTHLY METEOROLOGICAL REGISTER, AT THE PROVINCIAL MAGNETIC OBSERVATORY, TORONTO, CANADA WEST—FEBRUARY. 1856.

Latitude. 43 deg. 39·4 m'n. North. Longitude, 79 deg. 21 min. West. Elevation above Lake Ontario, 108 feet.

Day.	Barom. at temp. of 32°.				Temp. of the Air.				Mean Temp. +or— of the Av'age.	Tens. of Vapour.				Humidity of Air.				Direction of Wind.			Mean Direction	Velocity of Wind.				Rain in Inches.	Snow in Inches.
	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M	2 P.M	10PM	ME'N		6 A. M	2 P. M	10 P. M	M'N	6 A. M	2 P. M	10 P. M	M'N	6 A. M.	2 P. M.	10 P. M.		6 A.M	2 P.M	10PM	ME'N		
					°	°	°	°	°												°						
1	29.256	29.069	29·202	29·1710	20·0	28.4	15.8	21.50	— 2.38	0.097	0.136	0.073	0.104	.87	.87	.78	.84	Calm	S W b W	W b N	W 16 S	0.0	16.5	12.8	14.12	...	0.4
2	.309	.325	·397	.3562	5·6	7.6	—8.6	2.76	—21.15	·047	.049	.036	.042	.78	.74	.90	.77	W	W b S	W b S	W 2 N	12.2	22.0	9.5	15.17	...	...
3	.451	.430	—	—	·5.7	9.0	—	—	—	·027	.040	—	—	.72	.57	—	—	W	W	W b S	W 5 S	12.4	14.0	8.0	12.59	...	...
4	.469	.474	·569	·5148	4·9	11.5	7.5	8.20	—15.48	·045	.037	.054	.046	.75	.47	.81	.69	W b S	W b S	W S W	W 11 S	20.0	22.2	14.0	18.41	...	...
5	.703	.842	30.022	.8798	9.3	15.1	2.9	9.27	—14.72	·055	.062	.014	.054	.78	.67	.82	.76	W b S	W S W	W b S	W 17 S	25.8	16.6	6.3	13.08	...	...
6	30.086	.937	29·819	.9293	—0.4	13.6	13.3	9.85	—13.67	·037	.056	.070	.057	.81	.66	.82	.76	W	W b S	N E	W 36 S	5.7	7.5	2.7	7.01	...	1.6
7	29.452	·367	.518	.4702	24.8	30.0	22.6	25.23	+ 1.80	·127	.132	·104	.119	.93	.79	.84	.85	S S E	W b S	W b S	W 23 N	9.8	15.0	13.0	11.00	...	0.3
8	.677	·636	.545	.6103	4.7	11.1	7.7	6.73	—16.63	·016	.059	·018	.047	.79	.78	.72	.74	N	Calm	N N W	N 25 W	9.8	0.0	6.4	5.91	...	...
9	.545	·541	·643	.5840	2.2	18.0	8.6	9.80	—13.47	·036	.066	·058	.054	.69	·65	.83	.73	W N W	W b S	W b N	W 2 S	8.5	16.8	3.8	7.08	...	Inp
10	.631	.530	—	—	9.3	28.5	—	—	—	·035	.111	—	—	.50	·71	—	—	W	S W	S W b W	W 34 S	7.0	11.7	5.0	9.53	...	...
11	.450	.181	28.934	·1747	28·0	33.0	26.9	28.90	+ 5.63	·136	.169	.139	.145	.87	·90	.94	.90	W S W	E	N N W	N 43 W	3.8	3.5	15.8	11.64	...	5.0
12	.049	.299	29.574	·3120	9.0	2.5	—6.1	0.10	—23.15	·054	.031	.019	.032	.76	·57	.55	.62	N W b W	W N W	N W b N	W 25 N	28.2	32.0	5.0	18.59	...	...
13	.779	.830	·86	.8318	—18·7	2.3	—5.0	6.88	—30.13	·018	.032	·032	.027	.90	.61	.86	.77	W N W	W S W	W b N	W 2 N	4.0	7.0	5.6	6.47	...	...
14	.816	·673	.537	.6643	—8.2	10.1	2.2	1.65	—21.62	.022	.038	.041	.035	.67	.51	.80	.66	W N W	W S W	W	W 15 S	5.6	8.9	7.0	10.46	..	...
15	.573	.098	28.972	·1290	10.1	20.2	21.1	19.00	— 4.25	.063	.090	·113	.091	.85	.80	.84	.83	S W b W	S W b W	S W b W	W 44 S	14.5	16.8	7.8	13.83	...	0.3
16	28.849	28.778	29.031	28.8972	26.2	30.6	12.2	21.17	— 2.20	.127	.156	.059	.099	.87	.91	.73	.82	S W b W	S W b S	W N W	W 38 N	12.0	0.2	12.5	15.37	...	2.0
17	29.188	29.279	—	—	7.9	11.1	—	—	—	.045	.048	—	—	.66	.62	—	—	W N W	W N W	N W	W 25 N	19.2	22.2	2.8	14.37	..	0.1
18	.469	·593	.741	29·5998	0.7	6.3	3.4	3.80	—19.63	.035	.028	.045	.038	.73	.44	.80	.68	N W b N	N W	W b S	W 40 N	16.3	23.6	5.5	15.67	...	...
19	.844	.765	.588	.7207	5.7	23.1	19.4	16.32	— 7.22	.046	.077	·076	.069	.76	.60	.70	.70	N W	S W b S	S W b W	W 22 S	25.0	10.8	13.5	13.95	...	...
20	.431	·369	·433	·4142	24.1	34.8	31.6	29.87	+ 6·25	.115	.153	·154	.134	.85	.75	.87	.80	S W b W	W N W	W S W	W 2 N	16.7	17.8	8.2	12.40	...	...
21	.423	·380	.395	.3998	19.8	32.3	26.6	25.22	+ 1.48	.094	.124	·123	.110	.94	.68	.83	.78	W	S b W	S W b W	W 7 S	7.2	8.6	4.8	5.16	...	...
22	.402	.383	.324	.3687	13.7	34.5	28.0	25.33	+ 1.52	.071	.150	.128	.116	.81	.74	.83	.81	W N W	S W b S	N E	S 33 W	4.6	4.2	2.0	3.21	...	
23	.467	·122	.354	.2217	24.8	36.3	21.9	27.08	+ 3·32	.116	.151	·078	.110	.85	.71	.65	.73	N W b W	N W b N	N W b W	N 42 W	6.1	16.6	15.4	14.23	...	
24	.471	·447	—	—	14.4	27.1	—	—	—	.070	.098	—	—	.78	.66	—	—	W b N	W b N	N W	W 26 N	5.2	18.5	2.6	7.80	...	..
25	.356	.291	.439	.3715	14.8	27.6	16.3	19.30	— 5.03	.080	.192	.073	.082	.89	.67	.76	.75	W S W	S S W	W b N	W 20 N	0.5	6.2	5.6	6.17	...	...
26	.548	.560	.602	.5[illegible]25	6.2	26.9	20.8	18.65	— 5.88	.052	.087	·083	.077	.83	.59	.72	.72	N W b W	S b W	N b E	N 31 W	3.6	5.8	10.0	6.28	...	...
27	.614	·502	·567	.5635	15.8	28.7	17.2	21.05	— 3.67	.071	.123	·081	.089	.76	.77	.81	.75	N N E	E N E	N N E	N 42 E	9.2	18.2	6.0	19.81	...	...
28	.651	.642	.672	.6570	14.1	29.2	25.1	22.60	— 2·30	.077	.114	.111	.097	.87	.70	.81	.76	N	E b S	W N W	N 3 E	10.6	3.0	3.2	4.97	...	...
29	·722	·760	·826	·7723	20.0	31.8	26.6	25.87	+ 0.85	.092	.134	·129	.114	.82	.75	.88	.80	W	S W b S	N	W 33 N	2.2	6.6	4.0	5.37	...	...
M	29.4948	29.4567	29.5027	29·4883	11.10	21.82	14.65	15.69	— 7·98	0.070	0.094	0.079	0.080	.81	.69	.80	.76	W 11° N	W 4° S	W 17° N	W 9 N	10.54	12.87	7.54	10.71	none	9.7

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR FEBRUARY.

Highest Barometer .... 30.086 at 6 a. m. on 6th } Monthly range=
Lowest Barometer .... 28.778 at 2 p. m. on 16th } 1.308 inches.

Highest registered temperature .... 37°8 at p. m. on 21st } Monthly range=
Lowest registered temperature .... −18°7 at a. m. on 13th } 56°5

Mean maximum Thermometer .... 24°22 } Mean daily range = 20°65
Mean minimum Thermometer .... 3°57 }

Greatest daily range .... 28°7 from a. m. of 12th to a. m. of 13th,
Least daily range .... 9°0 from a. m. of 4th to a. m. of 5th,

Warmest day .... 20th ... Mean temperature .... 29°87 } Difference = 36°75.
Coldest day .... 13th .. Mean temperature .... −6°88 }

Greatest intensity of Solar Radiation.. ... 58°5 on p. m. of 21st } Monthly range=
Lowest point of Terrestrial Radiation .. −27°8 on a. m. of 13th } 86°3

Aurora observed on five nights, viz., on the 13th, 16th, 20th, 23rd, and 25th; possible to see aurora on 29 nights; impossible to see aurora on 9 nights.

No rain recorded this month.
Snowing on 8 days, depth 9.7 inches—snowing 50.6 hours.
Mean of cloudiness 0.55; most cloudy hour observed, 4 p. m., mean=0.64; least cloudy hour observed, 10 p. m., mean=0.39.

No thunder or lightning recorded this month.

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

North.	West.	South.	East.
2129.57	5306.28	1294.14	307.35

Mean direction of the wind, W 9° N.
Mean velocity of the wind ... ... 10.71 miles per hour.
Maximum velocity .... 32.6 miles per hour, from 7 to 8 p. m. on 16th.
Most windy day ... . 12th...Mean velocity 18.59 miles per hour.
Least windy day... ... . 22nd...Mean velocity 3.21 ditto.
Most windy hour .... 1 to 2 p. m....Mean velocity 13.42 ditto.
Least windy hour ...... 10 to 11 p. m....Mean velocity 7.81 ditto.
Mean diurnal variation ... 5.61 miles.

Halos observed—Round the Moon at 10 p. m. on 12th; Sun, 2 to 4 p. m. on 19th (perfect); Sun, 2 to 4 p. m. on 22nd (perfect); Moon, 10 p. m. to midnight on 22nd (perfect); Sun, 11 a. m. to 3 p. m. on 29th, (very perfect,) diam. about 42°.

Zodiacal Light very bright on the evenings of the 5th, 22nd, 24th, 26th and 27th.

TEMPERATURE.—The mean temperature of February was 6°95 below the average of the last 17 years, and it is the lowest recorded during that period, excepting those of February 1843, and February 1855. This month shews also the lowest maximum temperature and the lowest minimum but one during the same period. The column of daily means exhibits several remarkable changes.

SNOW.—The fall of snow during the month was 8 inches below the average of 14 years, and the least that has occurred during that period, excepting in Feb. 1851, when, as a compensation, the fall of rain was more than double its average amount.

RAIN.—No rain fell in Feb.; nor has there been any rain since 15th Dec. The only two examples of a total absence of rain in Feb. occurred in Feb. 1841, and Feb. 1846: but in each of these cases there had been an unusual amount of rain in the preceding month.

WIND.—The mean velocity of the wind exceeded the average by 3.34 miles, and is the greatest yet recorded in February by 2.54 miles.

COMPARATIVE TABLE FOR FEBRUARY.

YEAR.	TEMPERATURE.					RAIN.		SNOW.		WIND.	
	Mean.	Diff. from Aver.	Max. obs'd.	Min. obs'd.	Range.	Days.	Inch's.	Days.	Inch's.	Mean Direc'n.	Mean Force or Velocity.
1840	23.0°	+5.35°	49.1°	− 8.3°	57.4°	8	1.475	6	...	...	...
1841	22.4	−0.25	43.4	− 0.3	43.7	1	0.666	9	...	...	0.61 lbs.
1842	26.9	+4.25	48.7	+ 2.5	46.2	8	2.625	9	...	...	1.63 "
1843	14.5	−8.15	37.5	−10.2	47.7	1	0.475	21	14.4	...	1.05 "
1844	26.0	+3.35	47.1	− 0.4	47.5	4	0.430	7	10.0	...	0.43 "
1845	26.0	+3.35	46.6	− 3.9	50.5	5	Inap't	9	19.0	...	0.99 "
1846	20.4	−2.25	41.4	−16.2	57.6	0	0.000	13	46.1	...	0.65 "
1847	21.5	−1.15	42.2	− 1.0	43.2	2	0.550	13	27.3	...	0.69 "
1848	26.6	+3.95	46.9	− 0.6	47.5	4	0.775	8	10.8	W 25° N	5.69 miles.
1849	19.5	−3.15	41.1	− 9.2	50.3	2	0.240	13	19.2	N 41° W	6.58 "
1850	26.0	+3.35	49.2	+ 1.3	47.9	7	1.235	9	23.1	W 10° N	7.61 "
1851	27.6	+4.95	50.2	+ 1.3	48.9	7	2.600	4	2.4	W 25° N	6.94 "
1852	23.4	+0.75	41.2	− 3.2	44.4	3	0.650	11	13.0	W 15° S	6.42 "
1853	24.1	+1.45	43.4	− 0.6	44.0	4	1.030	15	12.6	W 41° N	7.29 "
1854	21.1	−1.55	42.7	− 5.7	48.4	5	1.460	15	18.0	N 7° E	6.91 "
1855	15.4	−7.25	37.3	−25.0	62.3	2	1.770	14	21.8	N 37° W	8.17 "
1856	15.7	−6.95	35.3	−18.7	54.0	0	0.000	8	9.7	W 9° N	10.71 "
Mean	22.65	...	43.72	−5.78	49.50	3.7	1.020	10.8	17.7	...	0.78 lbs. 7.37 miles

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

Latitude—43 deg. 39.4 min. North. Longitude—79 deg. 21 min. West. Elevation above Lake Ontario, 108 feet.

Day.	Barom. at temp. of 32°.				Temp. of the Air.				Mean Temp. +or− of the Av'age.	Tension of Vap.				Humidity of Air.				Direction of Wind.			Mean Direction.	Velocity of Wind.				Rain in Inches.	Snow in Inches.
	6 A. M	2 P. M.	10 P.M.	MEAN	6 A.M	2 P.M	10 PM	ME'N		6 A.M	2 P.M	10 P.M	M'N	6 A.M	2 P.M	10 P.M	M'N	6 A.M.	2 P.M.	10 P.M.		6 A.M	2 P.M	10 PM	ME'N		
1	29.826	29.660	29.328	29.5907	° 22.3	° 27.5	° 23.3	° 24.15	° − 1.07	.110	.126	.117	113.	.88	.83	.91	.84	Calm.	E b N	E N E	° E 24 N	0.0	15.6	22.0	15.06	...	4.5
	28.828	29.007	—	—	21.5	27.9	—	—	—	.095	.117	—	—	.79	.76	—	—	N b E	W b N	W b S	W 14 N	19.2	20.0	12.8	15.78	...	0.3
3	29.471	.610	.694	.6088	14.2	25.5	19.8	19.57	− 6.15	.071	.107	.077	.081	.80	.76	.70	.73	W b S	W b S	SW b W	W 21 S	10.8	16.5	6.4	11.01	...	3.4
4	.410	.236	.563	.4140	23.7	27.8	23.0	24.72	− 1.28	.125	.085	.110	.111	.96	.55	.85	.82	S E b E	W	W	W 8 S	14.7	41.6	22.2	20.88	...	0.4
5	.642	.489	.317	.4602	13.4	27.1	24.6	22.22	− 3.98	.076	.091	.116	.090	.88	.61	.86	.73	W b S	S W	S W	W 34 S	10.2	16.8	14.0	13.02	...	0.2
6	.218	.378	.629	.4253	20.0	23.0	9.4	16.40	− 10.10	.092	.081	.047	.071	.82	.64	.66	.72	W N W	N W	W	W 26 N	16.7	23.0	7.8	15.36	...	...
7	.620	.332	.385	.4457	2.7	23.3	19.4	15.02	− 11.80	.040	.089	.092	.076	.76	.69	.84	.79	Calm.	S S W	W N W	W 20 S	0.0	23.6	9.8	14.24	...	1.9
8	.566	.680	.793	.6937	1.3	8.3	−5.0	1.03	− 26.20	.037	.041	.026	.035	.74	.60	.69	.69	W N W	W N W	W N W	W 23 N	8.6	19.8	5.0	14.33	...	...
9	.812	.759	—	—	−13.6	6.8	—	—	—	.025	.051	—	—	.98	.79	—	—	W N W	SW b W	N W b W	W 31 N	11.4	4.0	11.8	8.71	...	...
10	.727	.639	.541	.6275	−12.2	12.6	15.4	6.55	− 21.27	.025	.052	.080	.052	.89	.64	.87	.78	W N W	W S W	W S W	W 18 S	13.3	21.4	19.8	19.15	...	...
11	.422	.340	.350	.3617	11.7	20.1	11.1	14.40	− 13.83	.065	.063	.048	.058	.80	.56	.63	.65	W b S	W b N	W b S	W 6 N	19.8	27.8	5.5	18.52	...	...
12	.373	.425	.554	.4627	9.5	23.7	19.4	18.28	− 10.27	.059	.089	.069	.071	.82	.68	.64	.69	W	N W b W	W N W	W 21 N	10.8	21.4	3.2	12.19	...	...
13	.693	.704	.758	.7237	15.8	27.6	20.8	21.90	− 7.00	.071	.087	.096	.085	.76	.57	.83	.71	N b W	W b N	N N W	N 34 W	5.8	5.3	8.5	7.83	...	...
14	.787	.742	.656	.7212	15.8	30.3	30.7	26.00	− 3.22	.067	.109	.124	.102	.72	.65	.72	.70	N W b N	S S W	S W b W	W 33 S	7.0	7.8	10.8	8.61	...	0.2
15	.672	.728	.739	.7177	24.8	32.7	28.4	28.77	− 0.95	.108	.151	.111	.120	.79	.81	.71	.75	W b S	W b S	S W b W	W 10 S	12.2	18.2	4.4	8.88	...	...
16	.674	.629	—	—	21.9	34.0	—	—	—	.097	.139	—	—	.80	.71	—	—	Calm.	W b N	W b N	W 8 N	0.0	13.2	1.6	5.66	...	...
17	.758	.781	.828	.7968	22.6	38.9	29.1	30.65	+ 0.20	.114	.108	.117	.115	.91	.45	.73	.68	S W b W	W b S	W	W 4 S	1.5	9.2	1.2	5.36	...	...
18	.879	.803	.658	.7687	16.2	35.5	29.6	28.55	− 2.30	.079	.131	.127	.118	.82	.63	.77	.74	N N W	E b S	N E	E 26 N	0.4	2.7	4.0	3.63	...	...
19	.496	.364	.408	.4150	31.2	33.4	30.5	31.60	+ 0.33	.160	.169	.148	.152	.92	.89	.88	.86	E b N	S	W	N 26 E	8.4	6.2	0.8	4.19	...	Inp
20	.413	.349	.386	.3820	25.5	36.8	25.5	29.82	− 1.85	.119	.148	.091	.126	.85	.68	.64	.75	N b E	S	N W b N	W 21 S	5.5	2.2	2.8	2.83	...	...
21	.389	.414	—	—	25.5	39.5	—	—	—	.120	.171	—	—	.85	.71	—	—	N W	S W b S	N N E	N 19 W	2.0	4.7	6.2	5.36	...	...
22	.500	.522	.537	.5248	28.4	38.2	29.1	31.90	− 0.58	.131	.110	.136	.128	.83	.48	.84	.72	N b W	S b W	N W b W	W 32 N	8.2	4.0	6.2	4.48	...	...
23	.542	.492	—	—	18.7	36.0	—	—	—	.087	.142	—	—	.82	.67	—	—	N W b W	S b E	S S E	S 15 E	5.5	7.0	9.4	5.48	...	1.0
24	.187	.196	.370	.2520	33.4	35.0	35.0	34.35	+ 1.18	.171	.182	.172	.174	.90	.90	.85	.88	E b S	N N E	N N W	N 20 W	4.2	7.3	13.2	10.79	Inap	3.6
25	.470	.542	.579	.5417	29.4	39.3	30.2	33.18	− 0.38	.140	.156	.145	.146	.85	.66	.86	.77	N W	W N W	W b N	W 32 N	16.6	14.5	12.5	11.79	...	...
26	.527	.445	.438	.4658	28.7	37.4	25.7	30.50	− 3.48	.137	.138	.119	.132	.87	.62	.84	.78	W b N	W N W	W b N	W 19 N	9.6	19.0	10.8	15.90	...	...
27	.380	.376	.402	.3922	23.7	28.0	21.9	23.88	− 10.53	.105	.077	.085	.086	.80	.49	.70	.66	N W b W	N N W	N N W	N 35 W	17.2	20.5	27.1	21.95	...	0.5
28	.446	.477	.571	.5073	15.8	21.0	24.1	20.50	− 14.22	.078	.083	.115	.091	.83	.71	.86	.79	N W b N	N W b N	W N W	W 41 N	17.0	23.2	15.1	18.53	...	0.2
29	.633	.608	.728	.6603	15.4	30.6	19.2	21.68	− 13.42	.061	.080	.077	.072	.65	.46	.71	.60	W	W N W	W N W	W 27 N	9.6	21.2	11.0	15.91	...	...
30	.746	.731	—	—	13.6	28.4	—	—	—	.066	.117	—	—	.78	.74	—	—	N W b N	N	N W b N	N 28 W	12.1	11.2	7.5	12.12	...	...
31	.938	30.030	30.049	30.0220	11.0	28.7	22.0	20.90	− 15.02	.049	.073	.102	.075	.64	.46	.84	.64	N b W	W N W	W N W	N 35 W	6.1	3.0	5.5	5.63	...	...
M	29.5622	29.5382	29.5704	29.5592	17.77	28.49	22.49	23.06	− 7.32	.092	.105	.102	.099	.82	.64	.78	.74	W 38 N	W 9 N	W 24 N	W 19 N	9.17	14.56	9.64	11.39	Inap	16.2

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR MARCH.

Highest Barometer .... 30.082 at midnight, on 31st } Monthly range=
Lowest Barometer .... 28.828 at 6 a. m., on 2nd } 1.254 inches.

Highest registered temperature......... +41°4 at p. m., on 25th } Monthly range=
Lowest registered temperature .... −14°0 at a. m., on 9th } 55°4

Mean maximum Thermometer......... 30°47 } Mean daily range = 17°60
Mean minimum Thermometer......... 12°87 }

Greatest daily range .... 32°4 from a. m. to p. m. of 10th.
Least daily range................................ 8°0 from p. m. of 24th to a. m. of 25th.

Warmest day......... 24th ... Mean temperature......... 34°35 } Difference = 33°32.
Coldest day............ 8th ... Mean temperature......... 1°03 }

Greatest intensity of Solar Radiation ... +69°4 on p. m. of 21st } Monthly range=
Lowest point of Terrestrial Radiation ... −22°0 on a. m. of 9th } 91°4

Aurora observed on 7 nights, viz.: 2nd. 3rd, 5th, 6th, 18th, 30th and 31st; possible to see aurora on 20 nights; impossible to see aurora on 11 nights.

Snowing on 12 days, depth 16.2 inches—snowing 75.5 hours. No rain recorded this month at Observatory.

Mean of cloudiness =0.52; most cloudy hour observed, 4 p m., =0.56; least cloudy hour observed, 10 p. m., =0.47.
No Thunder or Lightning recorded this month.

Y

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

North.	West.	South.	East.
3031.09	5984.00	1128.32	596.55

Mean direction of the wind, W 19° N.

Mean velocity of the wind .... 11.39 miles per hour.

Maximum velocity .... 41 6 miles per hour, from 1.30 to 2.30 p. m., on 4th

Most windy day.........................27th...Mean velocity 21.95 miles per hour.

Least windy day ....20th...Mean velocity 2.83 ditto.

Most windy hour .... 2 to 3 p. m....Mean velocity 14.55 ditto.

Least windy hour......... 5 to 6 a. m....Mean velocity 8.74 ditto.

Mean diurnal variation = 5.81 miles

Halo round the moon 13th at 10 p. m.; 18th at 7 p. m. to 1 a. m.. very perfect; 20th, at midnight.

Halo's round the sun 23rd at 2 p. m.

Zodiacal light very bright on 30th, 8 to 9 p. m.

TEMPERATURE.—The low mean temperatures of February and March, 1856, not compensated as in 1843 by a mild January, but preceded by the coldest January on record, combine to render the three first months of the present year extremely cold. The minimum—13.6 is an example of depression quite unprecedented in March.

BAROMETER.—A remarkable descent is to be noticed from 6 a. m. on the 1st to 6 a.m. on the 2nd.

RAIN.—With the exception of a drizzle too slight for measurement, no rain has fallen since 15th December, (107 days.)

WIND.—The most windy March on record.

COMPARATIVE TABLE FOR MARCH.

YEAR	TEMPERATURE.					RAIN.		SNOW.		WIND.	
	Mean.	Diff. from Aver.	Max. obs'd	Min. obs'd.	Range.	Days.	Inch's.	Days.	Inch's.	Mean Direc'n.	Mean Force or Velocity.
1840	33.3°	+3.4°	56.9°	8.7°	48.2°	8	1.640	8	...	...	...
1841	27.7	−2.2	53.5	−6.9	60.4	5	1.170	7	...	...	0.51 lbs.
1842	35.8	+5.9	68.7	14.9	53.8	4	3.150	8	...	...	0.70 "
1843	21.3	−8.6	38.6	−2.8	41.4	2	0.625	18	25.7	...	1.18 "
1844	31.3	+1.4	50.3	9.6	40.7	8	2.470	8	14.0	...	0.57 "
1845	35.4	+5.5	61.7	9.9	51.8	5	Imp't	8	2.8	...	0.66 "
1846	33.1	+3.2	49.3	7.6	41.7	9	1.965	5	2.3	...	0.30 "
1847	26.2	−3.7	44.3	4.8	39.5	5	0.850	6	4.2	...	0.71 "
1848	28.6	−1.3	58.9	0.9	58.0	5	1.220	6	9.7	W 13 N	5.80 miles.
1849	33.5	+3.6	53.4	15.4	38.0	7	1.525	2	2.3	N 3° W	5.37 "
1850	29.8	−0.1	46.0	6.0	40.0	2	0.745	7	11.2	W 38° N	7.62 "
1851	32.4	+2.5	58.7	13.1	45.6	3	0.770	9	8.8	N 21° W	7.65 "
1852	27.7	−2.2	44.8	−3.2	48.0	8	3.080	12	19.5	N 9° W	5.81 "
1853	30.6	+0.7	56.3	−0.1	56.4	6	1.080	8	7.1	W 28° N	5.87 "
1854	30.7	+0.8	52.8	10.4	42.4	9	2.425	3	2.8	W 40° N	8.02 "
1855	28.5	−1.4	48.6	−2.9	51.5	5	1.485	11	18.1	W 16° N	9.95 "
1856	23.1	−6.8	39.3	−13.6	52.9	0	0.000	12	16.2	W 19° N	11.39 "
Mean	29.94	...	51.89	4.22	47.66	5.3	1.512	8.1	10.3	...	7.50 miles.

MONTHLY METEOROLOGICAL REGISTER, ST. MARTIN, ISLE JESUS, CANADA EAST—MARCH, 1855.

(NINE MILES WEST OF MONTREAL.)

BY CHARLES SMALLWOOD, M. D.

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

Day.	Barom. corrected and reduced to 32° Fahr.			Temp. of the Air.			Tension of Vapor.			Humidity of Air.			Direction of Wind.			Mean direction of Wind.	Velocity in miles per hour.			Rain in Inches.	Snow in Inches.	WEATHER, &c. A cloudy sky is represented by 10; A cloudless sky by 0.		
	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.		6 A.M.	2 P.M.	10 P.M.			6 A.M.	2 P.M.	10 P.M.
1	30.051	29.914	29.888	12.6	34.2	3.8	.038	.190	.050	.87	.85	.86	E N E	E N E	E N E	E 22 N	2.11	0.81	Calm	...	...	Str 10.	Str. 10.	Str. 10
2	29.326	.065	.154	9.0	16.2	10.4	067	098	082	90	87	88	N E by E	N E by E	s w	N 34 E	17.00	23.47	5.41	...	3.15	Snow.	Snow.	Str. 4. [Light-
3	.494	.408	.866	8.1	21.0	3.6	065	086	049	89	64	85	w	w by s	w s w	w 10 s	9.88	21.70	10.81	...	...	Str. 4.	Clear.	Clr., Au.Bo.Zod.
4	.911	.496	.360	-6.0	21.7	21.0	029	125	098	82	88	80	S E by E	S E by s	w s w	w 35 s	1.63	6.04	22.20	...	1.34	Do. 4.	Snow.	Str. 2, ft. Au.Br.
5	.710	.647	.625	14.0	28.0	17.5	086	129	100	82	74	84	w	s w by s	s s w	w 34 s	13.56	17.61	3.96	...	..	Clear.	Cum. Str. 8.	Snow.
6	.353	.329	.514	17.0	28.4	16.8	094	144	098	84	82	88	S E by E	N W b w	N W b w	s 9 E	5.42	4.15	3.82	..	2.00	Snow.	Cir. Str. 6.	Str. 4, Aur. Bor.
7	.750	.701	.681	-3.8	26.5	13.0	033	119	088	83	76	87	w s w	s w	s s E	s 40 w	8.65	4.51	3.30	.	Inp	Clear.	Clear.	Slight snow.
8	.469	.516	.742	10.7	14.8	-2.9	032	039	036	88	81	84	w by s	w by N	w N w	w 12 s	3.08	15.67	25.67	...	...	Cum. Str. 6.	Cum Str. 4.	Clear, Aur. Bor.
9	.843	.790	.846	10.0	10.1	-4.7	023	035	034	77	68	89	w s w	w s w	w s w	w 17 s	13.64	14.62	12.06	...	...	Clear.	Clear.	Do. [Zod. Light.
10	.804	.631	.610	16.3	9.0	3.0	081	063	048	82	73	84	s w	s w	s w	w 44 s	3.40	11.50	1.20	...	...	Do.	Do.	Str. 4, Lun. Ha.
11	.530	.264	.882	12.0	18.3	2.5	080	106	046	83	87	84	w s w	w	N W b N	w 30 s	7.00	12.06	20.81	..	1.00	Snow.	Snow.	Cum. 4.
12	.426	.405	.577	-5.0	13.0	3.4	031	068	054	82	67	89	w s w	w by N	w by s	w 8 s	8.96	19.23	9.00	..	...	Clear.	Cir. Cm. Str. 4	Cum. Str. 4.
13	.766	.738	.856	-1.0	27.8	21.3	043	144	111	90	82	83	w by N	w s w	w N w	w 10 s	4.41	0.82	6.31	..	..	Do.	Str. 8.	Do. 10.
14	.908	.781	.817	19.5	38.4	22.7	101	214	120	87	84	82	w	s w by w	s w by w	w 8 s	0.09	5.69	8.32		...	Cir. Str. 10	Clear.	Str. 4.
15	.738	.714	.809	20.7	32.2	25.0	118	191	135	88	90	86	s w	w	w N w	w 25 s	5.08	5.62	13.30	..	Inp	Slight snow.	Cir. Cm. Str. 8.	Cum. Str. 8.
16	.783	.670	.754	23.0	38.7	26.7	112	226	128	77	90	76	w s w	w s w	s w by w	w 12 s	14.00	3.80	2.87	.	..	Str. 10.	Cum. Str. 10.	Do. 10.
17	.725	.807	.929	19.0	36.1	26.8	097	192	119	77	83	71	w	N W b w	N W b w	w 3 N	1.63	9.14	5.00	..	...	Cum. Str. 4.	Do. 6.	Cum. 4.
18	30.028	.967	.977	10.0	43.6	24.7	069	177	117	77	58	76	w by N	w s w	s by w	w 53 s	0.22	3.04	6.80	.	...	Clear.	Clear.	Clear.
19	.864	.612	.573	8.5	38.1	30.3	058	207	166	80	84	86	E by N	E by N	s E	E 5 s	2.53	2.47	0.63		...	Do.	Do.	Snow.
20	.542	.476	.580	23.5	44.1	29.7	119	223	160	80	73	86	w	s s w	w s w	s 3 w	0.25	0.74	0.22	..	1.40	Snow.	Snow.	Cir. Str. 4, hazy.
21	.574	.644	.686	30.0	50.3	28.4	160	283	135	86	75	78	s w by s	s by w	w by s	s 10 w	0.06	0.00	0.30	.	...	Fog.	Cir. Str. 6.	Do. 3, Lun. halo.
22	.714	.722	.718	17.0	51.0	26.7	036	293	119	84	76	78	N w by N	s by w	N W b w	w 33 N	0.03	0.20	0.00	...	...	Do.	Cir. 1.	Cum. Str. 4.
23	.720	.689	.715	28.0	45.2	27.1	119	221	137	76	71	82	E N E	w by N	s E	s 40 E	4.02	1.62	Calm	..	...	Cir. Cm. Str. 8.	Cir. 2.	Clr. Z.Lt. ft.A.B
24	.614	.604	.561	21.7	48.1	30.0	092	242	160	70	69	86	N N E	N N E	N E b E	N 34 E	1.63	3.15	8.00	.	...	Clear.	Cir. Str. 6.	Do, Zod. Light.
25	.614	.634	.504	25.7	53.0	23.7	123	230	091	76	57	69	N N E	s w	N W b w	N 35 E	15.32	1.61	2.08	...	...	Do.	Cum. Str. 6.	Do. Zod. Light.
26	.424	.325	.314	17.6	39.0	29.1	088	214	152	72	84	85	w N w	w N w	N W b w	w 3 N	3.27	17.54	14.60	...	..	Do.	Do. 6.	Do. Zod. Light.
27	.357	.352	.403	19.0	24.6	16.4	080	112	084	70	71	73	N W b w	w	N w	w 15 N	22.40	13.00	14.05	.	...	Cir. Str. 4	Do. 10.	Do.
28	.398	.336	.416	7.0	13.1	11.7	054	083	066	79	82	78	w N w	w N w	w N w	w 21 N	12.67	20.05	20.74	..	1.15	Cir. Cm. St. 10.	Snow.	Snow.
29	.516	.546	.671	10.6	23.0	20.0	082	112	101	88	77	78	w by s	w by N	N w	w 17 N	24.06	4.14	12.12	. .	1.43	Snow.	Cir. Str. 8.	Cir. Str. 10.
30	.751	.787	.916	12.7	23.0	11.3	077	112	070	78	77	73	w by N	w by N	w N w	w 17 N	20.40	8.82	13.83	...	Inp	Cir. Str. 10.	Do. 10.	Do.
31	30.026	30.056	30.130	10.4	39.0	19.4	082	169	114	88	71	87	w N w	s w	s w	w 23 s	7.62	0.61	3.40	...	..	Cir. Cm. Str. 4.	Clear.	Clear. Zod. Light.

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

(NINE MILES WEST OF MONTREAL.)

BY CHARLES SMALLWOOD, M. D.

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

Day.	Barom. corrected and reduced to 32° Fahr. 6 A.M.	2 P.M.	10 P.M.	Temp. of the Air. 6 A.M.	2 P.M.	10 P.M.	Tension of Vapor 6 A.M.	2 P.M.	10 P.M.	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	Direction of Wind. 6 A.M.	2 P.M.	10 P.M.	Mean direction of Wind.	Velocity in miles per hour. 6 A.M.	2 P.M.	10 P.M.	Rain in Inches.	Snow in Inches.	Weather, &c. A cloudy sky is represented by 10: A cloudless sky by 0. 6 A.M.	2 P.M.	10 P.M.
1	29.626	29.430	29.267	-4.6	4.7	9.1	.036	.056	.037	.99	96	91	N E by N	N E by E	N E by E	E 22° N	2.60	8.49	7.15	...	2.20	Cir. Cm. St. 4.	Snow.	Clear.
2	.360	.315	409	5.0	8.9	-1.0	051	059	038	80	79	81	W	W by S	W by S	W 1 S	4.15	11.57	9.01	..	...	Clear.	Cum. Str. 4	Do. Zod. Light.
3	.395	.311	415	-4.5	1.6	1.0	053	033	039	87	84	57	W by S	W by S	W	W 11 S	13.60	16.15	20.87	..	1.20	Do.	Do. 6.	Snow.
4	.465	.512	.566	2.6	8.4	2.0	047	065	046	83	82	83	W by S	W by S	W by S	W 11 S	8.40	11.45	12.80		Inp	Cir. Str. 10.	Do. 4.	Cir. Str. 4.
5	.750	.781	.987	—1.1	9.9	5.1	038	061	057	84	79	85	W by N	W	W by S	W 2 N	6.00	16.10	7.80		Inp	Do. 8.	Do. 8.	Clear Zod. Lt.
6	30.216	30.168	30.126	10.9	18.1	13.5	072	091	081	91	85	88	W S W	S W by W	S W b W	W 21 S	1.47	2.27	0.45		..	Cir. Cm. St. 6.	Cir. Cm. St 10	Cir. Str. 10.
7	29.796	29.531	29.517	14.3	27.3	17.7	080	140	098	90	89	91	E N E	S E by S	S S W	E 15 S	0.01	0.01	Calm		2.45	Snow.	Snow.	Do. 10.
8	.744	.757	.786	9.0	14.6	—2.5	057	078	032	90	81	71	W	S W by W	S E by E	W 13 S	10.27	3.13	4.40	...	...	Str. 2.	Clear.	Clear.
9	.746	.615	761	0.1	19.4	3.0	041	080	048	82	76	89	S E by N	S W	W by S	S 25 W	0.30	0.53	3.00		...	Cum. Str. 4.	Do.	Do. Aur. Bor.
10	.815	.759	.741	5.0	22.5	18.6	058	133	101	90	81	99	S	S by E	S by W	S 24 W	0.06	0.07	2.66	..	...	Do 6.	Cum. Str. 6.	Cum. Str. 10.
11	.565	365	.240	29.2	38.8	30.4	159	214	177	94	85	95	S W by W	S W by W	E by N	S 30 E	5.90	6.66	0.21	. .	1.45	Do 10.	Snow.	Do. 10.
12	28.781	.016	.414	31.9	11.6	6.5	121	077	020	99	82	81	S	W by N	W N W	W 10 N	4.22	22.61	29.27	.	0.50	Snow.	Cum. Str. 6.	Do. 10.
13	29.855	.862	.875	-21.4	3.	9.5	015	032	024	79	76	80	W S W	W S W	W S W	W 23 S	16.87	9.05	9.12		.	Clear.	Clear.	Clear.
14	924	810	.742	-11.8	8.0	1.3	021	066	043	82	80	86	W S W	S W by W	S S E	W 21 S	3.88	4.63	6.30		...	Do.	Do.	Cir. Cm. Str. 4.
15	.541	.457	.292	6.0	25.5	13.1	058	127	074	90	84	85	S	S S E	S S E	S 3 W	3.18	6.21	0.34	..	...	Cum. Str. 10.	Cir. Cm. St. 6.	Do. 10.
16	.100	.031	.088	20.4	25.2	18.6	103	118	101	87	79	8[illegible]	S E by E	S by E	E N E	E 3 N	1.61	0.81	3.92	..	1.20	Snow.	Cum. Str. 10.	Cum. Str. 10.
17	031	.160	150	17.0	15.4	9.0	089	088	060	89	90	86	S W by W	W S W	W N W	W 18 S	10.18	20.10	18.74	...	2.60	Snow.	Snow.	Str. 10.
18	.270	.303	.501	2.0	6.4	7.4	033	059	655	81	79	80	W	W	W N W	W 14 N	22.11	21.40	24.48	...	...	Cum. Str. 10.	Cum. Str. 10.	Cum. Str. 10.
19	714	.703	.725	7.2	17.1	10.2	057	087	065	82	80	84	W N W	W S W	S W b W	W 6 N	20.72	24.01	20.25	. .	..	Do. 4.	Clear.	Clear.
20	.521	.409	.440	18.1	39.7	25.1	099	152	135	79	81	86	W S W	W by S	W S W	W 25 S	10.21	6.40	4.21	. .	...	Str. 10.	Cum. Str. 6.	Str. 10.
21	.423	.323	.447	23.4	34.0	29.1	118	155	161	89	72	88	W N W	W	W N W	W 2 N	7.04	16.18	12.30	..	...	Cir. Str. 6.	Do. 10.	Clear. [d. 41°
22	.551	.572	.570	15.6	36.4	19.6	095	210	110	87	85	88	W S W	W S W	W N W	W 3 S	4.16	7.05	2.12	...	..	Clear.	Clear.	C.C.Str.4 L.H.
23	416	.279	.330	13.0	28.3	21.0	096	144	118	84	83	87	E N E	E N E	W N W	N 5 E	0.17	3.71	0.56	.	...	Cum. Str. 10.	Cir. Cm. St. 8.	C. Str. 10 Z. L
24	.481	.465	.524	10.2	19.7	15.2	074	089	081	82	68	77	W	W	W N W	W 15 N	6.25	8.53	11.55	...	...	Cir. Str. 6.	Cum. Str. 10.	Str. 8. Au. Bor.
25	.446	.432	.455	10.0	30.8	20.7	076	168	111	84	81	83	S W	W S W	W N W	W 10 S	0.16	7.44	9.22	..	...	Str. 10.	Do. 4.	Do. 10.
26	576	.595	.746	15.2	29.2	20.9	093	152	039	90	85	86	W by N	W by N	N W	W 27 N	11.66	10.35	12.43	...	...	Clear.	Clear.	Clr. Z. L. A. B.
27	859	.752	.748	3.8	32.7	16.2	050	161	098	83	78	88	S S W	S by W	N E	S 43 W	6.95	0.93	0.92	...	...	Do.	Do.	Do. Z L E 79.33
28	.874	.816	.856	—3.5	32.3	11.0	033	167	672	83	80	81	S W	S	W by S	W 36 S	1.17	0.01	0.01	...	...	Do.	Do.	Do.
29	.865	.874	.912	0.0	31.7	16.4	046	160	092	90	80	83	W S W	W S W	W S W	W 30 S	0.16	Calm	0.30	...	...	Str. 10.	Cum. Str. 10.	Do Zod. Lt.

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

Barometer	Highest, the 6th day	30.216
	Lowest, the 12th day	28.781
	Monthly Mean	29.561
	Monthly Range	1.435
Thermometer	Highest, the 22nd day	36°.6
	Lowest, the 13th day	—21°.4
	Monthly Mean	13°.46
	Monthly Range	58°.00
Greatest Intensity of the Sun's Rays		87°.5
Lowest Point of Terrestrial Radiation		—22°.6
Mean of Humidity		.845

No rain fell during the month.

Snow fell on 9 days, amounting to 11.66 inches; it was snowing 43 hours 29 minutes.

The most prevalent Wind was W by S—1147.70 miles.

The least prevalent Wind was E—1.00 miles.

The most windy day was the 18th; mean miles per hour, 22.66.

The least windy day was the 7th; mean miles per hour, 0.06.

Most windy hour, from 9 till 10. a. m.. on the 12th—41.10 miles.

Aurora Borealis visible on 3 nights—might have been seen on 13 nights—impossible on 13 nights.

Zodiacal Light unusually bright and well defined.

Winds resolved into the four cardinal points, N 71.90,—S 280.00,—W 4834.80,—E 277.20—total miles, 5463,90.

Ozone—was in moderate quantity.

The electrical state of the atmosphere has been marked by very high tension.

Electrometer almost constantly affected.

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

Barometer	Highest, the 31st day	30.130
	Lowest, the 2nd day	29.065
	Monthly Mean	29.647
	Monthly Range	1.065
Thermometer	Highest, the 24th day	54°.2
	Lowest, the 10th day	—17°.1
	Monthly Mean	25°.7
	Monthly Range	71°.3
Greatest Intensity of the Sun's Rays		119°.4
Lowest Point of Terrestrial Radiation		—18°.2
Mean of Humidity		.804

Snow fell on 10 days. amounting to 11.47 inches; it was snowing 77 hours 55 minutes.

No rain during the month,—it is now a period of 100 days since rain fell.

The most prevalent Wind was W—1119.20 miles.

The least prevalent Wind was W by S—1.00 miles.

The most windy day was the 28th; mean miles per hour. 17.82.

The least windy day was the 22nd mean miles per hour, 0.06.

Most windy hour, from 8 till 9. a. m., 2nd day—39.50 miles;—total miles traversed by the wind, 5366.40—resolved with the Four Cardinal Points, gives N 674.80 miles, S 917.30 miles, W 3706.60 milés, E 567.70 miles.

There were 177 hours of calm during the month.

Aurora Borealis visible on 5 nights—might have been seen on 14 nights—impossible on 12 nights.

Zodiacal Light visible.

Lunar Halo seen on 2 nights.

Ozone—was in rather large quantity.

The electrical state of the atmosphere has been marked by high tension, the Electrometer has been almost constantly affected.

Crows first seen here on the 19th day.

MONTHLY METEOROLOGICAL REGISTER, QUEBEC, CANADA EAST, FEBRUARY, 1856.

BY CAPT. A. NOBLE, R.A., F.R.S., AND MR. WM. D. C. CAMPBELL.

Latitud, 46 *deg.* 49.2 *min. North*; *Longitude*, 71 *deg.* 16 *min. West. Elevation above the level of the Sea*, 200 *feet.*

Date.	Barometer corrected and reduced to 32 degrees. Fahr. 6 A.M.	2 P.M.	10 P.M.	MEAN.	Temp. of Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Tens. of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N	Humid'y of Air. 6 A.M.	2 P.M.	10 P.M.	M'N	Direc'n of Wind. 6 A.M.	2 P.M.	10 P.M.	Vel'ty of Wind. 6 A.M.	2 P.M.	10 P.M.	Rain in Inches.	Snow in Inches.	REMARKS.
1	29.626	29.457	29.230	29.458	5.3	8.9	12.0	8.7	.038	.051	.078	.057	1.00	0.77	0.97	0.91	Calm.	E	E N E	0.0	6.2	10.9	...	4.0	
2	.099	.042	.105	.082	11.6	10.7	1.4	7.9	066	018	041	052	83	63	80	75	E N E	E N E	W N W	3.8	14.7	9.3	...	0.5	
3	.008	28.979	.085	.023	- 3.1	1.6	- 1.6	- 1.0	035	051	045	041	81	1.00	1.00	94	W N W	W	W	17.2	22.7	21.3	...	...	
4	.183	29.235	.330	.249	- 3.4	1.6	0.4	- 0.5	024	030	037	030	58	59	75	64	W N W	W N W	W N W	23.0	20.3	12.9	...	...	
5	.419	.516	.766	.567	0.1	8.9	9.8	6.3	045	045	039	045	93	64	59	72	W N W	W N W	W N W	13.9	11.3	10.9	...	...	
6	30.020	30.006	30.012	30.013	5.5	15.2	13.5	11.4	032	059	056	053	68	55	77	67	W N W	W N W	Calm.	10.0	6.2	0.0	...	...	
7	29.877	29.522	29.362	29.587	11.8	17.2	18.8	15.9	056	099	098	088	82	1.00	91	91	E S E	E	Calm.	3.8	10.9	0.0	...	3.0	
8	.469	.597	.620	.562	19.1	12.8	4.5	12.1	092	064	044	067	85	77	76	79	W S W	N	Calm.	8.8	6.2	0.0	...	0.5	
9	.594	.487	.561	.547	5.7	11.2	6.5	7.7	043	060	037	047	69	77	58	68	E	W N W	W N W	15.6	14.7	14.7	...	1.0	
10	.720	.652	.579	.654	- 0.4	11.7	14.2	8.5	035	057	072	055	74	71	82	76	Calm.	Calm.	Calm.	0.0	0.0	0.0	...	2.6	
11	.489	.380	.158	.342	19.2	28.1	28.9	25.4	108	151	160	141	1.00	1.00	1.00	1.00	Calm.	Calm.	W N W	0.0	0.0	3.8	...	6.0	
12	28.714	28.579	28.999	28.774	30.6	19.1	- 4.6	15.0	171	070	025	089	1.00	65	64	76	Calm	W S W	W N W	0.0	14.3	19.4	...	1.4	12th—Halo round moon 35° in diameter.
13	29.395	29.513	29.621	29.510	-17.4	9.7	- 8.5	-11.8	011	018	018	016	58	58	51	57	W N W	W N W	W N W	22.1	20.6	15.6	...	...	
14	.677	.611	.629	.639	-15.8	0.9	- 2.0	- 5.6	015	030	039	028	62	60	87	70	W N W	W N W	W N W	13.4	10.9	5.2	...	...	
15	.540	.328	.245	.371	- 2.8	11.2	11.9	6.8	013	053	054	049	1.00	65	67	77	Calm	Calm.	Calm.	0.0	0.0	0.0	...	2.0	
16	.104	.014	28.997	.038	14.8	22.2	20.7	19.2	063	162	104	090	70	83	89	81	E N E	E N E	Calm.	35.9	24.0	0.0	...	...	18th—Solar halo 45° in diameter. Between 10 and 11, p.m., velocity of gusts of wind 70 miles per hour.
17	28.915	28.808	.718	28.814	15.6	23.6	19.6	19.6	093	114	080	076	1.00	87	72	86	E N E	E N E	W S W	5.8	21.6	19.0	...	3.5	
18	.775	.880	29.068	.908	10.1	9.4	6.3	8.6	045	045	063	051	61	63	1.00	75	W	W	W	23.6	19.4	52.0	...	1.0	
19	29.319	29.402	.455	29.392	5.5	17.6	14.2	12.4	043	054	051	049	69	53	58	60	W	W	W	35.0	39.4	29.0	...	...	
20	.359	.217	.131	.236	9.6	23.4	24.3	19.1	057	091	106	085	79	70	80	76	W	W	W	10.0	7.2	6.2	...	...	
21	.142	.147	.211	.167	18.9	25.2	21.2	21.8	062	105	092	086	58	79	78	72	W N W	W N W	W N W	17.6	14.7	11.5	...	...	Auroral light observed on the 2nd. 8th. 9th, 13th, 24th, 25th, 26th, 27th, 23th, 29th.
22	.257	.363	.362	.327	18.7	24.5	16.9	20.0	078	095	098	090	75	66	72	71	W N W	W N W	Calm.	3.8	14.7	0.0	...	...	
23	.323	.196	.170	.232	28.9	23.7	14.7	22.4	074	082	112	092	75	56	86	72	Calm	Calm.	W N W	0.0	0.0	3.8	...	0.5	
24	.141	.195	.233	.190	16.4	21.0	15.8	17.7	080	063	052	065	82	54	55	64	W S W	W N W	W N W	14.7	10.9	12.9	...	...	
25	.227	.170	.177	.191	9.3	20.5	20.8	16.8	050	071	036	063	70	66	57	64	W N W	W N W	W	11.5	17.6	8.8	...	...	Auroral arch and streamers on the 14th.
26	.304	.307	.452	.354	11.8	25.1	14.5	17.1	056	070	052	065	70	55	69	65	W N W	W N W	W N W	19.0	16.0	11.3	...	...	
27	.610	.523	.575	.569	11.1	26.9	17.0	18.3	048	043	035	042	62	29	35	42	W N W	W N W	W N W	11.3	12.9	3.8	...	...	
28	.640	.603	.646	.630	6.8	21.1	22.4	16.8	034	05[illegible]	047	018	53	53	57	54	W S W	S W	Calm.	4.0	3.8	0.0	...	...	
29	.701	.711	.759	.724	6.0	25.2	12.2	14.5	045	052	043	047	71	39	53	54	W S W	W S W	W S W	3.8	3.3	5.2	...	...	
M	29.3631	29.3258	29.3536	29.3571	8.26	15.85	11.91	11.99	0573	067	0545	0629	.762	.670	.734	.722				11.2	12.7	10.1	...	26.0	

MONTHLY METEOROLOGICAL REGISTER, QUEBEC, CANADA EAST, MARCH, 1855.

BY CAPT. A. NOBLE, R.A., F.R.S., AND MR. WM. D. C. CAMPBELL.

Latitude, 46 *deg.* 49.2 *min. North; Longitude,* 71 *deg.* 16 *min. West. Elevation above the level of the Sea,* 200 *feet.*

Date.	Barometer corrected and reduced to 32 degrees, Fahr. 6 A.M.	2 P.M.	10 P.M.	MEAN	Temp. of Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Tens. of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N	Humid'y of Air. 6 A.M.	2 P.M.	10 P.M.	M'N	Direc'n of Wind. 6 A.M.	2 P.M.	10 P.M.	Vel'ty of Wind. 6 A.M.	2 P.M.	10 P.M.	Rain in Inches.	Snow in Inches.
1	29.920	29.875	29.906	29.867	4.5	17.5	8.8	10.3	.035	.048	.048	.044	0.60	0.48	0.69	0.59	W N W	W S W	Calm.	10.9	17.2	0.0		
2	.561	.449	28.997	.236	13.2	12.4	10.0	11.9	056	082	073	070	66	1.00	1.00	89	E	E	E	11.0	50.5	35.9	...	8.0
3	.142	.379	29.645	.389	5.9	13.2	12.5	10.8	045	050	050	048	69	60	61	63	Calm.	W	W	0.0	17.2	10.9	...	...
4	.870	.602	.183	.552	2.7	18.1	18.6	13.[illegible]	040	055	105	067	74	54	1.00	76	Calm.	W	E N E	0.0	3.8	13.4	...	4.0
5	.382	.475	.507	.451	10.5	21.5	15.7	15.9	058	065	087	076	77	55	93	75	W S W	W N W	S E	10.0	5.2	3.8	...	1.5
6	.368	.186	.345	.300	12.2	21.0	18.2	17.1	066	090	087	031	81	77	84	81	Calm.	E S E	Calm.	0.0	5.2	0.0	...	3.4
7	.495	.541	.516	.517	5.2	15.1	9.4	9.9	036	042	045	041	59	46	63	56	W	W	W	8.8	6.2	5.2	...	...
8	.376	.286	.422	.359	8.3	21.1	1.6	9.5	057	065	031	058	81	73	69	74	Calm.	W	W	0.0	7.2	12.9	...	1.0
9	.486	.529	.598	.538	-9.5	2.2	-2.8	-3.4	018	030	027	025	58	58	63	60	W N W	W N W	W N W	20.3	23.0	22.6	...	...
10	.536	.447	.439	.474	-10.8	3.5	-1.1	2.8	017	029	026	023	57	46	55	54	W	W	Calm.	3.8	8.5	0.0	...	...
11	.328	.079	.007	.138	-3.7	15.2	2.1	4.5	034	055	032	039	76	60	61	66	Calm	W	W	0.0	5.2	15.6	...	...
12	.088	.142	.366	.199	-6.7	7.8	0.6	0.6	026	041	034	034	72	61	68	67	W N W	W S W	W S W	17.2	18.3	10.9	...	...
13	.385	.580	.665	.543	3.9	19.3	16.2	13.1	033	062	062	053	58	57	65	60	W S W	S W	Calm.	16.5	20.3	0.0	...	...
14	.730	.685	.621	.679	10.9	29.5	22.5	21.0	055	111	115	094	72	67	92	77	W	W	Calm.	3.8	7.2	0.0	...	.5
15	.593	.515	.569	.559	16.9	30.3	21.7	23.0	070	113	071	085	71	66	59	65	W	S W	S W	5.2	5.2	6.2	...	.6
16	.611	.507	.529	.549	16.2	30.9	23.7	23.6	065	100	096	087	67	58	74	66	N N W	W S W	W S W	9.3	6.2	5.2	...	.2
17	.625	.638	.710	.668	22.3	30.4	23.0	25.2	080	078	084	081	65	46	66	59	W S W	W S W	W S W	5.2	5.2	5.2	...	...
18	.819	.757	.818	.808	10.4	30.4	23.2	21.3	043	063	072	052	57	37	56	51	W S W	W S W	W S W	3.8	3.6	2.1	...	...
19	.784	.498	.443	.575	11.8	37.9	29.4	26.4	057	074	103	078	71	33	62	55	W S W	Calm.	Calm.	4.0	0.0	0.0	...	...
20	.419	.394	.423	.412	29.3	38.0	31.6	32.[illegible]	111	134	153	133	69	59	87	72	Calm.	Calm.	Calm.	0.0	0.0	0.0	...	...
21	.452	.466	.531	.483	23.4	34.2	30.5	30.4	145	165	132	147	1.00	84	78	87	Calm.	Calm.	Calm.	0.0	0.0	0.0	...	...
22	.614	.606	.625	.615	25.2	32.8	20.9	29.3	167	144	167	139	73	77	1.00	83	E N E	E N E	E N E	2.0	20.3	21.6	...	...
23	.631	.574	.587	.597	29.1	32.1	28.8	30.0	149	145	138	141	92	80	86	86	E N E	E N E	E N E	23.2	23.9	22.1	...	...
24	.591	.500	.492	.528	22.5	32.5	29.0	28.0	090	138	133	12[illegible]	72	75	86	78	E	E N E	Calm.	5.2	6.2	0.0	...	...
25	.488	.365	.330	.394	21.0	35.2	24.7	27.0	0[illegible]1	199	112	114	70	72	83	75	Calm.	Calm.	Calm.	0.0	0.0	0.0	...	...
26	.207	.080	.087	.125	23.0	31.8	25.0	26.6	055	072	077	068	44	40	56	47	W N W	W N W	W N W	19.3	10.9	13.4	...	In p
27	.081	.159	.172	.134	18.9	23.5	17.7	20.0	073	073	069	072	68	57	68	64	W	W N W	W N W	12.4	10.0	6.2	...	In p
28	.081	28.987	.034	.041	14.7	15.2	13.3	14.1	075	091	084	083	83	98	99	93	W N W	W N W	W N W	10.0	11.3	14.3	...	3.6
29	.206	29.271	.427	.301	10.0	22.3	18.1	16.8	044	066	069	060	60	54	67	60	W N W	W N W	W N W	14.7	15.6	23.0	...	...
30	.523	.549	.665	.579	14.5	20.6	17.4	17.5	054	058	083	068	61	59	83	68	W N W	W N W	W N W	12.9	16.0	13.4	...	...
31	.882	.879	.982	.914	16.2	30.1	20.3	22.2	073	071	074	073	82	42	65	63	E N E	Calm.	N W	3.8	0.0	3.9	...	...
M	.4935	.4417	.4729	.4691	12.11	23.41	17.29	17.60	0627	0851	0821	0766	.698	.612	.749	.686				8.5	10.6	8.6	...	22.8

Remarks.

9th—Aurora appeared suddenly at 10, p. m.; streamers but no arch.

16th—Corona round moon.

19th—At 10, p. m., halo 40° in diameter round the moon.

20th—Circle round sun at 3, p. m., and a lunar corona at 10, p. m.

21st—Heavy fog from 6 to 9, a. m.

23rd—Aurora was observed through a break in the clouds.

Displays of aurora observed on the 1st, 9th, 17th, 23rd and 31st.

Auroral light on the 3d, 4th, 5th, 7th, 8th, 10th, 11th, 21st, 24th, 25th, 27th and 28th.

REMARKS ON THE QUEBEC METEOROLOGICAL REGISTER FOR FEBRUARY.

Maximum Barometer, 6 a.m. on the 6th	30.020
Minimum Barometer, 2 p.m. on the 12th	28.579
Monthly Range	1.441
Monthly Mean	29.3561
Maximum Thermometer on the 12th	31°9
Minimum Thermometer on the 13th	—18.0
Monthly Range	49.9
Mean Maximum Thermometer	17.89
Mean Minimum Thermometer	3.64
Mean daily Range	14.25
Mean monthly Temperature	11.99
Greatest daily Range of Thermometer, on 12th	49°3
Least daily Range of Thermometer, on 18th	5°5
Warmest Day, 11th. Mean Temperature	25.4
Coldest Day, 13th. Mean Temperature	—11.8
Climatic Difference	37.2

Possible to see Aurora on 13 nights.
Aurora visible on 11 nights.
No Rain fell.
Total quantity of Snow, 26.0 inches.
Snow fell on 12 days.

REMARKS ON THE QUEBEC METEOROLOGICAL REGISTER FOR MARCH.

Maximum Barometer, 10 p.m. on the 31st	29.982
Minimum Barometer, 2 p.m. on 28th	28.987
Monthly Range	.995
Monthly Mean	29.4694
Maximum Thermometer, on the 19th	39°0
Minimum Thermometer, on the 10th	—11.0
Monthly Range	50.0
Mean Maximum Thermometer	24.28
Mean Minimum Thermometer	—9.11
Mean daily Range	15 17
Mean monthly Temperature	17.60
Greatest daily Range of Thermometer, 8th	31.1
Least daily Range of Thermometer, 2nd	7.3
Warmest day, 20th	32.8
Coldest day, 9th	—3.4
Climatic difference	36.2

Possible to see Aurora on 19 nights.
Aurora observed on 17 nights.
No Rain fell.
Total quantity of Snow, 22.8 inches.
Snow fell on 11 days.

MONTREAL NATURAL HISTORY SOCIETY.

Ordinary Monthly Meeting—March, 1856.

L. A. H. Latour, Esq, First Vice-President, in the chair.

The following donations were laid on the table, and ordered to be acknowledged with thanks, viz.—From the Minister *des Colonies Françaises*, through Mr. A. Perry; one pair of sandales du Sénégal, one cartouchiere du Sénégal, and four birds—From W. H. Boulton, Esq., through Mr. Perry, one minie rifle bullet, and a piece of shell gathered on the heights of Sebastopol—From Mr. Perry, a few French coins—From E. Crisp, M. D., (the author) a copy of his work on "Structure and Use of the Spleen"—From L. A. H. Latour, Esq, a copper coin of Ferdinand III. king of Spain, with eleven other copper coins, and five Reports published by order of the Legislature—From Col. Stone, of Plattsburgh, through Mr. Rennie, some bullets taken from old houses on each side of the River Saranac, and an account of the celebration of the Battle of Plattsburg—From Mr. D. Browne, a specimen of soap-stone. The thanks of the Society were unanimously voted to Mr. A. Perry, for his exertions to advance the interests of the Natural History Society while in Paris. Mr. Perry acknowledged the compliment that had been paid him, regretting that he he had been able to do so little for a Society which deserved so well at the hands of the public. It was want of time, however, that prevented him, not want of will. He made many applications for specimens, and, as might be expected, got many refusals. He hoped at the next World's Fair, the Society would make arrangements to have itself specially represented there. He had several other specimens on their way to Montreal for the Society, and hoped they would reach safely. Mr. Perry having also stated to the Society that M. Milner, the Director of the Jardin des Plantes, in Paris, was anxious to put himself into communication with the Society, to obtain possession of specimens of living animals peculiar to this country, it was ordered that the Corresponding Secretary write to M. Milner, offering in the name of the Society to do all in its power to forward his views, and assist him in carrying them out. Dr. Barnston was also requested to open a correspondence with Sir William Hooker, of Kew Gardens, respecting the plants and roots he wishes to procure. Messrs. Dutton and Perry were named a Committee to prepare a paper on the subject of fish-breeding in our rivers, and bring it before the Society at its next ordinary meeting. The meeting then proceeded to ballot, when T. M. Taylor, Esq., James Taylor, Esq., and F. F. Mullins, Esq., were unanimously elected ordinary members.

A. N. Rennie, *Secretary*.

ERRATA.

Page 35—The sentence in the third line of note to description of *Necrophila affinis* should read thus:—*N. Canadensis* is evidently the ♀ (Venus) of *Americana*.

Page 38—♂ (Mars, sig. male) should be at the beginning of the description of *O. Bicornis;* and the second paragraph thus:—♀ same color as ♂.

THE

CANADIAN JOURNAL

OF

INDUSTRY, SCIENCE, AND ART:

CONDUCTED BY

THE EDITING COMMITTEE OF THE CANADIAN INSTITUTE.

NEW SERIES. NUMBER IV.

JULY, 1856.

TORONTO:

PRINTED FOR THE CANADIAN INSTITUTE,

BY LOVELL AND GIBSON, YONGE STREET.

CANADIAN INSTITUTE.

EDITING COMMITTEE:

GENERAL EDITOR, - - - DAN. WILSON, LL.D.

I. *Geology and Mineralogy:* E. J. CHAPMAN, Prof. of Geology and Mineralogy, Univ. Coll. Toronto.

II. *Physiology and Natural History:* JAMES BOVELL, M. D., Prof. of the Institutes of Medicine, Trin. Coll., Toronto.

III. *Ethnology and Archæology:* DANIEL WILSON, LL. D., Prof. of History and English Literature, Univ. Coll., Toronto.

IV. *Agricultural Science:* H. Y. HIND, M. A., Prof. of Chemistry, Trin. Coll., Toronto.

V. *Chemistry:* HENRY CROFT, D. C. L., Prof. of Chemistry, Univ. Coll., Toronto.

VI. *Mathematics and Natural Philosophy:* J. B. CHERRIMAN, M. A., Prof. of Natural Philosophy, Univ. Coll., Toronto; and Rev. G. C. IRVING, M. A., Prof. of Mathematics and Natural Philosophy, Trin. Coll., Toronto.

VII. *Engineering and Architecture:* F. W. CUMBERLAND, C. E., and ALFRED BRUNEL, C. E.

The Canadian Journal is printed exclusively for gratuitous distribution among the Members of the Canadian Institute, and such Institutions and Societies as the Council may determine; but Members may purchase extra copies at 2s. 6d. per number, and Provincial Literary and Scientific Societies may obtain the Journal at the same rate, by an annual payment in advance.

*** *Communications for the Journal to be addressed to the General Editor,* DR. WILSON, *University College, Toronto.*

THE CANADIAN JOURNAL.

NEW SERIES.

No. IV.—JULY, 1856.

DISCOVERY OF COPPER AND OTHER INDIAN RELICS, NEAR BROCKVILLE.

BY THOMAS REYNOLDS, M. D.

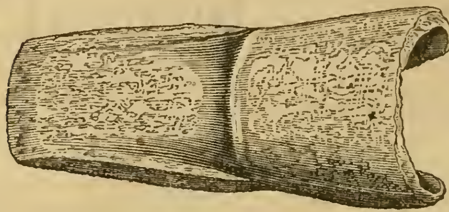
Read before the Canadian Institute, February 16th, 1856.

Attention having been recently called to the discovery of ancient copper relics, and other traces of primitive aboriginal arts, on the shores of Lake Superior,* it may not be uninteresting to compare with such remains, others of the same class discovered far to the eastward of the regions which supply the metal from which such weapons and implements appear to have been fabricated.

In excavating the St. Lawrence Canal, at Les Galops Rapids, in the year 1847, a curious collection of Indian relics was brought to light, at one of the beautifully picturesque points on the River St. Lawrence, at the head of the first rapid, or cascade, met with in descending that river. Thus situated at a point where the free navigation of the upper part of the river is first interrupted, this place is likely to have been frequently visited in former times, as a spot where both Indians and voyageurs would be tempted to rest, or camp for the night, before venturing their canoes upon the rapids; and this may perhaps have had to do with the deposition of the relics, discovered in the process of excavating the Canal destined to overcome the impediments which nature had there opposed to the free navigation of the noble river.

* Ante, p. 225.

The following description of such of the relics as have come into my possession, will serve, with the aid of the accompanying illustrations, to convey some idea of their various forms and special characteristics. The most massive of the copper implements, figured here, is an instrument in which will be observed a hollow or socket for a handle: the back, which is here represented, being convex, corresponding to the opposite concavity. The chisel-shaped termination is now blunt, but it retains sufficient indications of its having originally had a sharp edge. This instrument might perhaps answer the purpose of a chisel or gouge for hollowing out wood; but I was struck at first sight of it, with the resemblance it bears to the coulter, or point, of the old Jewish plough. The precise use for which it was designed can now only be surmised; and this might be an interesting matter for further inquiry, as one means calculated to throw light on questions in connexion with the origin of the native American tribes. The subject has been reverted to in relation to another discovery of copper relics found about the same time as those now described, at Penetanguishene, and the speculations thus originated, even if they lead to no very definite or practical results, are at least curious, and suggestive of interesting reflections.



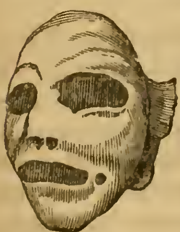
The dimensions of this ancient implement are six inches in length, fully two inches in breadth at the edge, and two and four-fifths at the broadest part of the socket. A second object may be described as a copper knife, of full size, with the edge still tolerably sharp, and bearing marks of considerable use. The point was broken off when it was first discovered; and the handle, which must have been of wood or some other material less durable than the metal blade, had yielded to the ravages of time. In its present mutilated state this instrument measures five inches and three quarters long, and when the blade was perfect was probably not less than eight inches in length.

A third implement, figured here, may be described as a knife, or small dagger, nearly five inches long, and with a hooked extremity, as represented in the annexed wood-cut, designed to serve some unknown purpose of Indian domestic economy, or convenience in war or the chase. This, it may be assumed, was used without any handle attached to it, whatever may have been the purpose to which it was applied.

The fourth copper instrument is a knife or dagger upwards of seven inches in length, including the narrow end for insertion in the haft; and the fifth, which is here figured, is a spear head, rudely

hammered out of the native copper, and presenting unmistakeable evidence of its having been brought to its present shape by the hammer, and entirely without the agency of fire. After being wrought, by means of the hammer, into the rude form of a spear-head, the broad end has been overlapped as shewn in the wood-cut, and roughly hammered to the desired shape, so as to provide it with a short narrow prolongation intended to fit into a handle, or to be secured to it by means of a cord or ligature, though it must have very imperfectly answered the purpose. This spear-head is of considerable thickness, and not much corroded. It is still pointed, and tolerable sharp on both edges; and, imperfect as it seems, was probably a weapon of no slight importance and value among the braves in olden times.

In addition to these weapons and implements of copper, I have in my possession a small pipe mouth-piece, found along with them, measuring an inch and a quarter in length, made of the celebrated Indian red pipe-stone; and also a miniature clay mask, figured here, (though with less minute accuracy, than would have been desirable,) about one half the diameter of the original.



It is in some respects a tolerably fair representation of the Indian skull, from which one might fancy it to have been copied. In its shape it struck me as resembling the appearance presented by the skulls found in the same place; and the hollow sockets of the eyes, though doubtless designed only to imitate the Indian masks, were assumed, on its being first found, to prove that it was meant as a representation of the bony structure of the head, and not the fleshy or living subject. This relic I presume is the head of an Indian idol or household god, modeled by the warrior-artist as a charm or protection in battle, or in the other trials and dangers to which he might be exposed. It is imperfect, having been broken off, some additional piece of workmanship, to which it was attached by the piece partially shown in the wood-cut, projecting behind; but it has no perforation or other indication such as would have shewn its use had it originally formed part of a pipe, which the Indians frequently shaped into a human or animal's head.

Shortly after the discovery of these specimens of ancient Indian art, I had an opportunity of showing them to Mr. T. S. Hunt, during a visit paid by him to Brockville in 1847, and this afterwards led to a correspondence with Mr. E. G. Squier, the well known American Archæologist. In his first letter he remarks: "Through my friend Mr. T. S. Hunt, I learn that you have in your possession some copper implements obtained near the banks of the St. Lawrence. I have in my possession a number of such, corresponding, so far as I can judge from the description, with yours, and which were obtained from the Southern Mounds. I am very anxious to institute comparisons between these relics, and shall be glad to obtain sketches of those in your hands." In consequence of this application I sent drawings to Mr. Squier, which were engraved, and my letter accompanying them published, by the Smithsonian Institute, in their Transactions, vol. 1, p. 201. Since then some cool Yankee has published an account of Indian Remains *found in the State of New York*, copying my drawings, and as much of my letter as suited his purpose. Such being the case: and this discovery of Ancient Copper implements, being, as I believe, one of the most remarkable disclosures of the kind yet noticed in Canada; and, also, possessing some peculiar claims to the attention of those interested in the past history of this continent, owing to their being found so far to the eastward of the copper regions; a detailed notice of the objects in question may not be undeserving of the attention of the Canadian Institute.

All these relics were found at a depth of about fourteen or fifteen feet below the surface, in a soil composed of clay and sand. The shore at the point of land, which is considerably washed by the action of the rapid stream, presents a face of large granite boulders with quartz conglomerate—a fitting resting place for the stalwart forms of a score of skeletons, which were found inhumed in a circular space with their feet towards the centre. Some of the skeletons were of gigantic proportions. The lower jaw of one is in my possession, and is sufficiently large to surround the corresponding bone of an adult of our present generation. The condition of the bones furnished indisputable proof of their great antiquity. The skulls were so completely reduced to their earthy constituents that they were exceedingly brittle and fell in pieces when removed and exposed to the atmosphere. The metallic remains however, of more enduring material, as also, several stone chisels, gouges made of the same durable material, and probably designed for tapping the sugar maple, and some flint arrow heads, all remain in their original condition, and furnish evidence of the same rude arts which we know to be still practiced by the aborigines of the far west. A few yards distant from this spot, and at about the same depth from the surface, another circular place of sepulture was exposed to view; but here the organic remains had been subjected to the action of fire, and the charred and partly consumed bones, with the charcoal ashes, bore testimony to the fact that the decomposition which time and the action of their mother earth would have produced, had been anticipated by the hand of man and his use of the fiery element. With reference to the question whether these copper remains are of European or native origin, I have only further to remark, that their structure is very rude; that they appear to have been wrought solely by means of the hammer, without the melting pot or the aid of fire; that while they were accompanied by stone and flint tools and weapons, no implements were found made of iron, which would have been the metal chosen by the European artizan; and finally that the copper appears to correspond in quality with the specimens of the native metal now found in such large quantities on the shores of Lake Superior. There is also a curious fact, which these relics appear to confirm, that the Indians possessed the art of hardening and tempering copper, so as to give it as good an edge as iron or steel. This ancient Indian art is now entirely lost.

For these reasons, as well as from the nature of the soil, which is one likely to preserve organic remains for a very long period of time, and the greatly decomposed state in which the bones were found, I should not hesitate to pronounce these instruments, tools and weapons of much older construction than the discovery of Canada by Europeans. In this part of the continent one might expect to find something bearing the stamp of Gallic manufacture as the French were the first to ascend the St Lawrence and remained for some time masters of its shores. Whereas in none of the relics which I have seen is there any thing which one could for a moment suppose to be of French workmanship.

The spot, it may be further added, where these relics were found, was not the usual place of sepulture of the Indians; for I have observed that their burying places were generally at some distance from the river. In this particular vicinity their cemetery is in a fine sandy ridge, some two or three miles inland, where remains are now found of very ancient deposit. From the interest which this discovery excited, I have frequently thought over the matter, and it has occurred to me as not improbable that at this point of the St. Lawrence a battle has been fought, and it requires no great stretch of imagination to fancy at this particular spot a party of Indians descending the river after spending the summer in the great copper country about the higher lakes, bringing with them the rudely formed instruments of the upper country—encamping for the night preparatory to their descent of this the first of the St. Lawrence rapids, attacked by the tribe of Indians whose hunting or fishing grounds were here situated, and after a fatal encounter, the burial of the friends of the victors with their trophies of war; while a few yards distant the bodies of the vanquished were destroyed by fire.

Independent of all theorising, however, the discovery of a collection of copper relics, so far to the eastward of the great copper regions of the upper lakes, is a fact of sufficient interest and importance to be deserving of record.

REPORT ON COPPER IMPLEMENTS FOUND NEAR BROCKVILLE.

BY HENRY CROFT, D. C. L.,

PROFESSOR OF CHEMISTRY, UNIVERSITY COLLEGE, TORONTO.

Read before the Canadian Institute, March 1st, 1856.

A collection of ancient copper implements, dug up on the banks of the River St. Lawrence, in the vicinity of Brockville, having been transmitted, by Dr. Thomas Reynolds, for exhibition before the Canadian Institute, along with various other relics of native art found at the same time; that gentleman accompanied them with a communication, containing remarks on the peculiar condition of the copper, as indicative of a supposed art of hardening and tempering the metal, which is assumed to have been in use by its ancient native workers, but to be now lost. From the allusions made to this same lost art of native metallurgy in a previous communication,* the subject was remitted to me to report upon, with special reference to the Brockville relics, which were put into my hands for the purpose of experiment and analysis.

The object of the following experiments, accordingly, was to ascertain whether the metal of which these implements are made is identical with the native copper of the Lake Superior Mines, or whether it had been subjected to some manufacturing process, or mixed with any other substance, by which its hardness might have been increased. A careful examination establishes the conclusions here stated:

1stly. No perceptible difference could be observed in the hardness of the implements, and of metallic copper from Lake Superior.

2ndly. The knife or small dagger, with a hook at the end, was cleansed as far as possible from its green coating;

It weighed	32.440	grammes.
It lost in water...............	3.741	"
Hence its specific gravity is.	8.66	

A small fragment, broken off the end of the broad, flat implement, described as a "copper knife of full size," having been freed from its coating, was found to have a specific gravity of 8.58.

During the cleaning of this fragment, a few brilliant white specks became visible on its surface; they appeared to be silver, from their colour and lustre. The structure of the metal was also highly laminated, as if the instrument had been brought to its present shape by hammering out a solid mass of copper, which had either split up or had been originally formed of several pieces. These laminæ, of course, contained air, and the metal was covered with rust, which could not be removed,—hence the specific gravity would naturally be less than if the metal had been dense.

It is probable that the structure of the dagger previously referred to, is the same; but as the coating of oxide, which could not be removed, would have more effect on the small fragment, which weighed only about three grammes, than on the larger dagger blade, the specific gravity of the latter was found to be rather higher.

A portion of very solid copper, from Lake Superior, of about the same weight as the fragment, was weighed in water, and its gravity found to be 8.92; in this piece there were no cavities perceptible.

The specific gravity of absolutely pure copper, varies from 8.78 to 8.96, according to the greater or less degree of aggregation it has received during its manufacture;

* The Ancient Miners of Lake Superior; ante, pp. 236, 237.

Hooked dagger	8.66	
Fragment	8.58	
Native copper	8.92	
Pure copper	8.78	8.96

The small differences between these numbers would lead to the conclusion that the implements were made of pure copper.

The fragment was completely dissolved by nitric acid; and the solution, on being tested for silver by hydrochloric acid, gave a scarcely perceptible opacity, indicating the presence of an exceedingly minute trace of silver. The copper having been separated by hydro-sulphuric acid, the residual liquid was tested for other metals. A very minute trace of iron was detected.

The native copper from Lake Superior was tested in the same manner, and was found to contain no trace of silver, but a minute trace of iron, the quantity being apparently about the same as in the fragment.

From this, it appears that the implements are composed of copper almost pure, differing in no material respect from the native copper of Lake Superior, and not of an alloy of that metal, with any other substance.

It is not by any means probable, from the conclusions resulting from the experiments detailed above, that these implements could have been hardened by any mechanical means; and no process is known at present by which copper can be rendered harder, although its density may of course be increased to a small extent by pressure and hammering.

ECONOMY OF FUEL FOR STEAM MACHINERY.

BY ALFRED BRUNEL, C. E.

Read before the Canadian Institute, March 29th, 1856.

Few questions attract so much attention among practical men at the present moment as that of economising fuel in Steam Machinery especially as relates to the motive power of Railways,—it is indeed a question of vital importance to many of the older Roads in the United States, and though wood for fuel can at present be obtained on the Canadian Railways at rates which do not render it an item of the first importance in the working expenses, yet it is one of sufficient magnitude to demand attention, and the time is not far distant when it will materially affect the tariff rates at which the traffic can be worked, as is already found to be the case in the New England States.

Any contrivance in discovery, therefore, which tends to reduce the consumption of Fuel in the creation of motive power, is of peculiar importance to the public as well as to Railway proprietors.

The following Table shewing the cost of Fuel in relation to the working expenses and earnings of twelve Roads in the United States and of two in Canada for the year 1855, has been calculated with a view to exhibiting the importance of fuel in Railway Economy.

NAME OF ROAD.	TRAIN MILEAGE IN 1855.	GROSS EARNINGS PER TRAIN MILE IN $.	COST OF WORKING PER CENT OF GROSS EARNINGS.	COST OF FUEL PER CENT OF GROSS EARNINGS.	COST OF FUEL PER CENT OF WORKING EXPENSES.
Boston and Lowell	295,517	$ 1·660	64	15·8	24·7
Boston and Maine........	583,016	1·650	49	12·0	24·5
Boston and Providence	316,238	1·766	62	19·0	32·0
Boston and Worcester	541,528	1·861	54	15·0	27·4
Boston and Fitchburh.......	451,944	1·572	59	11·7	20·0
Old Colony and Fall River....	408,107	1·601	53	14·0	26·3
Providence and Worcester....	196,183	1·588	53	15·3	25·3
Western...............	1,021,163	1·830	60	13·0	21·4
Hudson River	929,748	2·011	60	12·6	20·8
New York Central....	3,654,574	1·782	49	9·0	18·8
New York and Erie.........	3,181,878	1·706	45	8·0	17·5
Northern (Ogdensburgh)....	320,316	1·625	67	4·2	6·2
Ontario, Simcoe and Huron ...	251,417	1·358	67	0·1	13·0
Great Western*	503,781	1·962	51	8·0	13·8

* This is only for the first six months of the year, the last return not being published.

These roads embrace a length of 2,180 miles, and the train mileage for the period covered by the returns amounts to 12,750,000 miles, the cost of fuel being about $2,675,000. These figures, representing as they do about one-twelfth of the Railways of America, will give a faint indication of the interest involved.

In the above table we have abundant evidence of the effect which the Fuel account has on the profits of Railways, as well as a clear indication of the rate at which that account is increased as the forests disappear in the vicinity of the lines. There is no question but the consumption of wood in our Railways has been increased in their earlier stages by an insufficient estimate of the consequences, and it is doubtless true that less attention has been given to matters affecting it than to any other particular branch of Railway Economy. In England it has been more strictly attended to, but a wide difference between Coke and Cordwood has in a great measure negatived the value of the experience had in that country—the management of the one being quite unsuitable to the other. The time is arrived however, when the subject must receive greater attention, and some recent articles in American periodicals devoted to Railroads evince a desire on the part of our neighbours to enter upon a careful investigation of the question.

It is a received opinion among Mechanical Engineers, that only a portion of the heat generated in the furnace is imparted to the water in the boiler, and experiments have shown that this is owing to the want of a sufficient admixture of oxygen to produce the perfect combustion of the gases evolved from the burning fuel—hence the attempt to introduce a great supply of air at different parts of the furnace.

It was and is still with many a popular belief that the elongation of the flues of a boiler would produce a corresponding economy in the fuel—the flame escaping from the funnels of steamboats, and supposed to be continuous from the furnace, being pointed to as evidence of the escape of a large amount of unappropriated heat—it is now known that this flame is produced by the ignition of the gases on the coming in contact with the fresh air, and a careful set of experiments made by Mr. Stephenson and later by Mr. Armstrong gave conclusive evidence that no corresponding advantages are obtained from lengthened flues.

A recent writer in the American *Railway Times* says:

"There are two causes why all the heat which fuel may furnish is not obtained. First, that the inflammable gases, evolved by the heat, are not all consumed from a want of sufficient supply of oxygen, the air drawn through the fire being only sufficient to decompose more fuel than when decomposed it could burn, or supply with oxygen. The thick smoke, that escapes from a chimney, when fresh fuel is thrown in, is unconsumed gas, decomposed from the fuel without enough oxygen to burn, although there may have been a sufficient supply of heat."

* * * * * * *

"A second cause why the whole value of the produced heat is not obtained, is that so much is abstracted from the gases in passing through long tubes, that there is not enough left to continue the combustion, although the inflammable gas is still there. That a tube or any substance in the way of the gas does absorb heat enough to prevent the burning of the gases, is proved by the action of Davy's safety lamp. This is a common light, surrounded by a wire gauze, which so absorbs the heat from the flame, as to extinguish the latter at the gauze, by applying fire above the gauze the gas is again kindled, showing plainly that want of heat above had extinguished the flames."

To remedy the waste of heat resulting from these causes Mr. McConnell of the London and North Western Railway (England) introduced in some of his Locomotives what he termed a "*Combustion Chamber*," dividing his flues into two lengths—into this chamber a sufficient quantity of fresh air was introduced to produce the combustion of the gases; escaping unburned from the first length of tubes—in fact producing precisely the same phenomena in the combustion chamber as we frequently notice at the top of steamboat funnels. The arrangement is said to have produced the most satisfactory results as regards economy, though the practical difficulties in carrying it out, have prevented its introduction to general use; enough was done, however, to demonstrate the correctness of the theory, and there is no doubt but a duly regulated supply of oxygen in the tubes at that point in the length where the heat of the escaped gases would be just sufficient to ignite the mass, would be productive of a more complete absorption of the heat generated, than is affected in flues of the ordinary construction.

A most important influence is exercised on the consumption of fuel by the form and position of the heating surfaces through which the heat is transmitted to the water. Mr. Armstrong found that "a cubical metallic box submerged in water, and heated from within, generated steam from its upper surface more than twice as fast as from the sides when vertical, and the bottom yielded none at all. By slightly inclining the box, the elevated side much more easily parted with the steam, and the rate of evaporation was increased, while in the depressed side the steam hung so sluggishly, as to cause overheating of the metal."* Hence the advantages resulting from inclining the fire box

* Tredgold on the Steam Engine, vol. 1, 1850.

sides so as to allow the free escape of steam, and hence the truth of the observation that "the object of the fire box is more to generate heat than to absorb it, and the absorption takes place chiefly in the tubes."

In relation to the tubes Mr. D. K. Clarke says: "There is reason to believe that in the upper semi-circle part of such tube, the efficiency chiefly resides. The winding progressive motion, observable in tubes of considerable diameter, confirms the conclusion, as it is with much probability due to the cooling of the upper portions of the gases of combustion which, as they cool, also become heavier, and descend laterally to make room for the hotter smoke next the bottom of the flue, the general result of which is the spiral motion of the current in its progress forwards."*

The writer in the *Railway Times* has introduced most of the above quotations in his article, apparently for the purpose of paving the way for proposing a new plan of constructing Locomotive Boilers. If Mr. Clarke reasons correctly, however—and his argument appears to have been well considered and based on actual experiment—it is difficult to understand what advantages are likely to arise from the introduction of Montgomery's principle into the construction of the Locomotive Boiler, as proposed by the writer above alluded to, for though there is no doubt but an advantage in point of area would be obtained by applying the heat to the outer instead of the inner surface of the tubes, proportionate to the increased diameter, we are still unable to reconcile the following with Messrs. Armstrong and Clarke's experiments and deductions in relation to vertical free surfaces:

"If the ideas of Clarke and of Overman are correct, the value of vertical flues with the water inside, as compared with the horizontal flues with water outside, will be as follows: neglecting the physical advantage of applying heat to the convex surface so highly estimated by Overman.

One half of the surface of the horizontal tube (the upper half) is available, but this half generates steam twice as fast as the vertical sides of the upright tubes. Thus the amount of evaporation will be the same in either position for the same absolute tube surface, not considering the increase obtained by applying the heat to the increased surface of the outside over the inside."

Now it appears to us that Mr. Armstrong has shown that vertical surfaces are only one half as efficient as horizontal ones

* Railway Machinery, folio 126.

placed over the heat, and Mr. Clarke clearly says that the principal efficiency of tubes is in the upper semi-circle, from which it evidently results that the vertical tube would not be any more efficient, if so much so, as the horizontal one, unless the advantage resulted for the application of the heat to its exterior surface.

There are some good suggestions, however, in the following remarks, and especially in reference to contracting the ends of the tubes by the insertion of ferrules, which we have ever viewed as a serious, though unavoidable evil:

"We now submit the following application of Montgomery's boiler to the locomotive engine for increasing the efficiency of the steam-generating parts. Retaining the common firebox shell, produce it forwards, so that it shall just clear the driving axle, then let the sides drop to within two feet of the rail, and close up the bottom. Next, inside of this, place a rectangular box, which shall be a continuation of the inner fire-box, the top being about 9 inches above the diametric chord of the barrel, leaving a water space of 4 to 5 inches between the sides and bottom of the boxes. Fill the inner box with vertical tubes, the top and bottom being flue plates. The tubes being screwed in at one end, and fitted with a screw thimble at the other, may be removed for cleaning at any time, and will effectually stay the inner box against the immense pressure to which it is subjected. The pressure, being inside of the tubes, will tend to keep the end joints tight, where in the common boiler the reverse is the case.

"That the gases may retain sufficient heat to burn until they are discharged, there should be less tube surface to absorb the heat at the back, than at the front end; a requirement which is easily satisfied by decreasing the number and increasing the size from the front to the back end. *In the common boiler the ferrule area being less than the flue area, a stronger blast is required than is economical, because by drawing hard enough to get the gases through the ferrules, we draw too hard to carry them through the flues at a rate slow enough to admit of a complete extraction of their heat.* By means of the vertical flues we may arrange the gas area in any way we please, making it larger at the fire end, if necessary.

"Again, any amount of oxygen may be applied to the gases at any point of their passage from the furnace to the smoke box, by the admission of fresh air to any part of the barrel; thus the advantage of a combustion chamber (if there is any) is obtained without the sacrifice of a single inch of tube surface, as we are required only to admit the air between the tubes, and not inside of them. This may be done either by hollow stay bolts, or by larger openings, which may be opened or shut at pleasure.

"If the gases in passing through the boiler are left to themselves, we get without an effort the effect produced by Montgomery's third claim, viz., the application of the heat to the upper half of the tubes, by which circulation is established. And, however we wish to apply the passing heat to the flues, complete control over the motion of the gases may be had by a Venetian blind draught regulator at the smoke-box end of the flues, made in two parts, the upper and lower parts moving independently. Of course, by opening the lower and closing the upper damper, we draw the gases downwards, and *vice versa*.

"It might be objected that so much flat boiler surface would make a form more liable to explosion, than the circular barrel. Experiments lately made by Wm. Fairbairn of England, induced by the bursting of a locomotive fire-box at the flat sides, prove that the flat surfaces are the strongest part of the boiler, or, to use his own words, 'are conclusive as to the superior strength of flat surfaces, as compared with the top, or even the cylindrical part of the boiler.' His experiments show that two plates, 1-4 and 3-8 in., connected by screw stay bolts at a distance of 4 inches from centre to centre, will resist over 1000 lbs., square inch, and where 5 inches from centre to centre over 500 lbs."

By such a plan of engine we may always have any amount of heating surface with a moderate sized boiler and a low centre of gravity.

Of course such a boiler would be impossible with inside connections, but apart from the difficulty of keeping the flues tight and preventing an accumulation of ashes and dirt on the lower flue sheet, there does not appear to be any great practical difficulty in the way of construction —though, with the insertion of ferrules in the upper end of the tubes a serious obstacle would be offered to the disengagement of the steam which might result in overheating the metal, and even to explosions.

It has been surmised that the latent heat in water under pressure could be more freely disengaged by the agency of electric currents, and that in this way a great saving of fuel would be effected. We have not until recently seen any definite proposal as to the mode of applying this agency. A Mr. Harshman of Dayton, Ohio, however, professes to have made some important discovery in this direction, but the details of his experiments are given in such a manner as not to inspire much confidence in their value. Had the duration of the experiments—the time required to raise the steam to the pressure indicated—the temperature of the water at the commencement—the quantity of fuel used, and the quantity of water, been carefully noted, the experiment would have possessed much greater value; as it is however, it is sufficient to excite enquiry. It is not improbable that electricity may exercise an influence in converting water into steam, which has never been assigned to it, and we may yet live to see the combined action of electricity with heat and water produce as great an extension of the application of steam power as was effected by the improvements of James Watt.

Mr. Harshman's theory is: that water contains a large amount of latent heat, which, under some circumstances is capable of being rapidly and dangerously developed, and under others, of being gradually freed without danger, and that to accomplish this it is necessary to establish an electric or galvanic equilibrium in the boiler. That an iron boiler, covered in all but its fire surface and flues, with a copper coating, generates steam very rapidly, saving half the fuel, and cannot be exploded. It may rupture by over-pressure and relieve itself by allowing an escape of steam, but it cannot explode. The correctness of this theory Mr. Harshman says he has illustrated by repeated experiments, in every one of which the result has been uniformly satisfactory. Having satisfied himself on this point, he is now taking measures to bring his discovery and invention to the attention of the public, very justly believing that it will be properly appreciated so soon as sufficient evidence is furnished of its efficacy to prevent the recurrence of a species of calamity highly destructive to life and property.

The following details of the experiments carried on by him are from the *Railroad Record* of the *Railway Times.*

"The experimental boiler employed was a small cylinder without flues, twelve inches long and eight inches in diameter. The cylinder was made of iron 29 inches thick, and the ends somewhat thicker. The seams were riveted and soldered, and the safety valve fastened to the boiler by solder. The furnace was of common construction, without return flue. The boiler was placed in a strong frame of iron, the ends being confined, one by a bar extending across the end, and the other by a square piece of iron in the centre. One half the surface of the cylinder was exposed to the action of the fire, the other half was covered with copper. The ends were also covered with copper. The safety valve was confined by a long wire attached to a spring balance. The fuel employed was hickory wood well dried. The boiler being placed in such a position that its explosion could do no damage, the fire was lighted, and the observers withdrew to a distance to observe the pressure at the balance, and watch the operation of the experiment. In a few moments, steam had risen to a hundred, a hundred and fifty, and two hundred pounds, and in less than half an hour the balance indicated a pressure of two hundred and sixty pounds. At this point, steam was observed to issue from underneath the copper sheeting. The safety valve was drawn tighter, and the fire continued for ten minutes, steam continuing to issue. The safety valve was then loosed and steam blown off, and the fire put out. On first examination, the boiler seemed only to have opened at the seam around the front head, and at the point where the safety valve was fastened; but subsequent careful inspection shewed that the iron had opened in little fissures in several places which were perfectly tight under any ordinary pressure, but gave vent at the high pressure to which this experiment was carried. The ends of the boiler had bulged out to some extent, and the impression of the square nut at one end was left very distinctly crushed into the copper jacket. The day was clear and cold, with the wind blowing from the West. This experiment was repeated on Saturday with the same result. Now, according to all ordinary experience, the boiler should have burst with great force. Yet we are witness to the fact that it only ruptured and gave vent to the steam as easily as a safety valve usually relieves an ordinary boiler."

Such an experiment, if conducted on a larger scale with similar results, and with all particulars noted as mentioned above, would justify us in attaching great importance to Mr. Harshman's theory. Such experiments cannot be instituted in a satisfactory manner without the expenditure of more money than can generally be spared by private individuals, and it will require the favourable opinion of those whose knowledge of electricity fits them to pronounce on the probability of such results being secured ere the requisite outlay would be made.

THE SOUTHERN SHORES OF LAKE SUPERIOR.

BY DANIEL WILSON, LL. D.,

PROFESSOR OF HISTORY AND ENGLISH LITERATURE, UNIVERSITY COLLEGE, TORONTO.

Read before the Canadian Institute, March 1st, 1856.

The vast inland fresh-water sea which constitutes the head reservoir of the great chain of lakes that sweep over the Falls of Niagara, and find their way to the ocean by the River St. Lawrence, has been as yet so slightly encroached upon by the pioneers of modern civilization, that the glimpses which even a very partial examination of its shores affords of some of the phenomena peculiar to them, may not be unacceptable to the members of the Institute. With its wide extent of waters, covering an area of thirty-two thousand square miles, a lengthened period of sojourn in the regions with which it is surrounded, and many facilities for their exploration, would be required, in order to satisfy the curiosity of scientific enquirers in relation to their varied attractions. But even a brief visit discloses much that is highly interesting, and that serves at once to illustrate, and to contrast with what comes under the observer's notice elsewhere. Having employed both pen and pencil in noting several of the most striking features which catch the eye from their novelty, a description of some of them may not be unacceptable in the absence of more valuable contributions, even though trenching on the legitimate grounds of the geologist, with the mere notes of an amateur observer.

The settlers on the shores of the great fresh-water lakes of this continent are cognizant of various remarkable formations, differing from the phenomena with which the dwellers on the sea-coast are familiar. Of one class of such, the peninsula, or "Island" of Toronto Bay, is a striking, though by no means singular example. Similar natural barriers—hooks or spits, as they are termed, according to the curved or straight outline of their extremities—are still in course of formation on Lake Erie, as well as at other points on the shores of Ontario, by the waves and currents, under the action of the winds in certain prevailing directions, wasting away salient points of the coast, and depositing the detached debris on a less exposed bottom. Peninsular barriers of this class are to be met with also on the higher lakes, and constitute indeed a striking feature among the littoral features of Lake Superior. Certain peculiarities, however, distinguish the formations of this class in Lake Superior, from those belonging to the lower lakes; and it would seem as if a special character were traceable in such on each of the lakes. Owing to its uniform shallowness, the waters of Lake Erie appear to differ to a certain degree from those of Lake Ontario—which otherwise it most nearly resembles,—in their mode of action and the consequent results; while both present a striking contrast in these respects to Lakes Huron and Michigan, with their main coast lines running nearly due north and south, and thereby subjected to very varied actions from the same winds and currents. This diversity of aspect becomes still more apparent, when the same forces are found in operation, but the materials opposed to this united action are no longer the loose drift formations of the lower lakes, but the rock-bound coasts of Georgian Bay and Lake Superior.

Availing myself of the partial opportunities afforded by a brief sojourn on some parts of the shores of Lake Superior during last summer (1855) I was much interested in observing some of the singular conformations produced along its varied coast lines by the action of the waves or currents of that magnificent inland sea. Of these, no features are so remarkable as those presented by a portion of the extensive range of sand-stone cliffs which rear their massive fronts, and project their jagged and picturesque cliffs from the southern shore, soon after passing the Grand Sable: the first feature of commanding interest which meets the explorer after leaving the Rapids of Sault Ste. Marie. Here the rounded and slightly undulating shores, with their coast line of sand and loose shingle, is suddenly changed for a long reach of coast, still rounded in its forms, but rising abruptly from the shore in dune-like masses, to a height of upwards of three hundred and fifty feet. At their base the edges of the sand-stone strata are occasionally exposed by the action of the waves, but the greater portion of their surface is formed by sand and debris; and the same materials loosely accumulated on their tops, afford only at rare intervals sufficient soil for the trees, which elsewhere line the whole southern shore of Lake Superior with that unvarying monotony so familiar to the eye of the American traveller. Beyond the Grand Sable, the coast trends rapidly to the southward until it reaches the most southerly point of the lake, in the beautiful and sheltered harbour behind Grand Island: which in some respects reminded me of the magnificent natural harbour in the Clyde, formed by the sheltering barrier of Holy Island, and the bold coast of the Isle of Arran; though in the solitude of its embayed waters it presents a striking contrast to Lamlash Bay, towards which the merchant fleets of the Clyde, and of the whole Irish Channel, may be seen crowding all canvass to escape the dangers of a westerly gale. In approaching this fine natural harbour from the east, the coast presents for upwards of ten miles, a range of rocky cliffs of varying character and elevation, but rising in some places to a height of fully two hundred feet; and it is on a portion of this range of sand-stone rocks that the French voyageurs, from one of its peculiar features, conferred the name of "Les Portails," while they are more generally known to the American traveller by that of "the Pictured Rocks." To this latter name a fresh interest has been recently given by its introduction into Longfellow's Indian "Song of Hiawatha," where, in his hunting of the Storm Fool, Pau-Puk-Keewis fleeing from Hiawatha:

Sped away in gust and whirlwind,
On the shores of Gitche Gumee,
Westward by the Big-Sea-Water,
Came unto the rocky headlands,
To the Pictured Rocks of Sandstone
Looking over lake and landscape.
  And the Manito of mountains
Opened wide his rocky doorways,
Opened wide his deep abysses,
Giving Pau-Puk-Keewis shelter
In his caverns dark and dreary,
Bidding Pau-Puk-Keewis welcome
To his gloomy lodge of sandstone.

* * * * * * *

Then he raised his hands to heaven,
Called imploring on the tempest,
Called Waywassimo, the lightning,
And the thunder, Annemeekee;
And they came, with night and darkness,
Sweeping down the Big-Sea-Water,
From the distant Thunder Mountains;
And the trembling Pau Puk-Keewis
Heard the footsteps of the thunder,
Saw the red eyes of the lightning.
  And Waywassimo, the lightning,
Smote the doorways of the caverns,
With his war-club smote the doorways
Smote the jutting crags of sandstone;
And the thunder, Annemeekee,
Shouted down into the caverns,
Saying, "Where is Pau-Puk-Keewis!"

It is something altogether novel to have the spirit of its own national poetry thus associated with scenes of this new world, and breathing over them a living soul akin to that which haunts with such thrilling memories the cave of Staffa and the rocky shores of Iona. The striking, and in some cases, singularly beautiful forms of the Pictured Rocks, have been hewn out of the sand-stone cliffs along the south-eastern shore of the lake, by the prolonged action of the winds and waves sweeping from "the distant Thunder Mountains" of the far north through unrecorded centuries, and exhibit all the fantastic and picturesque variety which is so characteristic of the wave-wrought sculpturings of Nature's architecture. They have been described with considerable minuteness in Messrs. Foster and

Whitney's "Report on the Geology of Lake Superior," and are there spoken of in general terms as "a series of sand-stone bluffs, extending along the shore of the lake for about five miles, and rising in most places vertically from the water, without any beach at the base, to a height varying from fifty to nearly two hundred feet. Were they simply a line of cliffs, they might not, so far as relates to height or extent, be worthy of a rank among great natural curiosities, although such an assemblage of rocky strata, washed by the waves of the great lake, would not, under any circumstances, be destitute of grandeur. But in the Pictured Rocks there are two features which communicate to the scenery a wonderful and almost unique character. These are, first, the curious manner in which the cliffs have been excavated and worn away by the action of the lake; and second, the equally curious manner in which large portions of the surface have been colored by bands of brilliant hues."*

The rocks thus referred to have been figured by the authors, as well as by Schoolcraft; but they have been greatly less successful with their pencils than their pens. The former state their intention of supplying the want of a full and accurate description of the extraordinary locality, "partly by a series of illustrations, which, however deficient in artistic effect, have the merit of being careful copies from nature." But after having sailed close in shore, along the whole range of these magnificent cliffs, and availed myself of opportunities of sketching some of their most striking features, I must state that while the subjects of these illustrations can, in nearly every case, be recognised, they are altogether deficient in detail, and convey not only a very imperfect, but in many cases an inaccurate idea of the objects represented. It is not improbable that the original drawings may have been more faithful in their representations than the lithographed copies. Certainly, at least, faith in the fidelity of the latter is not strengthened by such supplementary features as a birch-bark canoe rigged with a high square sail, with one of its crew seated on the front cross-spar, as on the seat of an ordinary boat, and an Indian with flowing scalp-lock standing steering in the stern! (Plate IX.) Such artistic incongruities are much more suggestive of the Broadway lithographer's than of the surveyor's pencil.

The Pictured Rocks constitute a succession of bold promontories rearing their lofty and fantastic façades of natural architecture directly from the water's edge. The Indian name of these cliffs, *schkue-archibi-kung*, or "the end of the rocks," implies their being first

* Reports of the Geology of the Lake Superior Land District. Vol. II., p. 125.

visited by the Indians in the passage from the western regions going eastward down the lake towards the Sault Ste. Marie. Tracing their picturesque details in this direction, the voyager on sailing inside Grand Island, towards the shore, gradually approaches a range of stratified sand-stone cliffs, banded in layers of white, yellow, red, and deep-brown strata, and streaked with strongly-marked veins of perpendicular coloring, occasioned apparently by the water oozing through the seams impregnated with metallic oxides, or other coloring matter, and distributing it over the broad bands of white sandstone which constitute the main mass of the rock, and lie between the thin layers of colored rock or shale. In describing one magnificent segmental curve of the cliffs, to which, from its lofty and regular proportions, Messrs. Foster and Whitney have given the name of "The Amphitheatre," they remark: "It is in this portion of the series that the phenomena of colors are most beautifully and conspicuously displayed. These do not by any means cover the whole surface of the cliff, even when they are most conspicuously displayed, but are confined to certain portions of the cliffs in the vicinity of the Amphitheatre; the great mass of the surface presenting the natural, light-yellow, or raw sienna color of the rock. The colors are also limited in their vertical range, rarely extending more than thirty or forty feet above the water, or a quarter, or a third of the vertical height of the cliff. The prevailing tints consist of deep-brown, yellow and grey; burnt sienna and French grey predominating. There are also bright blues and greens, though less frequent. All of the tints are fresh, brilliant and distinct, and harmonize admirably with one another, which, taken in connection with the grandeur of the arched and caverned surfaces on which they are laid, and the deep and pure green of the water which heaves and swells at the base, and the rich foliage which waves above, produce an effect truly wonderful." This aspect accordingly, predominating over the other striking features of these rocks, suggested their English name, while the voyageurs of French descent, conferred on them a designation derived rather from their most characteristic forms. Many portions of the cliffs are indented by wedge-shaped recesses, which leave the intervening rock projecting like the wasted round towers or bastions of an ancient castle, while the loose soil and shale at top, yielding more freely to the action of the atmosphere, and of moisture and frost, have most frequently assumed the form of a conical roofing, greatly adding to the artificial look of the whole. In one group, especially, a little to the west of the magnificent natural arch styled "Le Grand

Portail," the illusion was for the time complete, which suggested to the fancy one of the ancient ruins of Roman masonry still to be seen in the south of England, where the tiers of chalk or stone are banded by occasional layers of the flat-tile Roman brick.

The cliffs are hollowed, arched, and perforated into caverns, evidently by the action of the waters when at a much higher, and varying relative level. Two groups of these, designated respectively the "Chapel" and the "Miner's Castle," have been excavated into aisles, arched recesses and columns, so as to rival the most picturesque ruins of the castled Rhine; while overhead the foliage of the uncleared forest crests their summits, and at one spot near the Chapel Rock, a beautiful cascade dashes in white foam over the cliffs into the Lake:

"The rolling stream, the precipice's gloom,
The forest's growth, and Gothic walls between,
The wild rocks shaped as they had turrets been
In mockery of man's art."*

"Le Grand Portail" is another of the more striking features of this scene. A huge quadrangular mass of rock projects out several hundred feet from the main range of cliffs, terminating, at their eastern end, one long and singularly picturesque group. Looking on this at a little distance, from the northwest, it presents the appearance of a castellated structure flanked on the west by two massive, but time-worn bastions with an irregular curtain wall between; and by a boldly projecting circular tower. A square, but time-worn mass terminates it on the east, while between, an elliptical arch seemingly from certain points nearly symmetrical in structure, appears to have been thrown over the intervening space, forming the Grand Portal, the dimensions of which, as given by the United States geologists, are about one hundred feet in height, and one hundred and sixty-eight feet wide at the water level. This forms the entrance into a vast cavern, or domed hall, hewn by the waves out of the projecting mass of rock, and perforated through another side of the cliff; while smaller arches and caverns correspond to the posterns and sally-ports of the ancient fortress which it so much resembles. Of this magnificent natural formation, the view in "The Geology of the Lake Superior Land District," is so deficient in every characteristic detail, with the single exception of a representation—far from minutely correct,—of the great archway which gives the name to the group of rocks: that in comparing it with the original, I conceived I must be looking on a sketch of some other portion of the Pictured Rocks to

* Childe Harold, can. III., s. lxi.

be afterwards seen. Instead of the square rectangular mass, with perpendicular walls, as there figured, it is worn away around the base, and to a considerable height, leaving the upper portions, especially on the western side, overhanging like the projecting turrets of the mediœval castle to which it has already been compared. The arch, also, is a flat, segmental, rather than a semi-circular arch, and its side-walls are jagged and under-worn, so as greatly to add to the picturesque outline of the mass, without marring the castellated character which pertains to is as a whole.

But the most wonderful illusion of all the fantastic sports of nature in this singular scene, is what is called the "Sail Rock." Here a quantity of debris has accumulated in a sloping tail at the base of the cliff, and on this a group of huge detached slabs, dislodged from the rock above, have been thrown together so as to represent the hull, jib, and mainsail of a sloop. These large slabs, one of them measuring nearly forty feet in height, rest against the cliff with their faces nearly at right angles to it; and when I saw the group, about midday under a bright summer sun, the whole of the cliff was in shadow, while the sun illuminated these detached blocks, and produced an effect so complete, that had I not examined them closely before seeing them under this aspect, it would have been scarcely possible to doubt that we were looking on a sloop-rigged vessel running in-shore, in full sail, for some inlet or harbor concealed by the rocky coast.

This remarkable range of rocks lies in the centre of the long indentation, which, sweeping from Keweenaw Bay eastward to White Fish Point, forms the bay behind Grand Island, the coast most distant from the northern shores of the Lake. Here they have been exposed through unnumbered ages to the action of the northerly winds, which have materially affected the diverse characters of the northern and southern shores of the Lake, while the process of upheaval, prolonged probably through vast periods of time, has contributed no unimportant share in the operations by which their present forms have been produced.* Lying as they do in the arc of the bay,

* While the elevation of the land, as the chief cause of the more remarkable changes dependent on the relative levels of the Lake and its shores, is proved by very obvious evidences, it is well known that the level of the Great Lakes is not of that unvarying and constant character which pertains to the ocean; and as the special attention of the Institute has been directed to the "rise and fall of the Lakes," the following notice, extracted from the Lake Superior Journal of July 23, 1851, by the U. S. geologists, may be worth repeating here:—"While at Grand Island, a few days since, Mr. Williams gave us an account of a remarkable instance of the sudden rise and fall of water, at that place in 1845. On a certain day, with

and behind Grand Island, they are remote from the regular line of traffic, and unless the voyager on Lake Superior avails himself of a canoe, or joins a pleasure party specially bent on exploring the attractive and picturesque features of the Lake, he may pass over its wide extent of waters, without obtaining more than a remote glimpse of the general aspect of the cliffs which present so many striking features when approached and viewed in detail.

To the westward of Grand Island, the traveller who pursues this voyage up the Lake, comes once more on rocky cliffs in the vicinity of Marquette. On the Marquette Landing,—so named after Father Marquette, the Jesuit missionary, by whom the Mississippi was reached in 1673,—were piled the rich products of the "Jackson Iron Mountain," twelve miles distant; and in the vicinity of the Landing there are groups of abraded and scratched trappean rocks, rounded and worn down, excepting where some of the deeper fissures and hollows lying beyond the reach of the active agent in the polishing of their exposed surfaces, show by the contrast the force of the action that must have been at work to smooth and round them into their present forms. Availing myself of a pocket compass, I noted that the scratches on the abraded surface of the rocks run nearly due N. and S., slightly inclining to N. E. and S. W. Immediately to the north of Marquette, the bold promontory of Presque Isle attracts attention from its rocky coast, presenting in some respects a marked contrast to the Pictured Rocks, though, like them, also indented and hollowed out into picturesque masses, and pierced with wave-worn caverns: the work of a former era, when the relative levels of the Lake and shore greatly differed from their present relations to each other. The rocky coast consists of a water-worn red sandstone (Potsdam ?) overlying a dark weathered igneous rock, granite or trap. Of this—with the exception of the Pictured Rocks, the boldest coast of the whole southern Lake shore,—I speak chiefly from observations made while sailing along in close vicinity to the picturesque headlands which here project into the Lake. Parts of the coast which I was able to examine are granite, and a bold rocky island which rises abruptly out of the water, about six miles from the shore, bears the name of Granite Island from its geological formation. But it is just at Presque Isle that the crystal-

---

out any appearance of wind on the Lake, the water rose and fell several times during the day, from four to five feet above high water mark. The weather was calm before and after the occurrence, and this was the case for a hundred miles, at least to the northwest of the Island, for Captain Smithwick, of the schooner Algonquin, was that day off Copper Harbor, and nearly becalmed."

line schists, with their intermingling masses of trappean and quartz rocks, richly impregnated with the specular and magnetic oxide of iron, pass into the granite and sandstone rocks, which intervene between the ferriferous formations and the copper-bearing traps of Keweenaw Point, and it is of this very locality that the authors of the report on the geology of the district remark: "It would be difficult to select another spot along the whole coast, where the rocks of so many epochs, from the oldest to the most recent, are represented. It contains an epitome of nearly the whole geology of the district."

With the exception of these strikingly marked rocky lines of the coast, the general character of the Southern Shore of Lake Superior is devoid of any very bold features, but consists almost entirely of the same rounded elevations and terraces, with gently sloping shores, or crumbling escarpments of drift, with which we are familiar on the lower lakes; and covered every where with dense forests down to the water's edge. In no place do the surrounding hills, to be seen inland, rise to such an elevation as to present any very striking general feature in the view, although on landing and exploring the scenery lying beyond the coast line, some bold and striking features in the landscape well repay the toil; as in the magnificent cliffs of trappean rocks running in a southwesterly direction from Keweenaw point to the Montreal River, and presenting their perpendicular sides to the south-east.

In reference to this character of the Southern Shore, Mr. J. Elliot Cabot, the author of a narrative of the Tour undertaken under the direction of Professor Agassiz in 1848, remarks* "Lake Superior is to be figured to the mind as a vast basin with a high rocky rim, scooped out of the plateau extending from the Alleghanies to the Mississippi Valley, a little to the south of the height of land. Its dimensions according to Captain Bayfield, are three hundred and sixty miles in length, one hundred and forty in breadth, and fifteen hundred in circumference. The mountainous rim is almost unbroken; its height varies from the average of about three or four hundred feet, to twelve or thirteen hundred; the slopes are gradual towards the north, and abrupt on the opposite side, so that on the north shore the cliffs rise steeply from the water, whilst on the south it is said the ascent is more gentle, the abrupt faces being inland. This difference of formation, joined to the prevalence of northerly winds, has given very different aspects to the two shores; the southern showing broad sand-beaches and remarkable hills of sand, whereas on the north

* "Lake Superior, its Physical Character," &c., p 123.

shore the beaches are of large angular stones, and sand is hardly to be seen except at the mouths of rivers. The rivers of the southern shore are often silted up, and almost invariably, it it said, barred across by sand spits, so that they run sometimes for miles parallel to the lake, and separated from it only by narrow strips of sand projecting from the west." In these remarks it will be seen that the writer speaks only in part from personal observation, though his observations receive confirmation from the detailed survey by Messrs. Foster and Whitney of the chief features of the southern shore.

The alteration in the relative levels of land and water, which is so strikingly recorded on the exposed face of the rocky coast, also finds its record in the less marked features of the river beds; and a discovery of copper relics, already brought under the notice of the Institute,* made during the past year near the mouth of the Carp River, some two miles to the south of Marquette, also disclosed evidence of an ancient river bed, situated about ten feet above the level of its present channel. On this subject Professor Agassiz, after describing the terraces, which form a striking feature of the lake shore, remarks:† "We must consider also, the river terraces which present similar phenomena along their banks all around the lake, with the difference that they slope gradually along the water courses, otherwise resembling in their composition the lake terraces, alltogether composed of remodelled glacial drifts, which, from the influence of the water and their having been rolled on the shores, have lost, more or less, their scratches and polished appearance, and have assumed the dead smoothness of water pebbles. Such terraces occur frequently between the islands, or cover low necks connecting promontories with the main land, thus showing on a small scale, how, by the accumulation of loose materials, isolated islands may be combined to form larger ones, and how, in the course of time, by the same process, islands may be connected with the main land.

The lake shores present another series of interesting phenomena, especially near the mouth of larger rivers emptying into the lake over flats, where parallel walls of loose materials, driven by the action of the lake against the mouth of the river, have successively stopped its course and caused it to wind its way between the repeated accumulation of such obstacles. The lower course of the Michipicotin River is for several miles dammed up in that way, by concentric walls across which the river has cut its bed, and, winding between them, has

* Ante, page 235.

† "Lake Superior, its Physical Character," &c., pages 414, and 415.

repeatedly changed its direction, breaking through the successive walls in different places." To these Mr. Foster has given the name of river-belts.

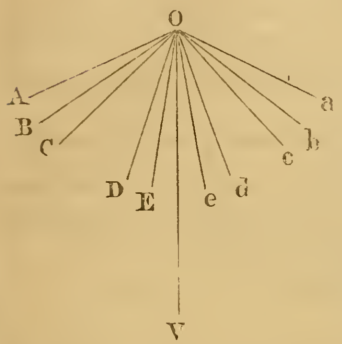
A striking example of this phenomenon attracted my attention from the gigantic scale on which it is exhibited, as well from some features peculiar to the particular case referred to; and a brief reference to it may be the more pardonable, as neither Professor Agassiz nor Messrs. Foster and Whitney appear to have extended their observations so far west as the Fond du Lac, where it occurs. The northern shores of Lake Superior may be roughly described as forming the segment of a circle, which terminates at its western end in the Fond du Lac, a comparatively narrow and deep inlet, or cul de sac, into which the waters of the St. Louis, Nemadji, and Aloues Rivers empty their streams. At this point the lake is exposed to the full force of northern and north-westerly winds, while the magnitude of the St. Louis River opposes to the silting action of the Lake a force well calculated to develope some of the most striking features of the phenomena in question. From either side of the Lake two long and narrow tongues of land project towards each other, leaving between their extreme points only a narrow channel, 2400 feet in width, to admit of entrance into Superior Bay, and to afford an exit for the waters of the rivers which there enter the lake. The northern tongue, which is called Minnesota Point, extends across the bay, between six and seven miles, while its average breadth is only seven hundred feet, and on the extreme point of it a picturesque group of Indian lodges shows that the aborigines have not yet deserted the shores of the great lake. Wisconsin Point, which stretches towards it from the southern shore, measures fully three and a half miles in length; while, within this outer barrier, a second series of walls is constructed independently by each of the rivers; one of these on the western side of the Nemadji forms an irregular and narrow tongue of land, about 4500 feet in length, and, with the broader delta of the same material, on its eastern side, projects the channel of the river far into the Bay of Superior. The inner peninsular formations at the mouth of the St. Louis are on a still larger scale, and run parallel to the Minnesota Point. The northern St. Louis Point stretches towards the southern one, across the bay of St. Louis, at the mouth of the river, fully one and a half mile in length, and smaller formations show the same process going on in the development of inner concentric lines. This remarkable series of spits and river-belts, it will be perceived, is on a scale of magnitude, far surpassing anything else to be met with along the shores of the great lakes, and is rather to be compared in its largest features, with such oceanic structures as those which the currents of the Atlantic have built up on the New England coast. On the shores of the Bay of Superior at the mouth of the Nemadji River, the site of the future town of Superior has been selected, and already plans are organising for constructing a railroad to the Mississippi, and thus completing by this northern lake-route a line of connexion between the Gulf of Florida and the great northern chain of lakes which find their outlet in the Gulf of the St. Lawrence. To the traveller fresh from the scenes of ancient European civilization, and influenced by the preconceived ideas naturally engendered by the circumstances of countries settled ages ago, and long densely populated, the opening up of a highway through the wilds of these western forests, and the planning and laying out of a city in this remote wilderness, seem chimerical in the extreme. Nevertheless, the proposed railway will only restore, for the new occupants of this continent, the ancient route by which the metallic treasures of these northern wilds were distributed throughout the regions watered by the Mississippi, and the prized sea shells of the Gulf of Florida, with the more substantial products indigenous to southern latitudes, were transferred to the shores of the great northern lakes. It was impossible to avoid feelings of a lively interest in looking on the first clearings, and the commencement of a pier and corduroy road for the city in embryo, destined, it may well be believed, to be the Chicago of Lake Superior, and to rival in magnitude, and in the rapidity of its growth, the most prosperous among the great cities of the new world. Viewed in this light, the remarkable features of Superior Bay and its tributary rivers seemed to possess a peculiar interest, thus seen in their natural state, the gradual formation of ages, and all untouched by the hand of man; presenting in this, as in so many other respects, a striking contrast to the ancient historic rivers of Europe, with their dykes and piers, and breakwaters, the monuments of enterprise and engineering skill, pertaining, like the dykes of the Essex Marshes on old Father Thames, to a date nearly coeval with the Christian era, or reaching backward, like those of the delta of the Nile, to the birth time of history and the infancy of the human race.

A NEW PROOF OF THE PARALLELOGRAM OF FORCES.

BY THE REV. GEORGE PAXTON YOUNG, M. A.,

PROFESSOR OF LOGIC AND METAPHYSICS, KNOX'S COLLEGE, TORONTO.

Read before the Canadian Institute, March 15th, 1856.



In the following proof it is merely assumed that the direction of the resultant of two equal forces bisects the angle (being less than two right angles) between the directions of the forces.

If $AOa = m\theta$, $BOb = (m-1)\theta$, $COc = (m-2)\theta$......... $DOd = 2\theta$, $EOe=\theta$, θ being $<$ a right angle, and m being a whole number; and if OV bisect the several angles AOa, BOb, &c.; the resultant of two forces, each equal to unity, in OA and Oa, lies in the direction OV. Call it R_m; and let R_{m-1}, R_{m-2}, ... R_2, R_1, represent the resultants, likewise in OV, of the same forces, when they act in OB, Ob, in OC, Oc, &c. Then a unit of force in OA, and another in OC, are together equivalent to a single force R_1 in OB. Also a unit of force in Oa, and one in Oc are together equivalent to a single force R_1 in Ob. Therefore a unit of force in each of the lines OA, Oa, OC, Oc, may be replaced by a force R_1 in each of the lines OB, Ob. But the resultant of a unit of force in each of the directions OA and Oa, is R_m, in the line OV; the resultant of a unit of force in each of the directions OC and Oc, is R_{m-2} in OV; and the resultant of a unit in each of the directions OB and Ob is $R_1\,R_{m-1}$ in OV. Therefore,

$$\begin{aligned} R_m + R_{m-2} &= R_1\,R_{m-1}\,. \quad \text{And similarly,} \\ R_{m-1} + R_{m-3} &= R_1\,R_{m-2} \\ \vdots \qquad\quad \vdots \quad &\qquad \vdots \\ R_3 + R_1 &= R_1\,R_2 \\ R_2 + 2 &= R_1^2 \end{aligned}$$

If R_1 may be assumed equal to $2 \cos \phi$, the above equations become $R_2 = 2 \cos 2\phi$, $R_3 = 2 \cos 3\phi$,......$R_m = 2 \cos m\phi$. Now, to shew that the assumption $R_1 = 2 \cos \phi$ is legitimate, it might perhaps be enough to observe that the resultant of two forces cannot be > than the sum of the forces, so that R_1 must be intermediate between zero and 2; and hence its value can always be represented by $2 \cos \phi$. But since it is desirable to take as little for granted as possible, I shall demonstrate that R_1 lies between the specified limits, without availing myself of this additional axiom. Should R_1 *not* lie between zero and 2, it may be denoted by $x+x^{-1}$, x being a positive quantity; and then $R_2 = x^2+x^{-2}$.........$R_m = x^m + x^{-m}$; where all the quantities, R_2, R_3, R, are positive. But this is impossible: for, $\frac{\theta}{2}$ being $< \frac{\pi}{2}$, it is plain that there is some number m, such that m times $\frac{\theta}{2}$ is intermediate between $\frac{\pi}{2}$ and $\frac{3\pi}{2}$, in which case R_m, the resultant of two equal forces, which act in the directions of the lines containing the angle $m\theta$, is negative. Consequently R_1 never can be > 2; and therefore we can assume

$$\begin{aligned} R_1 &= 2 \cos \phi. \quad \text{Hence also} \\ R_2 &= 2 \cos 2\phi \\ &\vdots \\ R_m &= 2 \cos m\phi. \end{aligned}$$

In proceeding to determine ϕ, we shall inquire after its least positive value, which must be $< \frac{\pi}{2}$. Now I say that the least multiple of $\frac{\theta}{2}$ which exceeds $s\pi + \frac{\pi}{2}$, is the same with the least multiple of ϕ, which exceeds $s\pi + \frac{\pi}{2}$: s being any whole number. For suppose that the law holds as far as $(s-1)\pi + \frac{\pi}{2}$. Represent by

$$h\frac{\theta}{2},\ (h+1)\frac{\theta}{2},\ \ldots\ldots\ (k-1)\frac{\theta}{2}$$

the multiples of $\frac{\theta}{2}$ between $(s-1)\pi + \frac{\pi}{2}$ and $s\pi + \frac{\pi}{2}$. Then since the quantities R_h, R_{h+1}, ... R_k, have all the same sign, the angles $h\phi$, $(h+1)\phi$, .. $(k-1)\phi$, of which they are the double cosines, must be betwixt $(s'-1)\pi + \frac{\pi}{2}$ and $s'\pi + \frac{\pi}{2}$, s' being a whole number. But $h\phi$ lies between $(s-1)\pi + \frac{\pi}{2}$ and $s\pi + \frac{\pi}{2}$; therefore, $s' = s$; and $(k-1)\phi$ agrees with $(k-1)\frac{\theta}{2}$ in being $< s\pi + \frac{\pi}{2}$. But $\frac{k\theta}{2} > s\pi + \frac{\pi}{2}$; and, since $\frac{k\theta}{2}$ gives rise to a resultant of a different sign from R_{k-1}, $\cos k\phi$ has changed its sign; that is, $k\phi$ is between the new limits, $s\pi + \frac{\pi}{2}$ and $(s+1)\pi + \frac{\pi}{2}$. Thus, the least multiple of $\frac{\theta}{2}$ which exceeds $s\pi + \frac{\pi}{2}$, is the same with the least multiple of ϕ, which exceeds $s\pi + \frac{\pi}{2}$; and the law holds universally, if it can be shewn to hold in one instance. But reasoning exactly similar to that which we have just employed, proves it to hold when $s=0$. Therefore it is universally true. This leads at once to the conclusion that $\phi = \frac{\theta}{2}$. For take

$$k\phi = s\pi + \frac{\pi}{2} + p,\ p \text{ being} < \phi.$$

$$\text{Then } k\frac{\theta}{2} = s\pi + \frac{\pi}{2} + q,\ q \text{ being} < \frac{\theta}{2}.$$

$$\therefore\ k\left(\phi - \frac{\theta}{2}\right) = p - q.$$

But by taking s sufficiently large, k may be made as great as we please, while $p-q$ retains a limited value. Therefore the equation, $k\left(\phi - \frac{\theta}{2}\right) = p - q$, cannot subsist, unless $\phi = \frac{\theta}{2}$. That is to say: the resultant of two forces, each equal to unity, and whose directions make an angle θ less than a right angle, is $2\cos\frac{\theta}{2}$.

The proof of the Parallelogram of Forces, in the most general case, follows from the result now obtained, by a few easy and well known steps, which it is not necessary to state.

REVIEWS.

Notes on Central America; particularly the States of Honduras and San Salvador: their geography, topography, climate, population, resources, productions, etc., etc., and the proposed Honduras Inter-oceanic Railway; with original maps and illustrations. By E. G. Squier, formerly Chargé d'Affaires of the United States to the Republics of Central America. New York: Harper & Brothers. 1855.

The title page of this volume, of which the above gives only a partial conception, will remind some readers of rarely read dumpy quartos and elaborate folios of the seventeenth century, in which the author, after having invested whole dungeons of learning in his ample pages, seems resolved to write the work over again on his first leaf. Caxton, and Chepman, and Wynkyn de Worde, got on very well without the modern invention of a title page; and the tendency in our own day is—if not altogether to follow their example in dispensing with it,—at least to make, of such "frontispieces," mere titles, and not indexes, catalogues-raisonnés, and tables of contents. The Author of "Notes on Central America," however, has sundry and diverse purposes in view, which even his ample title only embraces under the comprehensive "etc., etc." He has not only to set Ethnologists and Geographers right in relation to the country and its inhabitants, and to instruct the world at large as to the true line for the inter-oceanic railway or canal which shall wed the Atlantic and Pacific Oceans, but he has to nip in the bud "the pretensions of the British Government," and put both hemispheres for the first time in possession of the true bearings of this mysterious Central American difficulty between England and the States, which—notwithstanding Mr. Squier's goodly octavo, and many subsequent elucidations, official and unofficial—is still a mystery: vague, windy, and full of empty bluster, to not a few. A single extract from what the author styles his geographical introduction, will sufficiently shew his animus in this latter direction. After commenting on the imperfect data and blundering inaccuracies of Map-makers, excusable till recently by the unimportant nature of the country, he adds:

"Now, however, the case is widely different: not only is the value of Central America, in every point of view, beginning to be appreciated, but the enterprise of our people is setting in that direction in a full and increasing current. Apart from these strictly geographical errors, there are others in the various maps of Central America which are without apology and excuse; I mean the servile perpetuation in American maps of the arbitrary political subdivisions of the country, made under English authority, to sustain the pretensions of the British Government. The servility on the part of American map-makers shews how little pains they use to verify the facts which they undertake to present, and how profoundly ignorant they have continued to keep themselves of the issue of the scrutiny to which, in Central America, British pretensions have been subjected. Several maps have been published within a year in the United States which are obnoxious to the severest censure on this score.

"I have selected, as an illustration of the justice of these censures, and as affording an opportunity of correcting several surprising blunders, a sheet map, entitled "JOHNSTON'S ILLUSTRATED AND EMBELLISHED MAP AND CHART OF THE NEW WORLD. *New York*, 1844." And here I may observe that, although this map, so far as Central America is concerned, both geographically and politically, is full of the most egregious errors, yet it is in no degree more open to criticism than nine-tenths of the maps of equal pretensions which have been published in the United States. I. For the first time in any map, we find Vera Paz laid down as a distinct state. It is now, as it has always been, a department of the province and state of Guatemala. 2. The British establishment of Belize, the boundaries of which are clearly defined by the treaties between England and Spain as extending only from the Rio Jabon to the Rio Hondo, is represented as including more than four times the amount of territory legitimately pertaining to it, and extending from the Rio Hondo down to the Bay of Amatique. No such limits were ever conceded by Spain, nor by the inheritors of her territorial rights in that quarter of the world, nor have they ever been recognised by the United States or any other civilised country. They are impudent pretensions, which map-makers in England, accessory to the schemes of their own government, have adopted without scruple. The representation of the State of Michigan as a part of Canada West could not be more at variance with truth; and the acceptance of such pretensions in respect to Michigan by American map-makers would not be one whit more absurd than this servility to English authorities in the political divisions of Central America. 3. Honduras, which extends from sea to sea, having a frontage of upward of fifty miles on the Pacific (Gulf of Fonseca), is represented in this map as entirely cut off from that ocean by the states of San Salvador and Nicaragua, which are designated as contiguous; whereas, as I have said, they are separated by the territorities of Honduras. 4. Nearly one-third of Central America is assigned to the "Mosquito Shore," which is here represented as a distinct and sovereign state. The term "Mosquito Shore" never had a political sense, but has always been used geographically to designate a portion of the eastern coast of Central America. The Indians known as "Mosquitos" are only a few thousands of miserable savages, who are strictly confined to the coast, and never had establishments of any kind inland. Essentially fishers, they find a scanty subsistence in the numerous lagoons and creeks near the sea, their only traffic consisting of a few turtle-shells and a little sarsaparilla. Even if these savages were entitled to rank as a nation, they have not, nor could they ever have, the shadow of a pretense of sovereignty over the fractional part of the wide expanse of territory which this map assigns to them. But they have no title of sovereignty over any portion of the country, however small; they do not claim it for themselves; it is only set up on their behalf by Great Britain for sinister purposes, and, so far from being admitted, is positively denied by the United States and every other nation of the globe. The portion of territory assigned by this map to the fictitious Mosquito nationality above the Rio Wanks or Segovia belongs to Honduras; the part below pertains to Nicaragua. 5. The northern boundary of Costa Rica is inaccurate, and not conceded by Nicaragua. But this error may be excused on the ground of conflict of claims between those states. It is, perhaps, not to be expected that a map-maker should have the means of testing the merits of questions of this kind. The true northern boundary line of Costa Rica, as defined in her own Constitution, extends from the lower mouth of the River San Juan to the Rio Salto de Nicoya or Alvarada, falling into the Gulf of Nicoya. Consequently, the territories of Costa Rica do not touch the River San Juan nor Lake Nicaragua, but fall far to the southward of both. The map in question is therefore erroneous in this respect. In short, so far as Central America is concerned, it has no claim to be regarded as an authority. It can serve no purpose except to confuse and mislead.

"It may be claimed that the map here alluded to is general in its character, and does not pretend to specific accuracy. Such, however, is not the case with a large map recently published in London, which has very generally been accepted as an authority, namely, "MAP OF CENTRAL AMERICA, *including the States of Guatemala, Honduras, San Salvador, Nicaragua, and Costa Rica, etc., etc., by* JOHN BAILY, ESQ., R. M.—*Trelawney Saunders, London*, 1850.

"We are not surprised to find embodied in this map all the territorial pretensions and arbitrary political divisions of the country devised and set up by the British government. A few strokes of the colorist's brush have been sufficient to indicate British sovereignty over two-thirds of the Department of Vera Paz in Guatemala, to convert the islands belonging to Honduras, in the bay of the same name, into British dependencies, and to carry Mosquito jurisdiction over more than half of the respective states of Honduras and Nicaragua. Nor has it been less potent in settling the question of boundary between Nicaragua and Costa Rica in favor of the latter state, in which, by a singular coincidence, British influence has always predominated! These peculiarities of the map, in view of its origin, can hardly be regarded as surprising. Those who constructed it have probably smiled to know with what ignorant servility it has been copied on this side of the Atlantic.

"It may nevertheless be said of this map that it is the nearest approximation to accuracy which has yet been published. Still, in many important geographical as well as political features it is deficient, and in others totally wrong. Leaving out of view both Guatemala and Costa Rica, we find a number of most important errors in the remaining states, which appear all the more surprising, since Mr. Baily not only resided for many years in Central America, but must have travelled over a great part of its territories."

This extract is a sufficient clue to the political tendencies of the work, in so far as it bears on questions in dispute between the British and American Governments, and these must be borne in remembrance in studying its contributions to our geographical knowledge of the country, furnished by Mr. Squier, with the aid of large and well executed maps. After making all allowance, however, for the bias so unmistakeably influencing the American Chargé d'Affaires in relation to every thing in which Britain can be supposed to have the remotest interest, the contributions to our geographical knowledge of the important district referred to are interesting and valuable; and the more so as the authorities for many of the details are supplied, and their relative trustworthiness is accordingly patent to all. In the map of Honduras and San Salvador, for example, we learn that the leading points on the proposed line of railway were determined by Lieutenant Jeffers from numerous and careful astronomical observations; and these constitute the basis on which the details within their range are calculated. "These calculations are entitled to additional confidence from the circumstance that there are, both in Honduras and San Salvador, a number of elevated and commanding mountain and volcanic peaks, which are almost constantly kept in view by the traveller, and always enable him to determine his position with considerable accuracy." The bearings of these points have accordingly constituted important fixed data, in so far as they applied. Much, however, still remains, "inserted on the best information that could be obtained, and *in a few instances conjecturally.* The course of the Rio Patuca, and the relative positions of the towns situated on its upper waters, are on the authority of a rude map constructed by the mahogany-cutters who are established on the Patuca River and its tributaries." Other important areas are laid down in like manner, from data furnished by native maps; and how far these are to be relied on for minute accuracy may be guessed by the admission that "little reliance can be placed upon the *Itineràrios* which are appended to the various *Calendàrios* published in Central America in respect of distances. The computations are in leagues, and have been obtained chiefly from the professional *arrieros,* or muleteers of the country, whose estimates of distances are very loose, depending, as they often naively confess; upon *the qualities of their mules!*" And as it would seem that the rate of the arriero's mule has been assumed as the measure of the league in horizontal distance, alike over level ground and broken and mountainous districts, such as abound in the country, the precise value of the results, it is obvious, must present a vague and very variable approximation to the truth.

Both the Geology and the Natural History of Central America receive the attention of the observant author in the course of his work, and owing to the volcanic character of that portion of the American continent, some of his descriptions of the scenery, and his notices of volcanic phenomena, have a special interest. On this subject the following extract will furnish a good example of his style of treatment of such themes:

"The volcanic features of San Salvador are both numerous and striking. Only two of the eleven great volcanoes of the state are what are called "vivo," alive or active, viz., San Miguel and Izalco. The first named rises sheer from the plain to the height of six thousand feet in the form of a regular truncated cone. It emits constantly great volumes of smoke from its summit, but its eruptions have been confined, since the historical period, to the opening of great fissures in its sides, from which have flowed currents of lava, reaching, in some instances, for a number of miles. The last eruption of this kind occurred in 1848, but it resulted in no serious damage.

"It is difficult to conceive a grander natural object than this volcano. Its base is shrouded in densest green, blending with the lighter hues of the grasses which succeed the forest. Above these the various colors melt imperceptibly into each other. First comes the rich umber of the scoriæ, and then the silver tint of the newly-fallen ashes at the summit; and still above all, floating in heavy opalescent volumes, or rising like a plume to heaven, is the smoke, which rolls up eternally from its incandescent depths.

"The volcano of Izalco may, however, be regarded as the most interesting volcanic feature of the state. This volcano and that of Jorullo, in Mexico, described by Humboldt, are, I believe, the only ones which have originated on this continent since the discovery. It arose from the plain, near the great mass of the extinct volcano of Santa Anna, in 1770, and covers what was then a fine cattle hacienda or estate. About the close of 1769 the dwellers on this estate were alarmed by subterranean noises and shocks of earthquakes, which continued to increase in loudness and strength until the twenty-third of February following, when the earth opened about half a mile from the dwellings on the estate, sending out lava, accompanied by fire and smoke. The inhabitants fled, but the *vaqueros* or herdsmen, who visited the estate daily, reported a constant increase in the smoke and flame, and that the ejection of lava was at times suspended, and vast quantities of ashes, cinders, and stones sent out instead, forming an increasing cone around the vent or crater. This process was repeated for a long period, but for many years the volcano has thrown out no lava. It has, however, remained in a state of constant eruption, and received, in consequence, the designation of "El Faro del Salvador," the Light-house of Salvador. Its explosions occur with great regularity, at intervals of from ten to twenty minutes, with a noise like the discharge of a park of artillery, accompanied with a dense smoke, and a cloud of ashes and stones which fall upon every side, and add to the height of the cone, which is now about twenty-five hundred feet in altitude.

"The volcanoes of San Vicente and Tecapa have several orifices or vents, emitting smoke, steam, and sulphurous vapors, which are called "*Infernillos*," literally "Little Hells." In a word, it may be said, with truth, that San Salvador comprehends more volcanoes, and has within its limits more marked results of volcanic action, than probably any other equal extent of the earth. For days the traveller within its borders journeys over unbroken beds of lava, scoriæ, and volcanic sand, constituting, contrary to what most people would suppose, a soil of unbounded fertility, and densely covered with vegetation."

In many respects this region of Central America resembles the fair deceitful Italian fields, surrounding the classic crater of Vesuvius, and like them too, it has its buried Pompeii: the city of San Salvador, reared on a table land wholly made up of scoriæ, volcanic ashes, and fragments of pumice, overlying to the depth of hundreds of feet, the beds of lava which had flowed from the volcano before their ejection. The great volcano of "Our Saviour," as it is oddly enough named, rears its cone about three miles to the westward of the ruined city, to a height of about eight thousand feet, while beneath it, at a much lower altitude, is the jagged mouth of the crater, yawning its huge jaws, it is said, a league and half in circumference and nearly three thousand feet deep. Such is the chief central object of the region originally chosen as the site for the capital of the republic of San Salvador. The hills around the plain of the same name are covered with verdure, and the loose, but fertilising volcanic soil adds some other singular features to the locality.

"Those who have seen the scoriaceous beds which cover Pompeii can form an accurate idea of the soil on which San Salvador was built. The channels of the streams are worn down to a great depth through this light and yielding material, and constitute immense ravines, which render the approaches to the town almost impassable, except at the places where graded passages are cut down on either side paved with stone, and sometimes walled, to keep them from washing out and becoming useless. Some of these approaches are so narrow that it is customary, when mounted, to shout loudly on entering, so as to avoid encountering horsemen in the passages, which are frequently so restricted as to preclude either passing or turning back. San Salvador has more than once owed its safety in time of war, to these natural fortifications, which confounded the enemy with their intricacies and difficulties, while affording means of defense to the inhabitants.

"The facility with which the soil above described washes away has been the cause of several disasters to San Salvador. During a heavy rain of several days' duration, called a '*Temporal*,' which occurred in 1852, not only were all the bridges which crossed a small stream flowing through one of the suburbs of the town undermined and ruined, but many houses destroyed in the same manner. One of the principal streets, extending into the suburbs, began to wash at its lower extremity, and the excavation went on so rapidly that no effort could arrest it. A considerable part of the street became converted into a huge ravine, into which the houses and gardens on either side were precipitated. The extension of the damage was guarded against, when the rain ceased, by the construction of heavy walls of masonry, like the faces of a fortification. How serious an undertaking this was regarded may be inferred from the fact that its completion was deemed of sufficient importance to be announced in the annual message of the President.

"San Salvador, like all other Spanish towns, covered a large area in proportion to its population. The houses were built low, none being of more than one story, with very thick walls, designed to resist the shocks of earthquakes. Each was built around an inner court, planted with trees and flowers, and frequently containing a fountain. To the circumstance of the existence of these courts the people of San Salvador owe their general preservation in the late catastrophe. They afforded ready and secure places of refuge from the falling dwellings.

The population of San Salvador was estimated in 1852 at twenty-five thousand. Including the little towns in its environs and which were practically a part of it, such as Soyopango, San Marcos, Mexicanos, etc., its inhabitants might have been estimated at thirty thousand. It was the seat of a bishopric, with a large and beautiful cathedral church, and of a large and flourishing university, the buildings for which were only finished about a year ago. It had also a female seminary, several hospitals, and numbered some eight or ten churches. In 1852, a very large and beautiful cemetery, with a fine facade and dependent chapels, was constructed. Two aqueducts, one of which is five miles in length, supplied the city with water. It was also a place of considerable and improving trade. Under the auspices of the late president, Duenas, a cart-road was surveyed, and carried nearly, if not quite, to a successful conclusion, from the city to its port on the Pacific, called La Libertad, a distance of about twenty-two miles. This, in a country where the best roads are hardly equal to what we would here call cattle-paths, was certainly no inconsiderable advance.

"The market of San Salvador was well supplied from the numerous Indian villages around it. On feast-days, and on the occasion of the fairs, such as that falling on the anniversary of the victory of Alvarado, the town overflowed, not only with people gathered from within a radius of fifty leagues, but with foreigners and merchants from every part of Central America. At these fairs the accounts between dealers were adjusted, and contracts, sales, and purchases made for the ensuing year; the whole concurrence and bustle contrasting strangely with the usual monotony and quiet.

"With the exception of the central and paved part of the city, San Salvador was eminently sylvan, being literally embowered in tropical fruit-trees. The red-roofed dwellings, closely shut in with evergreen hedges of cactus, shadowed over by palm and orange-trees, with a dense background of broad-leaved plaintains, almost sinking beneath their heavy clusters of golden fruit, were singularly picturesque and beautiful. In recalling the picture, it is sad to think that all is now abandoned and desolote; that the great square is deserted, and that a silence, unbroken even by the fall of water from the lately glittering fountains, reigns over the ruined and deserted, but once busy and beautiful city of 'Our Saviour'!"

The treacherous nature of the site, that tempted by its fertile soil, the builders of the Capital to rear a City characterised by so many features of utility and beauty, in the vicinity of the "living" volcano, was evinced by repeated shocks of earthquakes in the sixteenth and seventeenth centuries, as well as by one in 1839, which did such damage to the city as then to lead many to think of abandoning it. A more dreadful manifestation of the power of the destroyer, however, was needed, before the people were at length affected by a terror sufficiently profound to overcome all the strength of local attachment and vested interests, and compel them to resolve on seeking a safer site whereon to found a new Capital, in imitation of the example of the citizens of Guatemala: originally built at a place now called the Antigua, or Old City. The earthquake which destroyed the city of San Salvador took place so recently as the month of April, 1854; and by a succession of sudden and terrific shocks, lasting altogether no more than ten seconds, levelled the entire city in ruins. The following contemporary account of this fearful catastrophe is derived from the *Boletin Extraordinaries del Gobierno del Salvador*, published only about a fortnight after the event which it records. The festival of Easter fell in that year on the 16th of April, and it was immediately after the celebration of Easter Sunday's commemorative services, associated with the miraculous passing of the destroyer over the ancient cities of the Nile, when all the first born of Egypt perished, that sudden destruction came on the long threatened Capital of San Salvador. The style of the bulletin which records this terrible catastrophe partakes in no degree, it will be seen, of the dry formality which we are accustomed to in such official documents.

"The night of the 16th of April, 1854, will ever be one of sad and bitter memory for the people of Salvador. On that unfortunate night, our happy and beautiful capital was made a heap of ruins. Movements of the earth were felt on the morning of Holy Thursday, preceded by sounds like the rolling of heavy artillery over pavements, and like distant thunder. The people were a little alarmed in consequence of this phenomenon, but it did not prevent them from meeting in the churches to celebrate the solemnities of the day. On Saturday all was quiet, and confidence was restored. The people of the neighborhood assembled as usual to celebrate the Passover. The night of Saturday was tranquil, as was also the whole of Sunday. The heat, it is true, was considerable, but the atmosphere was calm and serene. For the first three hours of the evening nothing unusual occurred, but at half-past nine a severe shock of an earthquake, occurring without the usual preliminary noises, alarmed the whole city. Many families left their houses and made encampments in the public squares, while others prepared to pass the night in their respective court-yards.

"Finally, at ten minutes to eleven, without premonition of any kind, the earth began to heave and tremble with such fearful force that in ten seconds the entire city was prostrated. The crashing of houses and churches stunned the ears of the terrified inhabitants, while a cloud of dust from the falling ruins enveloped them in a pall of impenetrable darkness. Not a drop of water could be got to relieve the half-choked and suffocating, for the wells and fountains were filled up or made dry. The clock tower of the cathedral carried a great part of that edifice with it in its fall. The towers of the church of San Francisco crushed the episcopal oratory and part of the palace. The church of Santo Domingo was buried beneath its towers, and the college of the Assumption was entirely ruined. The new and beautiful edifice of the University was demolished. The church of the Merced separated in the centre, and its walls fell outward to the ground. Of the private houses a few were left standing, but all were rendered uninhabitable. It is worthy of remark that the walls left standing are old ones; all those of modern construction have fallen. The public edifices of the government and city shared the common destruction.

"The devastation was effected, as we have said, in the first ten seconds; for, although the succeeding shocks were tremendous, and accompanied by fearful rumblings beneath our feet, they had compartively trifling results, for the reason that the first had left but little for their ravages.

"Solemn and terrible was the picture presented on the dark, funereal night, of a whole people clustering in the plazas, and on their knees crying with loud voices to Heaven for mercy, or in agonizing accents calling for their children and friends, whom they believed to be buried beneath the ruins! A heaven opaque and ominous; a movement of the earth rapid and unequal, causing a terror indescribable; an intense sulphurous odor filling the atmosphere, and indicating an approaching eruption of the volcano; streets filled with ruins, or overhung by threatening walls; a suffocating cloud of dust, almost rendering respiration impossible—such was the spectacle presented by the unhappy city on that memorable and awful night!

"A hundred boys were shut up in the college, many invalids crowded the hospitals, and the barracks were full of soldiers. The sense of the catastrophe which must have befallen them gave poignancy to the first moments of reflection after the earthquake was over. It was believed that at least a fourth part of the inhabitants had been buried beneath the ruins. The members of the government, however, hastened to ascertain, as far as practicable, the extent of the catastrophe, and to quiet the public mind. It was found that the loss of life had been much less than was supposed, and it now appears probable that the number of the killed will not exceed one hundred, and of wounded fifty. Among the latter is the bishop, who received a severe blow on the head; the late president, Senior Duenas; a daughter of the president, and the wife of the secretary of the Legislative Chambers, the latterly severely.

"Fortunately, the earthquake has not been followed by rains, which gives an opportunity to disinter the public archives, as also many of the valuables contained in the dwellings of the citizens.

"The movements of the earth still continue, with strong shocks, and the people, fearing a general swallowing up of the site of the city, or that it may be buried under some sudden eruption of the volcano, are hastening away, taking with them their household gods, the sweet memories of their infancy, and their domestic animals, perhaps the only property left for the support of their families, exclaiming with Virgil, '*Nos patriæ fines et dulcia linquimus arva.*'"

The peaked and lofty mountain groups already referred to, forming such striking landmarks to the surveyor, have an additional interest in some respects from the extensive evidences of volcanic action which show the process of upheaval still going on throughout a considerable area. Their mineral treasures, too, have long been celebrated. The San Salvador group of silver mines, known under the general name of *Minas de Tabanco*, hold the silver in combination with galena and sulphuret of zinc. They are reported to be easily worked, and to yield from forty-seven to two thousand five hundred and thirty-seven ounces to the ton. Of these the Santa Rosalina mine is the richest, and a considerable part of its ores are shipped direct to England. Rich mines of iron also produce a metal of great value, and easily wrought. The ore is found near the surface, in great abundance, and extensive forests in its immediate vicinity supply the means for making charcoal. Mr. Baily, whose geographical labours, as we have seen, come under the censure of Mr. Squier from their supposed exaggeration of British rights, states that some of this iron, from the mines near the village of Petapa, was sent to England a few years ago for the purpose of examination, and proved to be a "very valuable variety for conversion into fine steel, approaching in this respect very nearly to the celebrated *wootz* of India." But of still more practical interest than any other of its mineral treasures, is its coal, to which Mr. Squier specially directed his attention, and he here communicates the results of his observations:

"Among the many undeveloped resources of San Salvador, and one which may perhaps come to have a first value in the state, is its coal, of which there is reason for believing vast beds exist throughout the valley of the Rio Lempa, and in the valleys of some of its principal tributaries, over a region of country one hundred miles long by not far from twenty miles broad. Coal had long been reported to exist in the state, previously to my visit in 1853. The investigations which were then made, under my directions, may, however, be regarded as having put the question at rest. Coal was found at a number of places in the valley of the Rio Titiguapa, flowing into the Lempa from the west, of good quality, proper geological conditions and with every indication of abundance. This river, it may be observed, is navigable for seven months in the year. The coal occurs about two leagues above its junction with the Lempa; also in the valley of the Rio Torola, about three leagues from its junction with the Lempa, of good quality, apparently abundant, and having all the geological conditions perfect. Near the town of Hobasco, close to the Rio Lempa, it is reported to exist in large beds, and to have been used for many years by the village smiths.

The coal of San Salvador is all of the variety called *brown coal*, and is a later formation than what is known as *pit* coal. In Germany it is found in vast deposits in Croatia, Moravia, Bohemia, Tyrol, Saxony, Silesia, etc., and it is worthy of remark that all the coal which has been found south of the Mississippi Valley, in Mexico, Central America, New Granada, Chili, etc., appears to be of this variety. In the county of Mansfeldt, in Germany, the brown coal is used for toughening copper, and for melting the white metal for the blue metal in reverberating furnaces. All the steam-engines in the above named German coal districts are fed with this coal. It can be used for refining lead and silver, for the calcination of ores, and generally for all the operations performed in reverberatory furnaces. Trials which have hitherto been made to coke it, for use in blast furnaces, have not been successful. I am not aware that its use has ever been attempted for locomotives and steam ships. This is not remarkable, as it has hitherto been found where no opportunity has existed of submitting it to this kind of trial. That found in the valley of Rio Titiguapa, already alluded to, has a specific gravity of 1.57; ashes 10.5 per cent. It is of that peculiar kind of brown coal called *pitch coal*, and is rich in bitumen."

In these notices we have devoted the largest share of attention to San Salvador, which, though the smallest of the Central American States, is in many respects the most remarkable. It has relatively the most numerous population, and surpasses all the other States in industry and extent of commerce. But there is another subject, relating to the whole region of Central America, in reference to its varied population, which has specially engaged Mr. Squier's attention, and to which we shall devote the remainder of our space. There is a disposition apparent on the part of the author to disparage the Mosquito population, such as we can scarcely avoid ascribing fully as much to political as to ethnological grounds. But, making allowance for this, the following generalization is of considerable value:

"The area of Central America may be calculated, in round numbers, at 155,000 square miles—very nearly equal to that of the New England and the Middle States combined. The population may be estimated at not far from 2,000,000, of which Guatemala has 850,000; San Salvador, 394,000; Honduras, 350,000; Nicaragua, 300,000; and Costa Rica, 125,000.

The geographical and topographical features of all countries have had, and always must have, an important and often a controlling influence upon the character and destiny of their populations. The nature and extent of this influence receives a striking illustration both in the past and the present condition of Central America. At the period of the discovery, it was found in the occupation of two families of men, presenting in respect to each other the strongest points of contrast. Upon the high plateaus of the interior of the country, and upon the Pacific declivity of the continent, where the rains are comparatively light, the country open, and the climate relatively cool and salubrious, were found great and populous nations, far advanced in civilization, and maintaining a systematized religious and civil organization. Upon the Atlantic declivity, on the other hand, among dense forests, nourished by constant rains into rank vigor, on low coasts, where marshes and lagoons, sweltering under a fierce sun, generated deadly miasmatic damps, were found savage tribes of men, without fixed abodes, living upon the natural fruits of the earth, and the precarious supplies of fishing and the chase, without religion, and with scarcely a semblance of social or political establishments.

It is impossible to resist the conviction that the contrasting conditions of these two great families were principally due to the equally contrasting physical conditions of their respective countries. With the primitive dweller on the Atlantic declivity of Central America, no considerable advance, beyond the rudest habits of life, was possible. He was powerless against the exuberant vitality of savage nature, which even the civilized man, with all the appliances that intelligence has gradually called to his aid, is unable to subdue, and which still retains its ancient dominion over the broad alluvions, both of Central and South America. His means of sustenance were too few and too precarious to admit of his making permanent establishments, which, in turn, would involve an adjustment of the relations of men and the organization of society. He was therefore a hunter from necessity, nomadic in his habits, and obliged to dispute his life with men who, like himself, were scarcely less savage than the beasts of the forests.

Civilization could never have been developed under such adverse conditions. It could only originate where favorable physical circumstances afforded to man some relief from the pressure of immediate and ever recurring wants—where a genial climate, and an easily-cultivated soil, bountiful in indigenous fruits, would enable him not only to make his permanent abode, but to devote a portion of his time to the improvements of his superior nature.

Such were the circumstances which surrounded the dweller on the high plains of Honduras and Guatemala. There, wide and fertile savannas invited to agriculture, and yielded to the rudest implements of cultivation an ample harvest. The maize, that great support of aboriginal civilization in America, was probably indigenous there, and was thence carried northward over Mexico and the Floridas by the various families who established themselves in those regions, and whose languages and traditions point to the plateaus of Guatemala as their original seat.

The natural conditions which favored the development of mankind in one portion of Central America, and rigidly suppressed it in another, are still active and potential. The Spaniards stopped not to maintain an unequal struggle against savage nature on the Atlantic slope of the continent, but established themselves upon the dryer, more salubrious, and more genial Pacific declivity. The Mosquito Shore still remains the haunt of savages, whom three hundred years of contact with civilization have failed to improve; while the State of San Salvador sustains a population twice as great in proportion to its area as any other equal extent of Spanish America, and relatively as great as that of New England itself.

These natural conditions will continue to foster settlement and population on the one hand, and discourage and oppose it on the other; and not until those portions of Central and South America which are most favored in respect of position and climate are filled to overflowing, and the progress of discovery, both in science and art, has invested men with augmented ability to combat successfully the diseases and physical difficulties which exist in the valleys of the Amazon and Orinoco, and on the Mosquito Shore, will those regions be submitted to the influences of civilization, or become the seats of any considerable populations.

The natural relations of Central America, as indicated by the physical facts already pointed out, are clearly with the Pacific and the states which now exist or may spring into existence upon that coast. To California and the greater part of Mexico, as also to some of the states of South America, it must come sooner or later, to sustain a position corresponding with that which the West Indies have held toward the United States and Europe, with the important addition of being an established route of travel, and perhaps ultimately of commerce, between the eastern and western hemispheres. Its destiny is plainly written in the outlines of its coast, and is printed on its surface, not less than demonstrated by its geographical position."

The whole of the third chapter is devoted to the question of population, and embodies much valuable information, derived from official documents, statistical tables and various other sources of information, supplemented by the author's own peculiar views and critical deductions. From this, as well as some later pages of the volume referring to the same subject, we shall make some extracts:

"Mr. Thompson who was British commissioner to the old Federation of Central America in 1823, estimated the relative proportions of the people as follows:

Whites and Creoles	One fifth.
Mixed Classes	Two fifths.
Indians	Two fifths.

He estimates the Europeans, 'or perfect whites,' at not more than 5000. Mr. Crowe, referring specially to Guatemala, calculates the proportions as follows:

Indians	Three fifths.
Ladinos	One fourth.
Whites	One fortieth.
Mulattoes	One eightieth.
Negroes	One fiftieth.
Sambos	One hundredth.

Ladinos, it may be observed, is a term signifying gallant men, and is understood to apply to the descendants of whites and Indians. It is only used in Central America.

The following Table probably exhibits very nearly the exact proportions in Central America, so far as they may be deduced from existing data and from personal observation:

Whites	100,000
Mixed	800,000
Negroes	10,000
Indians	1,109,000
Total	2,019,000

From the foregoing facts and observations, it may be deduced generally that Central America is relatively the most populous portion of Spanish America; that while its population is increasing in a constant and rapid ratio, the exotic or European element is not only decreasing relatively, but in fact; and that the direct tendency of things is to its speedy absorption in the indigenous or aboriginal races. In this respect, as indeed in its moral and intellectual condition, Central America, not less than all Spanish America, seems to furnish a striking illustration of the laws which have been established as the results of anthropological inquiries during the past fifty years. Neither the statesman nor the political economist can safely overlook or disregard these results, since by the course of events, and the multiplication of means and facilities of communication, nations and races are more and more brought in contact, and the question of the nature and character of their relationship made of immediate and practical importance.

It may be claimed without hesitation that the wide physical, intellectual and moral differences which all history and observation have distinguished as existing between the various families of man, can be no longer regarded as the consequences of accident or circumstances; that is to say, it has come to be understood that their physical, moral, and intellectual traits are radical and permanent, and that there can be no admixture of widely-separated families, or of superior with inferior races, which can be harmonious, or otherwise than disastrous in its consequences. Anthropological science has determined the existence of two laws of vital importance in their application to men and nations:

First. That in all cases where a free amalgamation takes place between two different stocks, unrestrained by what is sometimes called prejudice, but which is, in fact, a natural instinct, the result is the final and absolute absorption of one in the other. This absorption is more rapid as the races or families thus brought in contact approximate in type, and in proportion as one or the other preponderates in numbers; that is to say, Nature perpetuates no human hybrids, as, for instance, a permanent race of mulattoes.

Second. That all violations of the natural distinctions of race, or of those instincts which were designed to perpetuate the superior races in their purity, invariably entail the most deplorable results, affecting the bodies, intellects, and moral perceptions of the nations who are thus blind to the wise designs of Nature, and unmindful of her laws. In other words the offspring of such combinations or amalgamations are not only generally deficient in physical constitution, in intellect, and in moral restraint, but to a degree which often contrasts unfavorably with any of the original stocks.

In no respect are these deficiencies more obvious than in matters affecting government. We need only point to the anarchical states of Spanish America to verify the truth of the propositions here laid down. In Central and South America, and Mexico, we find a people not only demoralized from the unrestrained association of different races, but also the superior stocks becoming gradually absorbed in the lower, and their institutions disappearing under the relative barbarism of which the latter are the exponents. If existing causes and conditions continue to operate, many years can not pass before some of these countries will have relapsed into a state not far removed from that in which they were found at the period of the conquest.

In Mexico there are less than two millions of whites, or of persons having a preponderance of white blood, out of a population of eight millions; in Central America, less than two hundred thousand out of two millions; and in South America at large, the proportions are nearly the same. It is impossible, while conceding all the influence which can be rationally claimed for other causes, to resist the conviction that the disasters which have befallen those countries are due to a grand practical misconception of the just relations of the races which compose them. The Indian does not possess, still less the South Sea Islander, and least of all the Negro, the capacity to comprehend the principles which enter into the higher order of civil and political organizations. His instincts and his habits are inconsistent with their development, and no degree of education can teach him to understand and practise them"

Here again, we perceive American ideas and prejudices of another kind influencing the deductions of our author. It is difficult indeed for an American, with his Southern helot population, and his Western Red Indian disputants for the soil claimed by the White supplanter, to take an impartial view of ethnological inquiries. The doctrine of the unity of the human race bears to the American no other meaning than this unpalatable one: That the degraded Negro slave and his White oppressor are of one race and of one blood; and hence the confusion of ideas relative to the causes of social and political degradation in Spanish America. But have not the same causes to a great extent produced the like effects in the Spanish mother country, where no such distinctions of race existed to be violated? A reference to Prescott's "Philip the Second,"—a valuable contribution to European History, to which we propose giving the attention it deserves in a future number,—would suffice to show Mr. Squier, that there is little need of any theory of "a practical misconception of the just relations of the races," to account for the degradation either of Spain or her autonomous colonies. In defining the condition of Spain so early as the middle of the sixteenth century, when possessed of resources greatly enlarged, and territory extended by a brilliant career of discovery and conquest, the historian of Philip II., speaks of it as already disclosing "those germs of domestic corruption which gradually led to its dismemberment and decay." And again, after noting the fatal blow to Spanish liberty by the overthrow of the patriots on the memorable field of Villalar, he thus refers to the products of the subsequent political tranquility,—such a tranquility as despotism alone renders compatible with life: "Sheltered from invasion by the barrier of the Pyrenees, her people were allowed to cultivate the arts of peace so long as they did not meddle with politics or religion,—in other words, with the great interests of humanity." Such were the causes which produced in Spain the tranquility and the corruption of death; and all these causes were not less, but more operative in her Colonies, where the corruption of despotism was present, but without its tranquility; and such arts of peace as could be practised promoted the aggrandisement of individuals only by the impoverishment and decay of the State. No more remarkable problem has ever been worked out in history than that which is now seen in the contrast between the descendants of the indomitable Anglo-Saxon puritans of New England and the Spanish colonists of Central and South America. That we are not ascribing more weight to the influence of prejudices arising from the peculiar social condition of the United States than is justly due in tracing to such, many of the opinions advanced by the Chargé d'Affaires, will, we imagine, be placed beyond doubt by the further deductions drawn from the previous views concerning "inferior races," "amalgamation of different stocks unrestrained by natural instinct," &c. After brief comment on the supposed aptitude of the Sandwich Islanders for civilization and self-government, which our author traces solely to the work of foreigners and white men, he thus proceeds to bring the question home to his own countrymen:

"To the Indians upon our southwestern border these remarks are scarcely less applicable. Under no circumstances have the North American Indians exhibited an appreciation of the value, or a disposition to abide by the reciprocal obligations involved in a government of the people. Their ideas of government, like those of the Arabs, and the nomadic hordes of Central Asia, are only consonant with the system called patriarchal: ideas which, at this day and in this country, are not only wholly inapplicable, but antagonistic to those upon which our system is founded. The only instance in which they have made a sensible progress in the right direction is that of the Cherokees, under the guidance of chiefs in whose veins flows a predominance of European blood. And while it may be admitted that the Indians of the old Floridian stock are in all respects superior to the islanders of the Pacific, yet neither in industry, docility, or traditional deference to authority are they equal to the Indian families of Mexico and Central America, where the attempt to put the latter on a political and social footing with the white man has entailed eternal anarchy, and threatens a complete dissolution of the political body.

In Guatemala, as in Yucatan, it has brought about a bloody and cruel war of castes, and in the former state has resulted in placing a treacherous and unscrupulous half-breed at the head of affairs, who rules over a desolated country with irresponsible sway. Not less disastrous has been the result in Mexico, while in Jamaica savage nature is fast resuming her dominion over deserted plantations, and the woods begin to swarm with half-naked negroes, living upon the indigenous fruits of the soil, and already scarcely one degree removed from their original barbarism in Africa.

To the understanding of intelligent and reflecting men, who are superior to the partisan and sectional issues of the hour, these considerations can not fail to appeal with controlling force; for if the United States, as compared with the Spanish American republics, has achieved an immeasurable advance in all the elements of greatness, that result is eminently due to the rigid and inexorable refusal of the dominant Teutonic stock to debase its blood, impair its intellect, lower its moral standard, or peril its institutions by intermixture with the inferior and subordinate races of man. In obedience to the ordinances of Heaven, it has rescued half a continent from savage beasts and still more savage men, whose period of existence has terminated, and who must give place to higher organizations and a superior life. Short sighted philanthropy may lament, and sympathy drop a tear as it looks forward to the total disappearance of the lower forms of humanity, but the laws of Nature are irreversible. *Deus vult*—it is the will of God!"

Deus vult !—The reader will not fail to call to remembrance when this *cri de guerre* was first adopted. *Deus vult !* shouted the crusaders of Western Europe when the first fanatical host prepared to set out for the purpose of exterminating the infidel races of the East, and with like pious consistency the enslaver of the African Negro and the exterminator of the American Indian in our own day, complacently pursue their own selfish ends as the will of God! Apart, however, from subjects which it is difficult for the American diplomatist and politician to view with an impartial eye, the ethnological speculations of our author are well worthy of attention, and have attracted notice in more than one previous work from his pen. In relation to the aboriginal population of San Salvador, he remarks:

"The inquirer into the history and relations of the aborigines of America is often surprised to find enigmatical fragments of the great primitive families of the continent widely separated from their parent stocks, and intruded among nations differing from them in manners, language, government, and religion. These *erratic* fragments—to adopt a geological term—in some instances present the clearest and most indubitable evidences of their origin and relationship, in an almost unchanged language, and in a civil and social organization, manners, and customs, little, if at all, modified from those of their distant progenitors. The inference from this would naturally be that their separation had been comparatively recent; yet these identities have been found to exist in cases where tradition fails to assign a cause or period for the disruption, or even to indicate the manner in which it took place.

At the period of the discovery of America, a colony or fragment of that primitive stock, which, under the name of Quichés, Kachiquels, Tzendales, Mayas, etc., occupied nearly the whole of what is now Guatemala, Chiapa, and Yucatan, was found established on the River Panuco. They bore the name of Huastecas, and from them had proceeded these beneficent men who carried the arts of civilization and the elements of a mild religion into those regions, where the Acolhuas and Aztecas, or Nahuales, afterwards built up the so-called Mexican empire. It was one of their leaders bearing the hereditary name Quetzalcoatl in the Nahual dialect, and Cuculcan in the Tzendal, who taught the higher arts to the inhabitants of Cholula, and who afterwards returned to the primitive seats of his fathers in the valley of the Usumasinta by way of the isthmus of Coatzacoalcos. The period of this migration to the Panuco dates back beyond the foundation of the principalities of Anahuac, and is anterior to the Tezcucan and Aztec dynasties.

In Central America, on the other hand, two considerable fragments of the true Nahual or Aztec stock were found intruded among the native or original families of that portion of the continent. One of these, as I have shown in my work on Nicaragua, occupied the principal islands in the Lake of Nicaragua, the narrow isthmus which intervenes between that lake and the Pacific, and probably a portion of the country to the southward as far as the Gulf of Nicoya. Their country was less than a hundred miles long by scarcely twenty-five broad; yet here they preserved the same language and institutions, and practised the same religious rights with the people of the same stock who dwelt more than two thousand miles distant, on the plateaus of Anahuac, from whom they were separated by numerous powerful nations, speaking a different language, and having a distinct organization."

Referring exclusively to the fragment of the Nahual stock in the San Salvador State, the author thus proceeds:

"As a general rule the aboriginal population has been much modified by three centuries of contact with the whites, and an equally long subjugation to the Spanish rule, yet there are towns even in the immediate vicinity of the capital, which have retained to a surprising degree their primitive customs, and in which the aboriginal blood has suffered scarcely any, if indeed the slightest intermixture. In most places, however, the native language has fallen into disuse, or only a few words, which have also been accepted by the whites, are retained. The original names of places, however, have been preserved here with the greatest tenacity, and afford a very sure guide in defining the extent of territory over which the various aboriginal nations were spread.

In the neighborhood of Sonsonate there are several large towns, inhabited almost exclusively by Indians, who also use the national language in ordinary intercourse among themselves. The same is true of some of the towns on the southern flank of the volcano of San Vicente, whose inhabitants, no later than 1832, attempted to reassert their ancient dominion, and exterminate not only the whites, but all who had a trace of European blood in their veins.

There is, nevertheless, one portion of the State of San Salvador where the aborigines have always maintained an almost complete isolation, and where they still retain their original language, and to a great extent, their ancient rites and customs. This district is known as the "*Costa del Balsimo*," or Balsam Coast. It is about fifty miles in length by twenty to twenty-five miles in breadth, lying between La Libertad, the point of the city of San Salvador, and the roadstead of Acajutla, near Sonsonate. This district is entirely occupied by Indians, retaining habits but little changed from what they were at the period of the conquest. It is only traversed by foot-paths so intricate and difficult as to baffle the efforts of the stranger to penetrate its recesses. The difficulty of intercourse is enhanced, if not by the absolute hostility of the Indians themselves, from their dislike to any intrusion on the part of the whites, be they Spaniards or foreigners. I was, however, fortunate in numbering among my warmest friends in Central America two gentlemen, who are the principal purchasers of the celebrated "Balsam of Peru," which is obtained exclusively by these Indians, and constitutes their only article of sale, and sole source of wealth. They not only have an extensive acquaintance with the Indians, but also great influence over them, which was exercised in putting me in relation with some of the more intelligent ones in their visits to the city of San Salvador. I was thus enabled to obtain a vocabulary of their language, which is nearly identical with the ancient Nahual or Mexican."

It appears, however, from further remarks of Mr. Squier, that a greater change has been produced on this remnant of the Aztec stock than the above remarks would lead us to suppose. They have adopted the Catholic religion, though intruding into its worship many peculiar aboriginal rites. The mechanical arts, moreover, are described as little understood, and the fine arts still less practised, while music is cultivated only as an accessory to the services of the Church. It is obvious, therefore, that like other aboriginal races, their contact with the European has led to the extinction of their own native arts and civilization, without their sharing in the higher civilization of their conquerors. The only title of rank recognised among them is that of "*Ahuales*, only conceded to persons over forty years of age, *who have had charge of the treasure-boxes of their various Saints*, or who have served in some public capacity." And the predominance of the foreign element in its ecclesiastical aspect is apparent throughout.

"Agriculture among them is carried on only to the extent of producing the maize requisite for the year, and nothing more. Their sole wealth consists of their balsam, calculated approximately to amount to twenty thousand pounds annually, and which they sell at four rials, or half a dollar the pound. This, it might be supposed, would gradually place in their hands some property, but it is quite spent in the festivals of the saints, which are rather eating and drinking bouts than sacred feasts."

Added to this, the following description of their physical characteristics suffices to complete the picture of their present condition :

"Physically, these Indians have more angular and severer features than those of the other families of Guatemala and Nicaragua. They are not so symmetrical in form, and are darker in color, more taciturn, and apparently less intelligent. Their women are much smaller than those of the other Indian nations, are generally ugly, and, when old, little short of hideous. Throughout the State they are industrious ; and San Salvador, favored generally with a fertile and arable soil, is undoubtedly the best cultivated, as it is the best populated state of Central America."

Our space forbids us following the author further in his interesting inquiries into the diffusion of the Nahual or Aztec stock at the period of the Spanish conquest ; but we have produced evidence enough to shew that, while Mr. Squier is an author whose views must be received with caution on all questions where American prejudices or American interests are involved, he has nevertheless produced a work which will be studied with interest by all who have made themselves familiar with his previous contributions to the Archæology and Topography of this continent.

D. W

Esquisse Géologique du Canada. Pour servir à l'intelligence de la carte géologique et de la collection des minéraux envoyées à l'Exposition Universelle de Paris, 1855. Par W. E. Logan et T. Sterry Hunt. Paris, 1855.

This admirable little *brochure*, published in Paris during the Exposition, was drawn up in French by Mr. Hunt, with the co-operation of Sir William Logan, chiefly to serve as a guide to the geological map and collection of mineral products exhibited in the Canadian department. The beautifully executed map, alluded to in the first number of the new series of our Journal, accompanies the volume. A better general view of Canadian geology it is impossible to obtain; and as no other connected view of our geology, beyond a few sketches of very limited extent, has yet been given to the public, we are glad to learn that its re-issue in an English dress may shortly be anticipated. Supplying a long-felt want, in a manner at once clear, accurate, and entirely free from scientific display, it cannot fail to command for itself the most extensive popularity.

The Essay opens with an introductory chapter, chiefly explanatory of the origin and general organization of the Survey, and then proceeds to discuss the various points of interest belonging to the following heads, each of which forms the subject of a separate chapter. (1.) The Laurentine Mountains, and the range of the Laurentian system generally. In a geological aspect, this zone of ancient metamorphic and crystalline rocks divides the Province into two broad districts, north and south: the latter being again subdivided by an anticlinal, running from the Hudson valley and Lake Champlain north-easterly towards Quebec, into an eastern and western basin, each with special characteristics of its own. (2.) The Laurentian system in its mineral and structural details. (3.) The Huronian system, the great copper-bearing region of the west, occupying a vast extent of country along the northern shores of Lake Huron and Lake Superior, and traversed by numerous dykes of trap. (4 and 5.) The Palæozoic rocks of the western basin, comprising, in an ascending series, the Potsdam sandstone; Calciferous Sand Rock; the Chazy, Bird's-eye, Black River and Trenton limestones: in places so rich in fossils; the Utica schist, with its peculiar trilobites; the Hudson River group; the Medina sandstone, or base of the Upper Silurians; the Clinton group; Niagara limestone; Onondaga salt group, with its gypsum beds and brine springs; and finally the Devonian formations, comprising portions of the Helderberg series*,

* The Oriskany sandstone and Corniferous limestone equivalents. The former feebly represented.

and the Hamilton shales: the latter with their petroleum springs and asphalt deposits. (6 and 7.) The Eastern basin, comprising various formations of the Lower and Upper Silurian series, including the Sillery group of conglomerates and graptolitic schists, unknown in Western Canada. In its geological position this band is intermediate between the Hudson River group and the Medina sandstone. The eastern basin includes also the Devonian and Lower carboniferous beds of Gaspé; and offers in its lines of disturbance and very generally metamorphosed condition, a remarkable contrast to the Western District. The metamorphic rocks of this division are discussed in detail in chapter 7, one of the most interesting in the volume. Chapters 8, 9 and 10, treat respectively of the post-tertiary and alluvial deposits, the mineral springs, and the great basin of the North. It may be remembered, with regard to the latter, that the results of the survey have shewn the absence of Lower Silurian strata apparently along the entire district: and hence the inference of Sir William Logan, that the southern boundary of the Laurentian range, from Labrador to the Arctic Ocean, formed the limiting shore-line of a Lower Silurian sea.

It was our intention to have presented to the readers of the Journal, a condensed translation of this most useful little work; but finding that an English edition, from the pen of Professor Hunt, is shortly to appear, we have confined ourselves, in the present notice of the publication, to a simple announcement of its contents.

The volume concludes with a classified list of the economic minerals of Canada, and of their respective special localities: forming a complete index to our mineral wealth. The Geological Commission would confer no common benefit upon the public, by re-issuing at once this latter part of the work, both in French and English, and causing its general circulation throughout the Province.

E. J. C.

Philosophy of Sir William Hamilton, Bart., Professor of Logic and Metaphysics in Edinburgh University, arranged and edited by O. W. Wight, Translator of Cousin's "History of Modern Philosophy." New York: D. Appleton & Co., 1853.*

We do not intend at present to enter into a formal and complete review of Sir William Hamilton's Philosophy, to which the title of

* The substance of the following review was originally produced in the form of a communication read before the Canadian Institute, 9th February, 1856, under the title of "Brief Notes on certain statements of Sir William Hamilton regarding the validity of our primary Beliefs." The date of that communication will account for its being written without reference to the death of the distinguished philosopher, some of whose opinions are brought under review.

this American publication might tempt us, but merely, by way of note, to advert to certain statements of that distinguished writer regarding the trustworthiness of consciousness: advanced with special reference to the theory of sensitive perception; but which, whether in their bearing on that doctrine, or in their application generally, seem to be open to grave objections. If we should be thought to criticise too severely the statements referred to, our excuse must be the pre-eminence—the deserved pre-eminence—of the philosopher by whom they are made. The mistakes of an ordinary writer might be left unnoticed, or passed lightly over; but should Sir William Hamilton really be in error in what he teaches on the fundamental question of the validity of consciousness, it is of the utmost importance that his error should be pointed out.

In his exposition of the "Philosophy of Common Sense," Sir William, after shewing that our knowledge is not all at second hand, but that some at least of our cognitions must be immediate, proceeds to answer the inquiry how these certify us of their veracity. Is consciousness perfectly trustworthy?

"Limiting, therefore, our consideration to the question of authority: how, it is asked, do these primary propositions— these fundamental facts, feelings, beliefs, certify us of their own veracity? To this the only possible answer is, that as elements of our mental constitution—as the essential conditions of our knowledge—they *must* by us be accepted as true. To suppose their falsehood is to suppose that we are created capable of intelligence, in order to be made the victims of delusion; that God is a deceiver, and the root of our nature a lie. But such a supposition, if gratuitous, is manifestly illegitimate. For, on the contrary, the data of our original consciousness must, it is evident, *in the first instance,* be presumed true. It is only if proved false that their authority can, *in consequence of that proof*, be, *in the second instance*, disallowed."

In another passage, after stating that, "though the veracity of the primary convictions of consciousness must in the outset be admitted, it still remains competent to lead a proof that they are undeserving of credit," Sir William continues:

"But how is this to be done? As the ultimate grounds of knowledge, these convictions cannot be redargued from any higher knowledge; and, as original beliefs, they are paramount in certainty to every derivative assurance. But they are many; they are, in authority, co-ordinate; and their testimony is clear and precise. It is therefore competent for us to view them in co-relation; to compare their declarations; and to consider whether they contradict, and, by contradicting, invalidate each other. This mutual contradiction is possible in two ways. (1.) It may be that *the primary data themselves* are directly or immediately contradictory of each other; (2.) it may be that they are mediately or indirectly contradictory, inasmuch as the *consequences* to which they *necessarily* lead, and for the truth or falsehood of which they are therefore responsible, are mutually repugnant. By evincing either of these, the veracity of consciousness will be disproved."

"No attempt," it is subsequently remarked, "to shew that the data of consciousness are (either in themselves or in their necessary consequences) mutually contradictory, has yet succeeded; and the presumption in favor of the truth of consciousness and the possibility of philosophy has, therefore, never been redargued."

Now these statements seem to us to open the door to scepticism. For what do they imply? Obviously, that though a denial of the primary data of consciousness involves what is abhorrent to our natural sentiments, and not to be thought of, except under the pressure of a logical necessity, yet there are at least conceivable circumstances in which such a denial would be warrantable. Sir William's doctrine renders it obligatory upon us to hear the pleadings of counsel against consciousness, if any person should come forward, and make affidavit that he can show consciousness to be self-contradictory. But if we can be required, under any pretence whatever, to listen to evidence against our primary beliefs, they cannot be absolutely, infallibly, in the strictest sense of the term, *certain*. Observe the language in which Sir William himself expresses the conclusion that satisfies his mind, and in which he wishes his readers to rest. It is exceedingly (we had almost said *painfully*) significant. "No attempt to shew that the data of consciousness are (either in themselves or in their necessary consequences) mutually contradictory, has yet succeeded; and the presumption in favor of the truth of consciousness and the probability of philosophy has, therefore, never been redargued." The *presumption* in favor of the truth of consciousness! And has it come to this? A presumption! To silence scepticism and render philosophy possible, we must have something more than a presumption—we must have an absolute certainty—of the truth of consciousness.

In most unfortunate consistency with the admission that it is "competent to lead a proof that they (the primary convictions of consciousness) are undeserving of credit," Sir William Hamilton assigns a reason for trusting the deliverances of consciousness. To doubt them would be to suppose that the root of our nature is a lie. Well: a sceptic might rejoin; what then? Be it so. It may be urged that our conceptions of the great Creator forbid us to entertain the thought. God cannot be a deceiver. Is then, we ask, our conviction of the trustworthiness of consciousness dependent on, or capable of deriving support from, the conceptions which we form of the Divine Being? No. The sole guarantee which, in the last analysis, we have for the validity of the conceptions which we form of the Divine Being, is consciousness itself. And does not a child, who has no idea of the moral attributes of God, believe the intimations of consciousness as firmly and as warrantably as the most enlightened philosopher? Even if the argument derived from the veracity of God be intended simply to corroborate the trustworthiness of consciousness; if Sir William Hamilton mean (as we presume he does) that consciousness certifies us of its own veracity, but that our instinctive persuasion of its truth is fortified by a consideration of what would be involved in its being false, viz., that God would be a deceiver; we are unable to consent to this. We deny that the trustworthiness of consciousness can receive the slightest corroboration from reasoning. A condition of the possibility of any thing being corroborated by argument, is, that it can be argued about. But *in no intelligible sense* (*as we shall presently endeavor to shew in a particular case*) *can the veracity of consciousness be even proposed as a question for debate.*

Sir William accepts the deliverances of consciousness "in the first instance." He accepts them, however, with this concession to the sceptic, that, if they should at any time be shewn to be, either in themselves or in their necessary consequences, contradictory, he will give up his faith in them. Now, on the part of consciousness, we protest against any such concession being made to scepticism. Consciousness is injured when we subscribe to its veracity with an *if.* "Your *if*," said Shakspeare, "is a great peace-maker." At times, it is something more. In the case before us it is a traitor who lets the enemy into the fortress. To say that we will regard a man as truthful until he be detected in a falsehood, is virtually admitting that, (much as it would be to our surprise and disappointment), he *may be* guilty of uttering a lie. The principle that consciousness is nfallible, is not indeed expressly gainsaid—on the contrary, it is in terms affirmed—by Sir William Hamilton. But that great principle, the recognition of which—as Sir William himself declares—alone renders philosophy possible, is, in our opinion, compromised by his mode of treating the subject. We have an instinctive feeling, he contends, that our primary cognitions are valid. We must begin by accepting them as valid; for otherwise we could not reason at all. It is certainly competent for a sceptic to lead proof to establish the contrary; but no sceptic has ever yet succeeded in such an attempt. Komorn has hitherto maintained, against all assaults, its character of impregnability. This is a comfortable confirmation of our first and natural impressions. The original presumption in favor of consciousness is strengthened. Our religious nature at the same time comes in to fortify our trust in consciousness. On the supposition that consciousness is not true, God would be a deceiver. Now, is it not palpable that, underlying this whole course of thought, is the silent implied concession, that the truth of our primary cognitions is not, in the strict and absolute sense of the term, certain; but that there is only a vast and incalculable probability, amounting to moral certainty, in favor of their truth? Philosophy, however, is impossible, unless we can vindicate for our primary cognitions, real and absolute, and not merely moral, certainty.

But the question will be put: must we not, even with our absolute faith in the infallibility of consciousness, still allow that its credit would be broken down, if (supposing that possible) it were shewn to be self-contradictory? We answer—and here lies the pith of the whole matter—that the question is absurd. We do not reply with Sir William Hamilton in the affirmative, and say that we would, in the circumstances supposed, give up our trust in consciousness. Neither do we reply in the negative, and say that we would *not* give up our trust in consciousness. We say that the question is absurd. In no intelligible sense (as we previously remarked) can the trustworthiness of consciousness be brought to trial. It is impossible within our present limits to shew this with regard to our primary cognitions at large. It must suffice for us to illustrate our assertion by referring to sensitive perception, the form of consciousness which Sir William Hamilton had specially in view in the statements on which we are commenting.

Sensitive perception is a relation of a certain kind between the *Ego* and the *Non-ego*. What, then, is intended by asking whether consciousness, in revealing the *Ego* and the *Non-ego* in their mutual relation, can be trusted? *The consciousness realized is nothing else than the Ego and the Non-ego existing in relation to one another.* Sir William Hamilton tells us that it is competent for a sceptic to lead proof, and therefore obligatory upon us to listen to his argument in favor of the assertion that consciousness is delusive. But sensitive perception, the consciousness to which our present observations are limited, being a relation, an actual relation, between the *Ego* and the *Non-ego*: to say that it is, or may haply be, found to be delusive, would seem to be equivalent to saying that a subsisting relation is, or may haply be found to be, not a subsisting relation; and before we can consent to hear evidence in support of such a conclusion, we must first be enlightened as to what is meant.

Sir William Hamilton allows that, in one respect, the data of consciousness are, from the very nature of the case, incapable of being canvassed: they are placed "high above the reach of question." But in another respect "they are not............beyond the possibility of doubt." Were we omitting to notice the distinction referred to—which is held to be important—it might perhaps be thought that we are proceeding upon a mistaken or defective view of the system which we are criticizing. We therefore observe that we are unable to look upon the distinction as well-founded; but that, even were it so, this would not remove our objections to Sir William Hamilton's statements. Sir William shall explain the distinction in his own words. "Here, however, it is proper to take a distinction, the neglect of which has been productive of considerable error and confusion. It is the distinction between the data or deliverances of consciousness considered simply, in themselves, as apprehended facts or actual manifestations, and these deliverances, considered as testimonies to the truth of facts beyond their own phenomenal reality. Viewed under the former limitation they are above all scepticism. But as doubt is in itself only a manifestation of consciousness, it is impossible to doubt that what consciousness manifests, it does manifest, without............the doubt contradicting, and therefore annihilating itself............ Viewed in the latter limitation, the deliverances of consciousness do not thus peremptorily repel even the possibility of doubt. I am conscious, for example, in an act of sensible perception, (1.) of myself the subject knowing; and (2.) of something given as different from myself, the object known. To take the second term of this relation:—That I am conscious in this act of an object given, as a *Non-ego*—that is, as not a modification of my mind—of this, as a phenomenon, doubt is impossible............ It is, however, possible for us to suppose, without our supposition at least being *felo-de-se*, that, though given as a *Non-ego*, this object may, in reality, be only a representation of the *Non-ego*, in and by the *Ego*."

Now, admit this discrimination (if it can be comprehended) and say if it in the least degree blunts the edge of the strictures offered above? In sensitive perception the deliverance of consciousness considered as a testimony to the existence of the *Non-ego*, is not "above all scepticism." It does not "peremptorily repel even the possibility of doubt." The idealist, in denying the existence of an external world, "does not advance a doctrine *ab initio* null." His scepticism is, no doubt, unphilosophical. but why? Because, in the first instance, the data of consciousness must be presumed to be true. It is only by setting out with this presumption that knowledge is possible. And as it has never yet been shewn that this presumption leads to results contradictory of one another, it follows that "as philosophy now stands," the declarations of consciousness are "entitled to demand prompt and unconditional assent." We are, of course, simply repeating what has been already said, when we charge this doctrine with opening a door to scepticism. Our faith in the existence of a *Non-ego* is nothing better than a "presumption;" a strong presumption, perhaps; but still only a presumption. We have *faith* in the *Non-ego;* but not a *knowledge* of it, in the proper sense of the term. It is within the bounds of possibility, that in *presuming* the *Non-ego* to exist, we are mistaken. Is Sir William Hamilton—the Apostle of Natural Realism—the St. George of Philosophy, whose spear has been thought to have given the death wound to that Dragon of Scepticism which so many valiant knights have assailed in vain—is he himself, after all, chargeable with holding sentiments essentially sceptical?

The distinction to which Sir William Hamilton attaches so much importance, would not remove our objections even if it were admitted; but we are unable to persuade ourselves that it has any foundation. In an act of sensitive perception (it is said) we are conscious of self, the subject knowing; and of something different from self, the object known. Now, let it be understood, that, though a two-fold object may be discriminated in an act of sensitive consciousness, the act itself, the consciousness, is not two-fold, but is single and indivisible. By one indivisible act of consciousness, the *Ego* and the *Non-ego* are apprehended in their mutual relation. The *Ego* is apprehended, not absolutely, but in its relation to the *Non-ego:* the *Non-ego* is apprehended, not absolutely, but in its relation to the *Ego*—the latter apprehension not being a distinct cognitive act from the former, but being identical with it. With this explanation, let us proceed. Our consciousness of the *Non-ego*, Sir William Hamilton tells us, may be viewed in two aspects; first, the consciousness realized may be considered as a phenomenon—in this aspect, doubt regarding it would be suicidal by self-contradiction: secondly, it may be viewed as a testimony to the existence of the *Non-ego*—in this aspect doubt is not peremptorily repelled. But are these aspects, we ask, in reality different? We maintain that they are not. Let us not be led, by mere diversities of expression, to fancy that there are real diversities, where none exist. Is it not a contradiction to speak of two different aspects of consciousness? What is the aspect in which we at any moment regard an act of consciousness, but the consciousness of the moment? Logicians may distinguish these things, if they please, but there is no real distinction between them. If so, it follows that two aspects, in reality diverse, in which the consciousness of a particular moment may be viewed, is an absurdity. For, let A be one of these aspects, and B another; C being the indivisible consciousness of the instant. Then A is identical with C; and B is identical with C; so that A and B must be identical with one another. In an act of sensitive perception, the consciousness realized (in whatever aspect, logically speaking, you may choose to view it) is in reality a relation between the *Ego* and the *Non-ego:* it is the *Ego* existing in relation to the *Non-ego;* and as doubt regarding the existence either of the *Ego* or of the *Non-ego*, in a case where a relation is established betwixt the *Ego* and the *Non-ego*, is self-contradictory, it follows that consciousness, not only when considered as a phenomenon (whatever that may signify), but also when regarded as testifying to the existence of Self and Not-self in their mutual relation, is "above all scepticism."

G. P. Y.

SCIENTIFIC AND LITERARY NOTES.

GEOLOGY AND MINERALOGY.

PALÆONTOLOGY OF NEW YORK.

It is universally allowed, that the great work on the Palæontology of the State of New York, by Professor James Hall of Albany, stands pre-eminent amongst the publications of recognised value emanating from American science. The high character, so fully established by the volumes already published, is not without danger, however, of being greatly deteriorated, as regards the completion of the work. It may not be generally known, that the original plan of the publication comprised the issue of five quarto volumes; each to contain about one hundred plates of figures, with appropriate letter-press descriptions. Two of these volumes have already appeared, and a third will be issued early in 1857. Professor Hall has also undertaken, by an agreement entered into between himself on the one part, and the Hon. E. Leavensworth, Secretary of State, and T. Romeyn Beck, Secretary of the Board of Regents, on the other—to devote his entire attention during nine months of each year to the completion of volumes 4 and 5; and to have these ready for press within two periods, each of four years, from the completion of volume 3. So far as we understand the question, an exception seems to have been taken by some of the Members of the Assembly, on the score of unnecessary expense, to certain details connected with the mode of publication. This appears to have led to the nomination of a select committee, to report upon the matter at issue and on the completion, in general, of the Natural History of the State. The Report of this committee, dated April 8th, 1856, is now before us. It condemns most unequivocally the present system of publication as one of unparalleled extravagance, but on grounds which we believe to be altogether erroneous. The system is to a certain extent, and necessarily, a costly one; but the cost, we repeat, is fully sustained by the character and acknowledged utility of the work. A strong objection is made in the Report to the number of figures or illustrations. Undoubtedly a smaller number might have been given, but with what result—simply the lowering of the work from its present high position to one of comparative mediocrity, alike prejudicial to the reputation of the State from which it emanates, and to the interests of science generally. In many instances, it is only by numerous and varied figures, that the true value of assumed specific or even generic distinctions can be shewn: more especially in the case of fossil specimens, in which distortions and obscurities unavoidably abound. To the earnest student, a single figure, it is well known, is often worse than useless; and we have no doubt that Professor Hall could add, with much benefit to science, many new examples to those already figured in the completed volumes. The Report observes—"The first volume of the Palæontology of New York, describes 381 species, illustrated by 2,000 figures on 100 plates, making the average number to exceed five figures to a species. One thousand figures ought to be regarded by all scientific men, as amply sufficient." Against this judgment we venture without hesitation to protest—knowing full well, that palæontologists, that all indeed who have had anything to do with fossils, will bear us out in our objection. Shackle the author by diminishing the legitimate number of his figures, and the reputation of the work is at once destroyed. We trust, therefore, not only for the sake of American science, but for that of science in general, that the original plan of the publication will be suffered to prevail. A false economy in the present instance, with half the work completed, would be most suicidal in its effects.

ELAPHUS OR CERVUS CANADENSIS.

A large fragment of a right horn belonging to the wapiti, or Canadian stag,* has lately been presented to the Canadian Institute by Mr. T. C. Gregory, resident engineer of the Great Western Railway. It was found imbedded in drift clay, eight feet below the surface of the ground, near the left bank of the River Thames, a few miles from London, C. W. The museum of the Institute possesses a fine and very perfect pair of horns of the same species. The wapiti was formerly abundant in all parts of Canada; and its horns, &c., are of common occurrence in our bogs and marshes. An interesting description of the animal will be found in the second number of the Canadian Naturalist and Geologist.

SUBSIDENCE OF THE NEW JERSEY COAST.

The second Annual Report of the Geological Survey of the State of New Jersey, lately published, contains some exceedingly interesting observations by the Assistant Geologist, George H. Cook, on the rapid encroachment of the sea on the coast line of the State: a phenomenon due in part to the abrading action of the waves, and partly to the actual sinking of the land. Mr. Cook remarks, "While

* Commonly but erroneously called the elk.

in the southern part of the State, my attention was frequently called to the rapid wearing away of the shores, and to the advance of the tide-waters on the land. Local causes were in general assigned for the increased height of the tides; but this and other phenomena were extended over so long a line of shore, that it was thought there must be some general cause for them; and this cause appears to be, the slow but continued settling or subsidence of the land. At the mouth of Dennis Creek, in Cape May county, and for several miles along the bay shore, on each side of it, according to the local surveyors, the marsh wears away, on an average, about one rod in two years; and from the early maps, it would appear to have been going on at that rate ever since the first settlement of the country. A map of Cape May in the possession of Dr. Maurice Beasley of Dennisville, and bearing the date of 1694, lays down Egg Island, the western point of Maurice River Cove, as containing three hundred acres; at low water it now contains a half or three-fourths of an acre, and at high water it is entirely covered. * * * That the tides rise higher upon the uplands than formerly, is the opinion of the oldest observers, upon the Atlantic and Bay Shores, from Great Egg Harbor quite round to Salem Creek. Their opinion is founded on the fact that on the low uplands, or those coming down to the salt marsh with a gentle slope, the salt grass now grows where upland grass formerly grew; and where the land was in wood, narrow fringes of it next the marsh are frequently killed by the salt water, and marsh takes its place. * * In all the salt marshes on the sea shore of southern New Jersey, and also in the salt and fresh tide marshes on Delaware Bay and River, stumps of trees, of the common species of the country, are found with their roots still fast in the solid ground at the bottom of the marsh, and this at depths far below low-water mark. The fact is known to every one living in the neighborhood of these marshes, and the evidence of it can be seen in the bottoms or in the banks of every ditch that is cut in them." Our space will not admit of further extracts, but the entire Report will well repay perusal. A subsidence of the land appears to have taken place, within comparatively modern periods, if it be not still going on, along the greater portion of the Atlantic coast of the Union, as well as in Nova Scotia and Newfoundland. Instances of submarine forests on the shores of Nova Scotia are cited with full details, in Professor Dawson's work on "Acadian Geology," reviewed in a late number of the Journal.

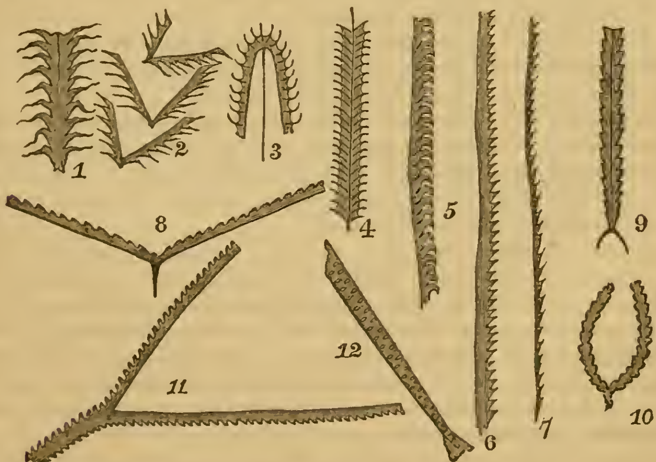
GRAPTOLITES.

The subjoined tabular distribution (with accompanying figures) of the more common forms of American graptolites, may not be unacceptable to some of the readers of the Canadian Journal. For the benefit of the general reader, it may be briefly stated, that the graptolites—confined entirely to the earliest fossiliferous periods of geological history—belonged, in all probability, to the Bryoza: a group of delicate compound, or coral-like forms, ranging at the base of the Molluscous types.* The Bryoza secrete a horny or semi-calcareous framework or common

* The writer has placed in the collection of the Canadian Institute several specimens of modern Bryoza (or of their skeletons rather), obtained by him on the south-eastern coast of England. Some of these have the most striking resemblance to graptolite forms. At the same time, a palæontological law, of very general application, would appear to oppose itself to the idea of even a generic relationship. This law assumes, that after a type has once appeared, it continues through all the intervening periods up to the date of its final extinction. The graptolites are altogether unknown above the lower or middle part of the Upper Silurians.

skeleton; and occur either free, or as an incrustation on stones, shells, sea weeds, and other bodies. The common form of the graptolite is that of an extremely narrow band, dentated or toothed on one or on both of its edges. The so called teeth constitute the cells or dwelling chambers of the separate animals (or vital centres) of the organized mass. The band itself, or stipe, is occasionally expanded into a leaf-like form; or narrowed, on the other hand, into a mere thread. Many specimens exhibit also a filiform central axis, often extending beyond the stipe.

These fossils have been grouped in several genera, of which the more important comprise:—*Graptolithus* (teeth on one side only, but close together, stipe unbranched). *Rastrites* (teeth far apart; stipe unbranched, but often convoluted). *Didymograpsus* (teeth on one side; stipe branched). *Diplograpsus* (teeth on each side of stipe). Certain branched forms, however, have a single row of teeth on the branches, whilst the main stem is toothed on both sides: and hence, in cases of this kind, fragments of one and the same form might be referred to different genera. The deeply recurved species of *Didymograpsus*, again, constitute transitional forms between that genus and *Diplograpsus*. The non-occurrence of doubly-toothed forms, as pointed out by Sir Roderick Murchison, in the Upper Silurians of England, does not militate against these objections: because, (so far as regards species) graptolites are never abundant in these upper rocks, and doubly-toothed species are found in them in other localities. There can be no doubt, moreover, as shewn by Sir W. Logan's discovery in the Point Levi district, that our common specimens exhibit merely a fragmentary condition of the original graptolite structure. The genus *Rastrites* does not appear to have been discovered in America. The other genera are included in this note, under the common term of *Graptolithus*.



§ 1. *Graptolites with mucronate serratures.*

G. mucronatus, Hall. Unbranched; flattened; doubly-toothed; teeth with mucronate and more or less wavy tips. Fig. 1. Hudson River group: Albany.

G. sextans, Hall. Branched; the branches separating from the base, and exhibiting teeth on the outside only; tips delicately mucronate, but often badly preserved. Fig. 2. Hudson River group.

G. caduceus, (*Didymograpsus caduceus*, Salter). Branched; the branches deeply recurved, and toothed on the outside. Long filiform rachis. Fig. 3. Sillery formation; opposite Quebec.

To this section belong also the European forms—*G. Sedgwickii*, Portlock; *G. (Diplograpsus) folium*, etc.

§ 2. *Graptolites with acute or sub-mucronate serratures.*

G. pristis, Hall. (*Diplograpsus pristis*, *Prionotis pristis*, Hisinger). Unbranched. Stipe with central filiform rachis, and teeth on each side; the tips sometimes sub-mucronate. Fig. 4. Trenton limestone, Utica slate, and Hudson River group. *G. amplexicaule* and *G. secalinus*, Hall, are probably varieties.

G. priodon, Bronn. *G. Ludensis*, Murchison: Silurian system. *G. Clintonensis*, Hall). Unbranched; toothed on one side only. Teeth deeply cut, and with recurved tips. Fig. 5. Clinton group. In Europe, in Lower and Upper Silurians.

G. sagittarius, Portlock. Unbranched. Stipe in long narrow pieces, straight or slightly flexuous, with acute teeth on one side only. Fig. 6. Hudson River group.

G. tenuis, Portlock. Unbranched. Stipe in long thread-like pieces, straight or flexuous, obscurely and distantly toothed on one side only. Fig. 7. Hudson River group.

G. serratulus, Hall. Branched: the branches widley divergent, very slender, and with somewhat distant teeth. Fig. 8. Hudson River group, Albany.

G. gracilis, Hall. In delicate, wavy branches. See Pal. New York; vol. 1, p. 274.

G. venosus, Hall. See Pal. New York; vol. 2, p. 40.

§ 3. *Graptolites with obtuse serratures.*

G. bicornis, Hall. Unbranched. Stipe tapering towards the base, and terminating in a short fork. Toothed on each side: teeth obtuse. Central rachis usually well pronounced. Fig. 9. Hudson River group.

G. furcatus, Hall. Branched: the branches near together and converging; bluntly toothed, in general, on both sides. Fig. 10. Hudson River group, Albany.

G. ramosus, Hall. Branched: the branches diverging at a moderate angle, long, and toothed on the outside only. Fig. 11. Hudson River group.

§ 4. *Graptolites with smooth borders.**

*G. scalaris.** Unbranched. Stipe alternately spotted, or transversely marked on each side, but with smooth margin. Gradually tapering, and terminating in a slight expansion. Fig. 12. Hall. Utica slate and Hudson River group.

This form differs very materially from the *G. scalaris*, described by Geinitz, in Bronn's Jarbuch for 1840 and 1842. It has rather the aspect of a *G. bicornis* flattened in a plane more or less perpendicular to the direction of the teeth.

G. lævis, Hall. Unbranched. Stipe narrow, flexuous, and slightly tapering. Utica slate (A doubtful form).

For more complete descriptions, &c., of the above species, the reader is referred to the standard work on the Palæontology of New York, by Professor James Hall. Our knowledge of the graptolites generally, is likely to receive considerable additions from some of the projected publications of the Geological Survey.

E. J. C.

---

* Probably a deceptive appearance, produced by flattening in a particular direction.

ETHNOLOGY AND ARCHÆOLOGY.

PERUVIAN GOLDEN SHROUD.

In a recent communication to the *National Intelligencer*, a correspondent, Mr. Thomas Ewbank, gives some important information in regard to the discoveries made in Peruvian tombs and tumuli derived from W. W. Evans, Esq., a gentleman of strong antiquarian predilections, and now engineer of the Arica and Tacna Railroad, in Peru. Mr. Evans states, that in making excavations for the railroad at Arica, hundreds of graves are demolished in all directions, in which are numerous Indian relics. The excavations are seventy feet deep, and as the soil is loose sand, as the work proceeds, every thing from the top comes sliding down—dead Indians, pots, kettles, arrow-heads, &c. Among other interesting mortuary relics, an Indian was started out of his resting place, rolled up in a shroud of gold. Before Mr. Evans had knowledge of the incident, the workmen had cut up this magnificent winding-sheet and divided it among themselves. With some difficulty Mr. Evans obtained a fragment and dispatched it to Mr. Ewbank. Mr. Evans notices a remarkable fact, that in hundreds of Indians' skulls which he has examined, not one has contained a decayed tooth. Mr. Ewbank thinks the weight of the entire shroud must have been eight or nine pounds, and, had it been preserved, it would have been the finest specimen of sheet gold that we have heard of since the times of the Spanish conquest. In some remarks upon the preservation of souvenirs of the departed, Mr. Ewbank observes: it is the form of features, and not the body, of the dead, that should be preserved. The mummies of Egypt are quarried for fuel, and, whether their wives, their priests, or their slaves, they are split open, and chopped up with the same indifference as so many pine logs. The gums and balsams used in embalming them have made them a good substitute for bituminous coal; and thus the very means employed to preserve them have become the active agents of their dissipation. So it is when the materials of coffins have a high market value, they are then seized as concealed treasure, and their contents cast out as rubbish. Like heroes in the Eastern hemisphere, the descendants of Manco Capec were sometimes, if not always, entombed in such, and with considerable treasure besides, in vessels of gold and silver; hence we learn how the Spanish conquerors sought for, often found, and as often plundered rich Indian sepulchres.

GREEK SLAVE OF THE FIFTEENTH CENTURY.

At a recent meeting of the Society of Antiquaries of Scotland, Mr. Joseph Robertson communicated a notice of a Letter of Safe Conduct and Recommendation granted by James II., King of Scots, to Nicholas Georgiades, a Greek of Arcosson, travelling through Scotland to collect the alms of the Faithful for the ransom of his brother, taken prisoner by the Turks at the capture of Constantinople in 1453.

This document afforded a casual illustration of the feelings which the fall of the capital of the Roman Empire in the East excited even in the farthest frontiers of Western Europe. Six years after that memorable event, a Greek who had lost his all in the siege, and left a brother captive in the hands of the Mahometan conquerors, made his way, maimed of a limb, to the Scottish shore. He bore a letter from the Cardinal of Jerusalem, and on the faith of this, and moved by the wanderer's story as heard from his own lips, the Scottish King, James II., issued a letter under the great seal, taking the goods, person, and servants of the exile under his especial protection, and recommending the lieges and subjects of Scotland to give their help and favour to the Greek in the pious object of his mission: the gathering, from the charity of Christians, of a sum sufficient to ransom his brother from the power of "those enemies of the Cross of Christ," as they were termed, "the execrable Turks." It appeared that Nicholas Georgiades was not the only Greek of the Byzantine Empire wafted to the distant coast of Scotland. In 1459–60, King James II., ordered a sum of fifteen pounds to be divided between "two Knights of Greece"—warriors, doubtless, whom the triumphs of the Crescent had left without a home or a country. Mr. Robertson, in illustration of the intercourse between Scotland and the East about the end of the fifteenth century, adduced the case of a younger son of Hume of Fast Castle, whom the love of adventure or the spirit of devotion had conducted to the banks of the Nile, where he rose to distinction in the service of the Sultan of the Mamelukes reigning at Cairo. Here tidings reached him that, one after another, eight of his kinsmen had died, leaving him the nearest heir of the gloomy fortress and wild domain which are supposed to have suggested to Scott his picture of Wolf's Crag, the last retreat of the Master of Ravenswood. In order to defray the ransom of his son, the laird of Fast Castle shipped from Leith forty-seven sacks of the wool of the Lammermoors—each sack containing about 640 pounds weight—and the adventurer returned to Scotland in 1509, in the train of that young Archbishop of St. Andrews (the pupil of Erasmus) along with whom he was fated so soon to fall at Flodden. Mr. Robertson added that if we knew more of the individual life of our forefathers, we should perhaps discover that such foreign travels as those of Cuthbert Hume were less unfrequent than might be supposed. The same year, for instance, which saw his return from Egypt, beheld a bailie of the Scottish burgh of Peebles departing on a pilgrimage to Jerusalem.

INDIANS OF GUATEMALA.

Referring to a previous announcement in the *Literary Gazette*, a writer in that journal remarks: "At a recent sitting of the Imperial Academy of Sciences at Vienna, Dr. Scherzer read a paper on a Spanish manuscript discovered in 1854 at Guatemala, containing a complete history of the first Indian population of that part of the continent of America, and an account of their religion, laws and manners. The author of the manuscript is, it appears, a Dominican Monk, named Francisco Ximenez, who was Missionary to the Indians about a hundred and thirty years ago; but as he is known to have written on the Indians in the native Guichey language, it is probably only a translation. It is, notwithstanding, the most valuable account of that interesting race which exists, all previous records having been lost or destroyed. It was for many years feared that all the writings of Ximenes, which were very voluminous, had been lost also; indeed, it was believed that the religious order to which he belonged had caused them to be burned, because he did not hesitate to blame in them the cruel means which the Dominicans employed to convert the Indians; but the manuscript in question was preserved in some convent, and from it was transferred to the University of Guatemala, where it remained until brought to light some eighteen months ago. In the account of the Indian religions it mentions two curious facts,—the first, that the Indian notion of the creation was: that God created eight couples at the same time; the second, that the first of their race in America came from the East, beyond the seas "de la otra parte de la mar del Oriente."

D. W.

CHEMISTRY.

Amorphous Phosphorus, prepared by keeping common phosphorus for some time at a temperature between 446°—482° F. in an inert atmosphere, whereby it becomes incapable of spontaneous inflammation, has lately been used largely in the arts ; as thus obtained, it is always mixed with some unaltered phosphorus, from which it is with difficulty purified by repeated washings with sulphuret of carbon, the process is attended with danger. Nickles puts a little of the sulphuret into the retort, in which the conversion has been effected; heats gently to separate the cake, adds a solution of chloride of calcium, of 38°—40° Beaumé, and shakes the mixture. The sulphuret of carbon floats on the surface, containing nearly all the unchanged phosphorus, a second portion will remove every trace, and leave the amorphous substance quite pure.

Chlorine.—C. T. Dunlop employs the residuum of the manufacture of chlorine in preparing an oxide of manganese, which can be again employed for the same purpose, being equal to about 80 per cent. of pure peroxide. The chloride is converted into carbonate by carbonate of ammonia, or by lime and the subsequent treatment of the hydrated oxide with carbonic acid, or by the joint action of carbonic acid and carbonate of lime. The carbonate is heated in contact with the air until oxidized.

Oxide of Cobalt.—By calcining the oxalate, the chloride, or the peroxide, with sal ammoniac, in the two latter cases in a current of oxygen or atmospheric air, and boiling the mass with hydrochloric acid, Schwarzenberg obtained the protoperoxide in the form of octohedral crystals, insoluble in most acids, and not magnetic.

By fusing an oxide of cobalt with hydrate of potassa, for a length of time, he obtained a black, micaceous, soft, scaly substance, which is not acted on by cold dilute nitric acid. On the supposition that cobaltic acid is Co^3O^5 the new salt would be KO, 3 Co^3O^5 +3HO.

Antimony.—Schneider has determined the equivalent of this metal, by reducing its native sulphide in a current of hydrogen at a low temperature; he finds a number much lower than that of Berzelius, viz. 1503 instead of 1613. [Is it not possible that a small quantity of antimoniuretted hydrogen may have been formed? Berzelius' numbers have not been generally found very incorrect.—H. C.]

Tungsten.—A. Riche prepares the metal by acting on tungstic acid heated with hydrogen for several hours in a porcelain tube. It appears as small hard crystalline grains, infusible in the heat of a furnace, but fusible by 200 Bunsen's elements. It is not oxidized in the air unless at a very high temperature; it combines with chlorine at 572° F. Nitric acid slowly converts it into tungstic acid. At a red heat it rapidly decomposes water. Iodide of tungstmethyle can be obtained in the usual way, and from this the oxide, which forms uncrystallizable salts. The equivalent of tungsten is 87.

The terchloride is obtained by the action of chlorine on the metal, and the bichloride in small quantities by the action of hydrogen on the terchloride. By heating one part of tungstic acid with three parts of charcoal in a current of chlorine, the so called chloride is obtained, which the author finds to be WCl^2O, with 2HO it gives WO^3+2HCl. The bisulphide was also obtained.

Titanium.—Mr. Duppa has obtained the bromide by passing bromine over a heated mixture of titanic acid and charcoal, and purifying by distillation over mercury. It forms a magnificently crystalline amber-yellow mass. SG=2.6. Fuses at 39°, boils at 230° The chloride boils at 135°. The difference = $3 \times 31\frac{1}{3}$ which is exactly the same difference as between the bromide and chloride of silicium. According to Kopp, the boiling points of the bromides differ from those of the chlorides by 32° for every equivalent of bromine replacing chlorine. According to this the formula of Titanic acid would be TiO^3, and the equivalent would require alteration. Further experiments are required to test this hypothesis.

Mercury.—R. Weber has examined the behaviour of sulphide of mercury to the compounds of the alkalic metals, and finds that it is capable of forming a crystalline sulpho-salt with the protosulphides of potassium or sodium, which compound however can only exist in presence of free alkali. According to Brunner the potassium salt is $KS+HgS+5HO$.

Silver.—Mr. Hambly has made some valuable experiments on the loss of this metal, resulting during its cupellation. Plattner has also investigated the cause of the loss of silver observed during the roasting of its ores, and he is inclined to believe from some experiments on the subject, that it results from the fact of oxide of silver being formed, which is again reduced in an exceedingly finely divided state, and is thus carried off by the gas of the furnace.

Sulphur in Hops.—It is often of importance to determine whether hops have been treated with sulphurous acid. The old silver test being of little value, Heidenreich evolves hydrogen from zinc and hydrochloric acid, with which the hops have been mixed; the formation of sulphuretted hydrogen, indicated by the brown color produced on passing the gas through a solution of acetate of lead, proves the presence of sulphurous acid. Wagner adopts the same process, but uses a pale solution of nitroprusside of sodium made slightly alkaline. The test is exceedingly delicate, but will not succeed if the hops have been kept some months.

Iodates.—Rammelsberg has carefully examined the crystalline forms of the double salts formed by biniodate of potassa with chloride of potassium and sulphate of potassa. The formulæ are $KCl+KO$, $2IO^5$ and $KO.IO+4KO.2SO^3$ the latter being remarkable as containing anhydrous bisulphate.—*Pogg. Ann.* 97, *p.* 92.

Silicium.—Wöhler has described the properties of the graphite modification of silicium, obtained by fusing aluminium with dry silicofluoride of potassium or sodium. The mass is crushed, the aluminium extracted by hydrochloric acid, the silica by hydrofluoric acid, the residue washed. It forms opaque metallic crystalline leaves, very similar to graphite, but with more metallic lustre; it is harder than glass, but softer than topaz. S. G. = 2.490, being less than that of its oxide. Cannot be oxidized by oxygen even when heated to whiteness, infusible, like the amorphous silicium, when heated with carbonate of potassa, it oxidizes and produces combustion. Insoluble in acids, but slowly dissolved by solutions of potassa or soda. Combines readily with chlorine. *Pogg. Ann.* 97, *p.* 484.

Chromates.—Löwe has examined two chromates of bismuth, one obtained by precipitating nitrate of bismuth with chromate of potassa, the other by the action of dilute acids on the salt so formed. The formulæ are $3BiO^3+2CrO^3$ and BiO^3+2CrO^3. J f. Pr. Che 67. 288.

Solubility of Sulphate of Baryta in acids.—Mr. Noad has made some experiments to determine the effect of dilute hydrochloric acid in rendering sulphate of baryta soluble, in reference to Calvert's statements. (Vide ante, No. III., p. 311.)

From these it appears, that in moderately dilute solutions the whole of the sulphuric acid is precipitated by the addition of very little more of the barium salt than is theoretically required, but if the dilution be very great then a loss occurs, which, however, is not found if any excess of the precipitant be employed. As we do not generally precipitate from very dilute solutions, and always employ an excess of the precipitant, no danger need be apprehended from the presence of free hydrochloric acid. Mr. Noad points out, however, that fuming nitric acid often contains sulphuric acid, although it does not give any precipitate with a salt of barium when diluted. By driving off the greater part of the acid, and then diluting, the presence of sulphuric acid may be detected.—*Quar. Jour. of Chem. Soc. No.* 33.

Affinity.—Dr. Gladstone has published a lengthy investigation into the "Circumstances modifying the action of chemical affinity," which does not admit of an abstract.—*Phil. Trans.* 1855, *p.* 179. *Quar. Jour. of Chem. Soc. No.* 33.

Ammoniums.—T. Weltzien has published a very interesting paper on the "Ammonium Molecules of the Metals," and proposes an ingenious theory by which the formulæ of the anomalous compounds of ammonia with the haloid and oxy-salts, the ammonia-cobalt salts of Fremy, and the platinum, palladium and iridium combinations, are reduced to very simple and rational expressions. The paper can scarcely be abstracted without occupying more space in the Journal than the chemical department may justly claim.—*Ann. der Ch. iu Pharm.* 97, 19. H. C.

ENGINEERING AND ARCHITECTURE.

A NEW STEAM HAMMER.

Mr. Naylor, the Norwich superintendent of the locomotive department of the Eastern Counties Railway, has just succeeded in completing an important invention, in the form of a steam hammer, which he believes to be, in many respects, superior to any other that has yet been constructed. Its peculiar qualities consist in its adaptation to all descriptions of work brought under it. It can deal with a small piece of iron with the greatest precision, be it ever so small, or it can efficiently operate upon a piece of iron six or seven inches thick. Such is the command over it that it can be made to strike a light or heavy blow at will, and, if necessary, the light and heavy blows can be given alternately, while it is dealing 200 blows a minute. The rate of working may, moreover, if desired, be reduced to less than 100 blows per minute. Most power hammers obtain their force by their accelerated velocity in their fall. Consequently when working upon a large piece of iron, the greatest force is necessary; but, as the distance of the fall of the hammer is reduced by the thickness of the iron it is operating upon, the full power of the hammer cannot be exercised. Mr. Naylor has, however, a provision for this difficulty, for, by his peculiar and patented arrangements, he can put any amount of steam power upon the hammer in addition to its own gravity, and it matters not, therefore whether the hammer falls through a space of six inches or six feet, so long as its velocity is the same at the instant of its contact with the iron on the anvil. The steam can be applied above as well as under the piston of the hammer, or, by merely turning a small handle, the steam is prevented entering into the top of the cylinder, leaving the hammer to fall (as others do) by its gravity alone. The fact that this change may be made while the hammer is at work shows the great advantage of Mr. Naylor's arrangement over that of others, and is more striking even to those who do not profess an intimate acquaintance with steam hammers. By having a short blow as effective as a long one, a greater number of blows can be given in the same time, and all practical men know the advantage of striking the iron while it is hot. The hammer weighs about 6 cwt., and its greatest fall is but 18 inches. It is very simple in its construction, yet beautiful in its details. To show its extraordinary power one instance will suffice. We were shown a bar of iron six feet long, three inches wide, and three-quarters of an inch thick, which had been drawn at one heat in eight and a half minutes out of an old block of machinery not more than 12 inches long, thus producing out of the old scrap of iron a bar of new iron of the very best quality. The principle of this hammer has been patented by Mr. Naylor, who considers it equally applicable as a riveting machine for boiler making and iron ship-building, as well as for iron making, smith's forging, stamping ore, and, indeed, for all purposes requiring the process of hammering; and to meet every end, it can be worked by elastic gas, compressed air, steam, or vacuum.—*Norfolk News.*

NEW IRON LIGHTHOUSE.

Lieutenant Meade, U. S. Topographical Engineers, has designed a new iron light-house for the Florida Reefs. It is now in process of construction by Philadelphia manufacturers. The structure will be 150 feet in height, and 50 feet in diameter at the base. It is built in the form of an octagon, strengthened by eight cast iron columns outside, from which braces and ties extend. The sections, one above the other, are equally well made and secured. The braces are of the most substantial character, but unenclosed.

LITERATURE AND THE FINE ARTS.

SIR WILLIAM HAMILTON.

The announcement of the death of this illustrious philosopher, which took place since our last issue, has been received with the deepest sorrow by all who are capable of appreciating the fruits of his literary labors, and his wonderful intellectual endowments, which fitted him for far greater contributions to his favorite department of mental science, than he has accomplished.

Sir William was the lineal representative of the Hamiltons of Preston, an ancient Scottish family, celebrated in the history of Scotland's covenanting struggle, the head of which was created a baronet in 1673. The title had been dormant for some time, until it was assumed by Sir William in 1816. He is succeeded in the Baronetcy by his eldest son William, born in 1830, now in India.

Sir William was born in Glasgow, on the 8th March, 1788. He had thus completed his sixty-eighth year. After studying at the University of that City, he went to Oxford on the Snell foundation, where he obtained first class honors. He was called to the Scottish bar in 1813. In 1821 he was appointed Professor of Universal History in the University of Edinburgh; and in 1836 he obtained the chair of Logic and Metaphysics, which he occupied to the period of his death. The following notice is extracted from the *Scotsman:*

Sir William is known to the world chiefly by his contributions to the *Edinburgh Review*, and his edition of the works of Dr. Thomas Reid. The contributions to the *Review* extend from the year 1829 to 1839, and were collected and republished in 1852. His edition of Reid, which was the work of many years of patient and profound thought, first appeared in 1846. These writings are known and prized throughout both Europe and America. Among those who take an interest in philosophical pursuits, it has long been matter of regret that the state of Sir William's health rendered it doubtful whether he should be able to confer systematic completeness on those incomparable philosophical fragments which he from time to time gave to the world, and unfold even more fully his great stores of learning. There is now but one feeling of unmingled sorrow that the great mind which alone could have worthily filled up the sketch it delineated, has passed for ever from amongst us.

By the death of Sir William, the University has lost its greatest ornament, and Scotland one of the most illustrious of her sons. His attainments in general erudition were of the highest order; at once so varied and minute as rarely to be equalled, and in these times certainly unsurpassed. His historical learning, especially, was both ample and profound. In the department of speculative science, with which Sir William's name is peculiarly identified, he stood alone in Britain, if not in Europe—remarkable alike for subtle and profound thought, and for breadth and minuteness of erudition. His writings and academic teaching have inaugurated a new era in the history of Scottish speculation—an era that reflects in a high degree the qualities of mind and habits of thought of its founder. In the hands of Reid, Stewart and Brown, Scottish philosophical thinking was comparatively limited in its range, being chiefly psycological, and its relation to other schools, whether preceding or contemporaneous, were but few and ill-defined. By the influence of the great master, who has so recently departed, Scottish thinking, —while it has lost nothing of its manly independence and its sober but elevated spirit,—has widened its sphere and put itself in contact and alliance both with ancient and modern speculation. The wonderful philosophical erudition of Hamilton peculiarly fitted him for this task. With ancient, mediæval, and modern speculation he was thoroughly familiar. And what is a still rarer circumstance, and one more peculiarly distinctive of a powerful and independent mind, the amplitude of his erudition, instead of impeding or fettering the free exercise of his intellect, only lent it additional stimulus. No thinker, perhaps—at least, no modern thinker —has made greater and better use of the historical results of philosophical inquiry, in the way of moulding and sustaining his own thinking, than Hamilton. But in regard to the historical anticipations of the doctrines of this system, it may be truly said that it is only in the illumination which his own independent reflection has cast upon them that they acquire clearness, distinctness or significance. He walked at large through the domain of the history of speculation; but so obscure in themselves are many of the indications of doctrines which he developed and raised to the highest importance, as at once to impress us with the conviction that what he discovered there was mainly in virtue of the light which he carried with him, and brought to bear on what would otherwise have been faint and undistinguished.

Sir William Hamilton is no more; but he has left behind him a name of which Scotland may well be proud, and which will henceforward be a familiar word in philosophical schools. The doctrines that are peculiarly identified with his name will doubtless form the chief groundwork of philosophical debate in the future course of Scottish, we may say of European, speculation. His influence will be felt even where his positive teachings may chance to be repudiated. But, apart from his fame as a philosopher, Sir William will long live in the love and veneration of many a pupil and friend—for his heart would indeed be insensible who, having known the man, treasured no fond remembrance of the perfect courtesy and the genuine kindness that were conjoined with an intellect so gifted, and accomplishments so rare.

DANIEL SHARPE, F. R. S.

The "Literary Gazette" announces the sudden death of Daniel Sharpe, Esq., President of the Geological Society, adding another to the list of eminent geologists, including De la Beche, Mantell, Greenough, Forbes, Strickland, and others, whose deaths have recently been recorded. Mr. Sharpe's death was occasioned by his being thrown from his horse while riding in the neighborhood of Norwood, by which he sustained a fracture of the skull.

Mr. Sharpe was not less valued for his labours in philological and ethnological science, than as a successful student of geology. His learned essays on the ancient Lycian inscriptions and coins, appended to the works on Lycia by Sir C. Fellows and Edward Forbes, are enduring monuments of his classical learning and archæological acumen. He was a nephew of the poet Rogers, whom he has so very shortly survived, and was only in his fifty first year, and still in the full vigor of life, when this sad accident abruptly brought all his labors in the cause of science and learning to a premature close.

LITERARY GOSSIP.

The death of James Wilson, Esq., F.R.S.E., distinguished as a naturalist, and greatly loved among Edinburgh circles, is recorded in the Scottish journals. He was a brother of Professor Wilson.

Among the candidates for the Chair of Metaphysics in Edinburgh University, the contest is thought to lie between the Rev. Prof. Fraser, of New College, Edinburgh: the editor of the "North British Review;" and Professor Ferrier, of St. Andrews: the author of "The Institutes of Metaphysics;" both able men, and well fitted for the chair. Besides these, the candidates are: Scott, of Manchester,—formerly of University College, London; Stowell—if we mistake not, the Rev. W. H. Stowell, Professor of Theology, Rotherham College, and author of the "History of the Puritans in England, under the Tudors and Stuarts;" Rev. Dr. McVicar, author of the "Catholic Spirit of True Religion," &c., Ramsay (?), and Thomas Spencer Baynes, the translator of the "Port Royal Logic," and author of "An Essay on the New Analytic of Logical Forms." Morell, Henry Rogers, and others, spoken of as candidates, have not advanced their claims.

Professor Aytoun, the author of "The Lays of the Scottish Cavaliers," &c, is bringing out, one of these days, "Bothwell," a long poem on Mary Queen of Scots.

M. J. Geoffroy Saint Hilaire, the naturalist, Vice President of the Academy of Sciences of Paris, has succeeded to the Presidency, in consequence of the death of M. Binet, the eminent mathematician, and M. Despretz has been elected Vice President.

A Photographic Society has been established in Edinburgh, under the name of the Photographic Society of Scotland. Prince Albert has accepted the post of Patron, and Sir David Brewster undertakes the active duties of President.

Robert Chambers has generously paid over to Mrs. Begg, the surviving sister of the poet Burns, the sum of £200; being the first profits derived from his Life and edition of the Works of the poet.

A SHAKSPEARIAN EPITAPH.

According to a recent correspondent of the Athenæum, there is an epitaph in Tongue Church, Shropshire, ascribed in positive terms to Shakspeare, by William Dugdale, in his Visitation Book. It is on Sir Thomas Stanley, who died about 1600:—

"Not monumental stone preserves our fame,
Nor sky-aspiring pyramids our name.
The memory of him for whom this stands
Shall outlive marble and defacer's hands.
When all to time's consumption shall be given,
Stanley, for whom this stands, shall stand in heaven."

REYNOLDS' SKETCH BOOKS.

Among the various art-treasures accruing to this continent, the Athenæum thus comments on one acquisitiou in terms that seem to indicate our neighbours in the States have borne off from the dispersion of the Rogers' collection, only "an empty oyster shell!" Its interest, however, is considerable when regarded biographically, whatever be its actual artistic value, and on this account we may refer to it now that it is to be at so accessible a distance as New York.

"Sir Joshua Reynolds used to regret he had not enjoyed the advantages of an academical education in his youth, and always felt that he was unable to draw. The difficulties he laboured under are very apparent in three curious little books recently sold at the Rogers' sale. Two of them were the sketch-books Reynolds used in Italy, and contain notes and sketches of some of the most celebrated pictures and works of art, together with records of dates, places, travelling expenses, and frequent memoranda of colour. They were purchased by Rogers at the sale of the painter's effects, and are now on their way to America, where they can only be valued as having been the actual property of our great painter. Many of the pages, containing merely lead-pencil outlines, display such weak and uncertain drawing as a child would produce, rather than the notes of an experienced artist. Where broad shadow occurs the power of Reynolds may be seeu. He worked in masses, not lines, and it is curious, where he was confined to the latter, to observe how he proceeded, addiug one line upon the other until he arrived at somethiug like his intention. He floundered, and was anything but academic. These peculiarities, however, were a part of the man, and never thoroughly overcome. In studying the individual artist they form an inseparable part of his character, and afford an insight into his mind. By these books we observe what pictures, scenes, and objects he thought most worthy of treasuring in his memory, and therefore it is to be regretted that they have passed so far from us into private hands where they become mere curiosities. He frequently designed and completed his composition on one and the same canvas, so that the masterly brush strokes at last concealed the wavering pencilings of the beginning. Such weakuesses are not discreditable to Reynolds; aud it would be a pity for those who are jealous for his fame to anxiously endeavor to conceal them, since we know that by labour and perseverance these difficulties were at last overcome. He rarely quitted a subject till nothing more was to be desired."

Compared with his pictures, adds the writer in the Athenæum, these books are but a sorry introduction of Sir Joshua to Brother Jonathan. Where his pictures are, his sketch-books ought to have been preserved.

CANADIAN INSTITUTE.

SESSION 1855–56.

SEVENTH ORDINARY MEETING—*9th February*, 1856.

E. A. MEREDITH, Esq., LL. B., Vice President, in the Chair.

The following Gentlemen were elected Members:

R. M. BOUCHER, Esq., Colborne.
EDWARD GOLDSMITH, Esq., Toronto.
WALTER ARNOLD, Esq., Toronto,
W. R. WRIGHT, Esq., Toronto.

The following Papers were then read:

1. By Rev. PROFESSOR YOUNG, M.A.:
"Brief Notes on Certain Statements of Sir William Hamilton, regarding the Validity of our Primary Beliefs."
2. By PROFESSOR WILSON, LL.D.:
"Remarks on a Singular Conformation of the Land produced by the Confluence of the St. Louis and Nemadji Rivers into Lake Superior."
3. By PROFESSOR CHAPMAN, Curator:
"A Report on the Minerals lately received by the Canadian Institute from the Toronto Athenæum."

EIGHTH ORDINARY MEETING—*16th February*, 1856.

G. W. ALLAN, Esq., President, in the Chair.

The following Gentlemen were elected Members:

FRANCIS H. LYNCH, Esq., Toronto.
ROBERT A. HARRISON, Esq., Toronto.
GRANT POWELL, Esq., Toronto.

The following Papers were then read:

1. By JAMES BROWNE, Esq.:
"On the Manners and Customs of the Aborigines of Australia. Part Second.
2. By THOMAS REYNOLDS, M. D.:
"On a Collection of Copper Implements and other Ancient Relics found in the neighborhood of Brockville."

The copper implements were exhibited and a selection from them recommended to be engraved, to illustrate the paper in the Canadian Journal. On the motion of Dr. Wilson, it was remitted to Professor Croft to examine and report upon the character of the copper of which the Brockville implements are made, and on the supposed hardening process to which they have been subjected.

3. By G. W. ALLAN, Esq., President:
"On the Migratory Birds of Canada."

NINTH ORDINARY MEETING—23*d February*, 1856.

G. W. ALLAN, Esq., President, in the Chair.

The following Gentlemen were elected Members:

Rev. W. ORMISTON, B. A., Toronto.
GEORGE CRAWFORD, Esq., M. P. P., Brockville,
FREDERIC KINGSTON, Esq., Barrister at Law, Toronto.

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

1. From the Hon. J. M. Brodhead, of Washington:—
"The Army Meteorological Register, for twelve years, 1842 to 1854 inclusive. Compiled from observations made by the Officers of the Medical Department of the United States' Army.
2. From Dr. Carter, of Nelson:—
"Illustrations of Japan, by M. Titsingle, formerly Chief Agent to the Dutch East India Company at Nagasaki.

The following Papers were then read:

1. By Sandford Fleming, Esq., C. E.—
"The Canadian Geological Survey, and its Director, William Edmond Logan, Esq., F.R.S."

After the reading of this communication, it was moved by Mr. Fleming, seconded by Mr. Armour, and resolved:

That the Council be requested to take into consideration the propriety of memorializing the various branches of the Legislature, setting forth the value and importance of the Geological Survey, and the services of Mr. Logan, as its Director, as well as the chief representative of Canada at the London and Paris exhibitions; and that the Legislature, in acknowledgment of the value of the Survey to the material prosperity of the country, and of his services in developing the resources of the Province, be solicited to place the Survey on such a liberal scale as will enable Mr. Logan to carry on to a satisfactory completion, at an early day, this important service; and that a Committee be appointed, with power to take such steps as may seem to them necessary to carry out the object of the proposed memorial.

2. By Professor E. J. Chapman:—
"A Review of the Trilobites; their character and classification."
3. By the Rev. A. C. Geikie:—
"An Inquiry into the Causes of Deterioration in the Population of New England."

TENTH ORDINARY MEETING—1*st March*, 1856.

G. W. ALLAN, Esq., President, in the Chair.

The following Gentlemen were elected Members:

WILLIAM G. DICKINSON, M. D., Hamilton,
CHARLES EDWARD ROMAIN, Esq., Toronto.
WILLIAM F. MEUDELL, Esq., Toronto.

Donations were announced from Mr. W. Couper, of a mud-turtle, and a stone curiously perforated by the action of water, both found on "The Island," and the thanks of the Institute were voted to the donor.

The following Papers were read:

1. By P. MacGregor, Esq.—
 "On the Climate of Canada."
2. By Professor Wilson, LL.D.—
 "On the Pictured Rocks of Lake Superior."
3. By Professor Croft, D.C.L.—
 "Analysis of Ancient Copper Relics found in the neighborhood of Brockville, Canada West."

ELEVENTH ORDINARY MEETING—*8th March*, 1856.

G. W. ALLAN, Esq., President, in the Chair.

The following Gentlemen were elected Members:

REV. A. LORIMER, Librarian, University College, Toronto.
JAMES ALEXANDER, Esq., Toronto.
GEORGE KENT RADFORD, Esq., C.E., Toronto.
EDWARD C. RADFORD, Esq., Toronto.

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

1. From T. C. Gregory, Esq., of Windsor:—
 "Annual Report of the Board of Water Commissioners to the Common Council of the City of Detroit."
2. From the author, H. Goadby, M.D., of Detroit.—
 "The Medical Independent and Monthly Review of Medicine and Surgery."
3. From the publishers, Messrs. Gould & Lincoln, of Boston:—
 "Annual of Scientific Discovery, 1856, a Year-book of Facts in Science and Arts."
4. From the editor, E. Billings, Esq., Barrister at Law, Ottawa:—
 "The Canadian Naturalist and Geologist."
5. From the publishers, Messrs. Phillips, Sampson & Co., of Boston:—
 "Prescott's Philip the Second, King of Spain." 2 vols. 8vo."
 "American Almanack, 1856."
6. From the Hon. J. M. Brodhead, of Washington:—
 "The Official Army Register of the United States, for the year 1856."
 "The Navy Register of the United States, for the year 1856."
7. From H. Bovell Hope, Esq.—
 Fifty-five silver coins of Edward II. and III., Edward VI. and Queen Elizabeth.
 "Communications to the Society of Antiquaries of London, on Coins found at different places." Illustrated with engravings.

The following Papers were then read:

1. By Professor Hind, M.A.—
 "On the Blue Clay of Toronto."
2. By Joseph Robinson, Esq.—
 "On 'Fish Jointing' on the permanent way of Railroads."
3. By Professor Croft, D.C.L.—
 "On a New Process for Preventing Explosion in the Camphine Lamp."

TWELFTH ORDINARY MEETING—15*th March*, 1856.

G. W. ALLAN, Esq., President, in the Chair.

The following Gentlemen were elected Members:

REV. DAVID INGLIS, Hamilton.
S. M. JARVIS, Esq., Toronto.

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

By the Hon. J. M. Brodhead, of Washington:—
"United States Official Register for 1855."
"Report on the principal Fisheries of the American Seas, by Lorenzo Sabine."

The following Papers were then read:

1. By the Rev. Professor Young, M.A.—
"A New Proof of the Parallelogram of Forces."
2. By T. C. Keefer, Esq., C.E.—
"On Civil Engineering."

THIRTEENTH ORDINARY MEETING—29*th March*, 1856.

G. W. ALLAN, Esq., President, in the Chair.

The following Gentlemen were elected Members:

HERVEY W. PRICE, Esq., Toronto.
Rev. JOHN JENNINGS, Toronto.
WILLIAM SMART, Esq., Belleville.
Rev. R. J. MACGEORGE, Streetsville.
JOHN O. HATT, Esq., Hamilton.
Rev. EDMUND BALDWIN, M.A., Toronto.
CHARLES GRIFFIN, Esq., Toronto.
A. N. MACLEAN, Esq., Toronto.
F. P. HINCKS, Esq , Toronto.
JOHN C. GEIKIE, Esq., Toronto.
G. M. EVANS, Esq., M.A., Simcoe, C. W.

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

1. By James Alexander, Esq.—
"Suggestions for a Simple System of Decimal Notation and Currency."
2. By Mr. W. Couper.—
Six species of exotic Dytescidæ.
Ten species of exotic Lamillicornæ.
A Racoon Skin.

The following Papers were then read:

1. By Colonel Baron de Rottenburg—
"Some Observations on the supposed Self-luminosity of the planet Neptune."
2. By Alfred Brunel, Esq., C. E.—
"Economy of Fuel for Steam Machinery."

The President intimated, by order of the Council, that at the following meeting the Portrait of the First President of the Canadian Institute would be hung up in the Hall of the Institute, and that Sir William Edmond Logan—on whom, since the passing of the resolutions which were then to be carried into effect, Her Majesty had conferred the distinguished honor of knighthood—had been invited to be present on that occasion, to receive the address prepared in accordance with the resolution of a former meeting.

FOURTEENTH ORDINARY MEETING—*5th April*, 1856.

G. W. ALLAN, Esq., President, in the Chair.

The Hon. J. M. BRODHEAD, Washington, was elected a Life Member.

The following Gentlemen were elected Members:

T. G. HURD, Esq., Toronto.
EDWARD MORTON, Esq., M.R.C.S., Queensville.
A. G. ROBINSON, Esq., C.E., Orillia.
A. W. SCHWIEGER, Esq., C. E., Toronto.
J. ADAMS, Esq., M.D., Toronto.
DANIEL WRIGHT, Esq., Thornhill.
Col. KINGSMILL, Niagara.
T. ARNOLD, Esq., M.D., Toronto.
R. T. PENNEFATHER, Esq., Toronto.
D. A. SAMPSON, Esq., Toronto.

The President, on behalf of the Institute, then presented to Sir William Edmond Logan, an address prepared by the Council in accordance with the resolution of a former meeting. In the fulfilment of this resolution he remarked:

"Gentlemen, before proceeding to the other business of the evening, we have a gratifying duty to discharge to the distinguished and honored guest who is with us to-night. You are all aware that our resolution to adopt some special mode of marking our sense of the valuable services rendered to Canada by the eminent Geologist who first filled the office of President of this Institute, had been fully considered and recorded before the pleasing intelligence reached us that the valuable labors of Sir William Logan, in the cause of science, had been honored by a distinguished mark of the favor of his Sovereign; and that so soon as we had ascertained that his return to Canada, for which he had done so much, might soon be expected, it was unanimously resolved that we, the members of the Canadian Institute, should take the first opportunity, as a body, to tender him our congratulations on his well-merited honors; and further, that we should request him to sit for his portrait, to be hung up here as a lasting memorial of one to whose name we could always point with pride and satisfaction, as the first Canadian who has achieved for himself an European reputation in the world of science. And now, Sir William, with your permission, I will proceed to read the address, on behalf of myself and my brother members, which I am sure is not the language of mere formal compliment, but is sincerely expressive of the feelings of affectionate esteem and respect entertained towards you by every member of this Institute." The President then read the following

ADDRESS

TO SIR WILLIAM EDMOND LOGAN, F.R.S., F.G.S., &c. &c. &c.

CANADIAN PROVINCIAL GEOLOGIST.

We, the President, Council, and Members of the Canadian Institute, beg to offer you our cordial welcome on your return to Canada, after the successful completion of your labors on behalf of the Province at the Parisian Crystal Palace, and to tender to you our most hearty congratulations on the high, but justly merited, honors with which it has pleased Her Majesty to mark her sense of your distinguished merits as the foremost in the ranks of scientific men in this Province of the Empire.

We rejoice in the fresh evidence which your reception of the distinguished honor of knighthood affords, of our full share, as Canadians, in all the honors and privileges which pertain to the members of the United Empire; while we feel a peculiar gratification, as members of this Institute, in hailing as the recipient of one of the highest distinctions conferred on men of science by the British Sovereign, one on whom the first choice of this Institute fell to fill its presidential chair.

In now adorning our Hall of meeting with your portrait, permit us to assure you that while our estimate of your distinguished rank as a scientific geologist, and your disinterested and indefatigable zeal in all that can develope the resources and promote the true interests of Canada, cannot be affected by any distinctions conferred on you, we fully sympathise in the just pride which you must feel in being made a recipient of the same honors which British Sovereigns have already employed to mark with peculiar distinction the intellectual achievements of a Newton, a Davy, a Brewster, a Lyell and a Murchison. Nor can we withhold the expression of our congratulations on other no less merited honors, and especially on your receipt, by the award of your scientific brethren, of the Wollaston Medal; one of the highest marks of distinction with which they could testify their sense of the rank you have achieved in your labors as a Canadian geologist.

In the same spirit we now seek to confer on you such evidences of our appreciation of your successful labors in the cause of science as it is in our power to bestow; and, humble as is our position in relation to science, we venture to hope that our cordial congratulations will not be the less acceptable that they are addressed to the most distinguished among the scientific men of Canada, by a Canadian Institution.

Sir William Logan replied—' Mr. President, I am very grateful to yourself, to the Council, and to the Members of the Canadian Institute, for the very flattering manner in which you have been pleased to speak of me in your address—for your kind welcome—and for the congratulations which you offer me, on my success in France and in England. Whatever distinctions, however, may be bestowed on us at a distance, it is upon the respect, esteem, and confidence shewn us at home, that our happiness and satisfaction must chiefly depend. I can assure you, with sincerity, that the honor conferred upon me when you elected me the First President of the Institute, was one highly prized, although the circumstances of a distant domicile, and the intent pursuit of the investigations with which I am charged, rendered it extremely difficult for me to be of much use in your proceedings. And I feel it as no slight compliment that you should place a memento of me by the side of my friend, and much more worthy successor, Colonel Lefroy, whose constant exertions in the exact observation of Meteorological phenomena, have tended so greatly to spread the name of Toronto in the scientific world. It is a fortunate circumstance for me that my name should be connected with an act of grace on the part of Her Majesty, which serves to confirm your feeling in regard to the fact that as Canadians we enjoy a full share in the honors and privileges of British subjects. And I am proud to think that it was, perhaps, more because I was a

Canadian, in whom the inhabitants of the Province had reposed some trust, that the honor which has been conferred upon me by Her Majesty was so easily obtained. That I am proud of the honors which have been bestowed upon me by the Emperor of France, in respect to my geological labors, and also by my brother geologists in England, there can be no doubt. But I have striven for these honors because I have considered they would tend to promote the confidence which the inhabitants of the Province have reposed in me, in my endeavors to develope the truth in regard to the mineral resources of the Province; and in this work none could have been more interested in my success than the Members of this Institute. We have on the other side of the hall* an evidence of the interest taken by the Institute in the Geological Survey, and you have, in publishing what appears within that frame, published the one-half of what is included in the enlarged map which I presented to the exhibition at Paris. You have in it the whole of the Geology of Canada, as far as it is at present understood, and I think it will, perhaps, not be disagreeable to you that I should submit a short account of its leading features."

Sir William then proceeded to explain the Geological Map, and illustrated, first, the conformity of the physical structure of the country to its geography; secondly, the difference in conditions between the eastern and western troughs of North America which run through Canada; and thirdly, a circumstance which is considered a very striking one in regard to the physical structure of Canada; the want of all the formations which exist between the Laurentian rocks and the Upper Silurian, viz., the whole of the Lower Silurian rocks on the north side of the granite ridge. He had learned, while in Europe, that this last circumstance was applicable also to Russia. These facts, proving the existence of land round the North Pole, at the time of the deposit of the Lower Silurian, were three great scientific facts which have been brought out by the examination made by himself and his associates in Canada.

The Wollaston Medal, and the Gold Medal of Honor received by Sir William from the Emperor of France, were then produced for the inspection of the Members, along with a work containing the sketch of the Geology of Canada, which he had considered it proper to prepare and present to the Jury of the first class, as explanatory of the Geological Map in the Paris Exhibition.

The following Papers were then read:

1. By Paul Kane, Esq.—
 "On the Habits and Customs of the Walla-Wallas, one of the North American Indian Tribes," from the Journal of the Author.

2. By Professor Chapman:—
 "Brief Notes by Lieutenant Maury, of Washington, on some comparative phenomena of the North and South Atlantic Oceans."

3. By Professor Chapman:—
 Some fossil specimens from the Crimea examined and described.

* The Geological Map of Upper Canada, published in the Journal, Old Series, Vol. II, p. 1, to illustrate Sir William Logan's paper, "On the Physical Structure of the Western District of Upper Canada," which occupied one side of the Hall, was here referred to. On the other was hung the large Parisian Geological Map of the whole Province, and the neighbouring districts, which he employed in illustrating the peculiar physical structure and geological formations both of Upper and Lower Canada, as established by the labours of the Geological Survey.

FIFTEENTH ORDINARY MEETING—19*th April*, 1856.

G. W. ALLAN, Esq., President, in the Chair.

The following Gentleman was elected a Member:

Rev. Professor AMBERY, M. A., Trinity College, Toronto.

The following letter from the Provincial Secretary was read.

Secretary's Office,
Toronto, 15th April, 1856.

Sir—I am commanded by His Excellency the Governor General, to acknowledge the receipt of the Memorial of the Canadian Institute, signed by you, as the President of the Society, praying His Excellency to cause provision to be made for carrying on the Geological Survey of the Province on a more extended scale, so as to insure its completion in every detail, at the earliest possible period.

His Excellency desires me to request you to assure the Canadian Institute that he entirely coincides in the opinion expressed in their Memorial, as to the importance to the Province, both in a scientific and economical point of view, of the Geological Survey, and as to the value of the services of the distinguished Canadian by whom it has been conducted.

I am to add that the prayer of the Memorial will receive His Excellency's full consideration.

I have the honor to be,
Sir, your most obedient servant,
GEORGE E. CARTIER,
Secretary.

G. W. Allan, Esq., President Canadian Institute,
Toronto.

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

1. By Robert A. Harrison, B.C.L., Toronto—
   Package of Antiquarian Papers.
2. By T. C. Gregory, Esq., Windsor, C. W.—
   Collection of Fossil Elk Horns.
3. By W. C. Chewett, Esq., M. D.—
   A letter was read by Professor Cherriman from Dr. Chewett, intimating a donation of Fifty Pounds worth of Books to the Library of the Institute, to be selected by the Council, from the stock of Messrs. Maclear & Co.
   On the recommendation of the Council, Dr. Chewett was nominated for election as a Life Member.
4. By the Publishers, through A. H. Armour, Esq.—
   "Appleton's Cyclopædia of Biography." 1 vol.
5. By the Hon. J. M. Brodhead, of Washington—
   "Maps and Views to accompany the President's Message and Documents, 1854-5." 1 vol.
   "Dr. Jackson's Report on the Michigan Mineral District, 1847-9, with Geological Maps, &c."
   "Forster & Whitney's Reports on the Copper and Iron Districts of Lake Superior. Parts I. and II., 1850-51, with Geological Maps, &c."

The following Papers were then read:

1. By E. A. Meredith, Esq., LL.B.—
   "On the Influence of the recent Gold Discoveries on Prices."

2. By the Rev. Professor Young, M.A.—
"A Review of Reichenbach's researches on Animal Magnetism."

SIXTEENTH ORDINARY MEETING—*26th April*, 1856.

G. W. ALLAN, Esq., President in the Chair.

W. C. CHEWETT, Esq., M.D., was elected a Life Member.

The following Gentlemen were elected Members:

JOHN J. VICKERS, Esq., Toronto.
CHRISTOPHER DUNKIN, Esq., Advocate, Montreal.
JOSEPH LESSLIE, Esq., Toronto.
JOHN ROAF, Esq., Toronto.
FREDERICK O'BRIEN, Esq., Barrie.
W. S. CONGER, Esq, M.P.P., Peterborough.

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

1. From the Regents of the University, ex officio Trustees of the State Library, on behalf of the State of New York:—
"Documents relating to the Colonial History of the State of New York." 1 vol. 4to., being vol. VI. of the work.
"New York Meteorology, from 1825 to 1850." 1 vol. 4to.
"Sixth Annual Report of the Regents of the University of the State of New York."
"Annual Report of the Trustees of the New York State Library."
2. From J. McNaughten, Esq , P.L.S., Ottawa City:—
A Map varnished and mounted of "The Geographical Position of Canada and adjacent countries, &c."
3. By Mr. W. Couper.—
Fourteen species of Lamellicornæ, with duplicates of four—exotic.
One Elater—exotic.
Two species of Buprestidæ—exotic.

The following Papers were then read:

1. By Professor Bovell, M.D.—
"On the Unity of the Human Race."
2. By P. MacGregor, Esq.—
"On the Physiological Character of the Climate of North America."

This being the last ordinary meeting of the session, H. Mortimer, Esq. and J. Stevenson, Esq. were appointed Auditors, in accordance with the laws; and the President, after congratulating the Institute on the conclusion of a highly prosperous session, adjourned the meeting till November.

MONTREAL NATURAL HISTORY SOCIETY.

ORDINARY MONTHLY MEETING—*April*, 1856.

Mr. Dutton submitted the following report:—

The Committee appointed at the last monthly meeting of the Natural History Society, to inquire into the best methods of rearing fish from spawn, with the view to promote that department of Natural History, and render it subservient to the interests of the Province of Canada, beg to report—

That your Committee have not had an opportunity of discussing the subject or maturing any plan in reference to it, in consequence of the absence of Mr. Alfred

Perry, at Toronto, during the greater part of the intervening time; and, therefore, beg further time for that purpose. Respectfully submitted,

Jos. T. Dutton.

Montreal, 31st March, 1856.

The report was received and adopted; and the Committee allowed until next ordinary meeting to draw up their report.

The following donations were received, and the thanks of the Society ordered to be conveyed to the respective donors:—from Dr. Kingdom, R. C. Rifles, three volumes of Reports, embracing the Meteorology of the United States, from 1826 to 1842 inclusive. From W. Woodwork, Esq., of St. Eustache, two curious specimens of Indian corn.

Dr. Barnston read the following report:

Report of the Sub-Committee authorised by the Committee appointed by the Council of the Natural History Society of Montreal, at a special meeting held 19*th March*, 1856, *to examine the Meteorological Observatory of Charles Smallwood, M. D., at St. Martin, Isle Jesus, C.E. and to report thereon.*

On Tuesday, March 25th, the Committee, consisting of the Vice-Presidents, Drs. Workman and Hingston, Mr. Rennie, and Dr. Barnston, assembled at the Council-room of the Natural History Society, and left town at half past three in the afternoon, in company with a few other gentlemen interested in the promotion of Meteorological science. After a somewhat perilous journey over bad roads, they arrived safely in the village of St Martin, where they were received by Dr Smallwood, who shewed every attention to his visitors, and exhibited the whole apparatus connected with his Observatory, at the same time explaining the nature and uses of each instrument. From the information derived through his kindness, the Sub-Committee are enabled to furnish the Society with the following details, which are by no means so minute and extended as they could desire.

The Observatory is situated in the village of St. Martin, on the Isle Jesus, about nine miles due west of Montreal, in lat. 45° 32′ N. and long. 73° 36′ W., or 4 h. 54 m. 20 s. in time from Greenwich. It is a small square wooden building, conveniently situated in an open space, a few yards N. W. of his dwelling house. It is placed in the magnetic meridian, and its roof is furnished with a sliding shutter, which, when opened, enables him to obtain observations of stars as they pass the meridian, for which purpose a small transit instrument is used. The apparatus to be seen within the building may be described as follows:

Of the *Barometers* there are—1. A Newman's standard, the brass scale of which extends from the cistern to the top of the tube. The tube itself is 0.6 of an inch in diameter internally, and is so contrived that its oscillations can be taken by photography;—2. A standard by Negretti and Zambe; and—3. Another instrument with a smaller tube. The cistern of the barometer is 118 feet above the level of the sea.

The *Thermometers* consist of Rutherford & Lixes' self-registering—a standard thermometer where the reading coincides with that existing at the Kew Observatory. There is likewise a wet bulb-thermometer (or psychromatic) from which are deduced the temperature of the dew point, the elastic force and weight of aqueous vapour, and the humidity of the atmosphere.

The observatory also possesses an instrument for registering the intensity of the solar rays, and another for terrestrial radiation—the latter being furnished with a parabolic speculum, possessing 100 inch focus.

The *Anemoscope* is self-registering, and shews the direction of the wind; while the *Anemometer* records constantly its velocity in miles. The latter instrument is simple and novel in construction, and furnishes results which coincide with those in use at Toronto, Liverpool, and other places. Attached to it is a self-registering *Rain-guage*, which shews the commencement and the termination of each fall of rain and the amount in tenths of an inch.

The *Snow-guage* presents a surface of two hundred square inches, while there is an *Evaporator*, with a surface of fifty inches.

Among other instruments may be mentioned those:—1. For ascertaining the amount of dew; 2. For measuring the amount of water in a given quantity of snow; and 3. For the measurement of the degree of evaporation from the surface of ice.

The quantity of *Ozone* is registered by the methods adopted by Schombien and Moffat.

Without the building, is the apparatus for the investigation of atmospheric electricity, consisting of a long pole, 70 feet high, furnished with a slide or groove, by means of which is hoisted an apparatus to which is attached a collecting lantern. This is supplied with two lamps which are kept constantly burning in order to secure insulation. The electricity thus collected is conveyed by copper wires to a conductor within the observatory, where it is connected with a variety of electrometres and other contrivances by which is precisely ascertained the *intensity* and *kind*.

Investigations are also made on the formation and varied shapes of snow-crystals, of which copies were exhibited as obtained by the Chromotype process, which is intended to be likewise applied to the self-registration of the Barometer and Thermometer.

The fixed hours of observation daily are, 6 and 7, A. M., and 2, 9 and 10, P. M. Extra hours are often requisite, and indeed hourly and minute observations are sometimes necessary.

It may be also mentioned that Dr. Smallwood invariably records observations upon storms, the aurora borealis, meteors, and other phenomena, while notice is taken regularly of the periodic appearance of animals, birds, &c., as well as the time of the leafing and flowering of plants.

Such then is but a short description of the apparatus by means of which Dr. Smallwood has for many years sedulously carried out his valuable Meteorological observations. The whole has been constructed at his own expense; and while many of the instruments bespeak their own cost, there are not a few contrived by himself, which exhibit a vast amount of ingenuity, combined with simplicity and economy. Not to speak of the outlay necessary to complete such a series of apparatus for standard observations, the greatest credit is due to Dr. Smallwood for the indefatigable manner in which he has laboured for years in the cause of Meteorological Science—unassisted by Government patronage, and unrecognised, even to the present day, by any Scientific Society or Institution. His observations extend so far back as the year 1841. Year by year he has varied and extended his investigations by means of gradual additions and new contrivances, until at the present time, in spite of all difficulties and the shameful short-coming, on the part of those Authorities, Societies and Institutions, which should have extended to him the right hand of support and recognition, it may be asserted, we believe, without contradiction, that he possesses the simplest and most ingenious series of apparatus for Meteorological Observations in the Province; nor can it be denied that, although the records of his investigations are still confined to manuscript, he has already, by example as well as by occasional publications of part of his labours, done much to advance the cause of Meteorology in Canada.

The Sub-Committee notice with pleasure the munificence of the Provincial Government in providing the Upper Province with the means for the establishment of several efficient stations for Meteorological purposes, and why should the valuable records of unquestionably the first Meteorologist in Lower Canada, extending fifteen years back, be dormant and unseen? It is for this Society—coming, as it does, within her legitimate province—to answer this question; and if the Provincial Government is likely to omit an acknowledgment, which it owes to a private individual, or to neglect an equally important duty to Lower Canada; in other and plainer words, to sacrifice it to the interests of its more favored sister Province, the Sub-Committee have no reserve in urging upon this Society, most respectfully but most strenuously, the *necessity* of taking the subject into immediate consideration, and of adopting such measures as will most speedily bring to light the valuable but still hidden records of Dr. Smallwood's extended experience, and recommending at the same time the provision of such ample means as will enable him to carry out more effectually those observations which will, no doubt, ultimately and under more favorable circumstances, lead to important results—creditable alike to Science and its votary, and beneficial to the general welfare of the public.

W. H. Hingston, M. D.,
James Barnston, M. D.

Montreal, March 31st, 1856.

On motion of Rev. A. D. Campbell, seconded by Ass't Com. Gen. Ibbetson, it was resolved that the Report of the Sub-Committee of the Council appointed to report on the recent visit of a deputation to Dr. Smallwood's Meteorological Observatory, be adopted and be referred to the Council, with full power to found a petition thereon, to the Houses of Legislature, now in session, for a supplementary grant in aid of Dr. Smallwood's efforts; for the establishment of a Provincial Observarory in Montreal or its neighbourhood; and for the general advancement of Meteorological Science in Lower Canada.

The meeting then proceeded to ballot for members, when the following were elected:—

As Corresponding Members:—Hon. G. E. Cartier, Hon. F. Lemieux, and A. Brunel, Esq., of Toronto, and Rev. W. Brethour, M. A, of Ormstown.

As Ordinary Members:—Rev. Professor Thomson, M. A., of Lennoxville; Rev Canon Gilson, M. A.; Deputy Com. Gen. Clarke, and John W. Haldimand, Esq., of Montreal.

L. A. H. Latour, Esq., intimated that he was about to publish, in three volumes, a Manual of Dates, in form of Chronology, or encyclopedical repertory of the most important historical dates. This work he proposed to dedicate to the Members of the Natural History Society.

A. N. Rennie,
Secretary.

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

Latitude—43 deg. 39.4 min. North. Longitude—79 deg. 21 min. West. Elevation above Lake Ontario, 108 feet.

Day.	Barom. at temp. of 32°.				Temp of the Air.				Mean Temp. + or — of the Av'age.	Tens. of Vapour.				Humidity of Air.				Direction of Wind.			Mean Direction.	Velocity of Wind.				Rain in Inches.	Snow in Inches.
	6 A	2 P.M.	10 P.M.	MEAN	6 A.M	2 P.M	10 PM	ME'N		6 A.M	2 P.M	10 P.M	M'N	6 A.M	2 P.M	10 P.M	M'N	6 A.M.	2 P.M.	10 P.M.		6 A.M	2 P.M	10 PM	ME'N		
1	30.061	29.965	29.871	29.9607	° 15.1	° 35.2	° 28.7	° 27.55	— ° 8.68	.072	.148	.132	.121	.80	.72	.83	.80	N b E	S S E	E N E	° E 14 S	0.8	4.8	0.6	2.51	...	...
2	29.630	.423	.294	.4313	30.9	35.5	37.3	34.92	— 1.72	.143	.184	.201	.172	.82	.89	.91	.85	E	E b S	S b W	E 14 S	6.2	6.2	2.4	4.95	0.550	...
3	.205	.236	.298	.2503	37.3	40.8	35.9	37.95	+ 0.93	.194	.193	.195	.196	.87	.76	.92	.86	S b E	S W b S	S W	S 42 W	0.2	11.6	5.8	6.35	.175	...
4	.348	.461	.585	.4737	34.8	36.6	32.8	34.45	— 2.88	.178	.169	.150	.163	.89	.78	.80	.82	W N W	N N W	W b N	N 43 W	5.2	6 6	5.5	7.37	...	0.1
5	.605	.632	.660	.6355	31.2	42.0	36.0	36.72	— 1.00	.155	.172	.165	.163	.89	.65	.79	.76	N W b N	N W b W	N W b W	N 39 W	11.2	10.2	1.8	6.21	...	...
6	.650	.620	—	—	31.9	44.7	—	—	—	.159	.191	—	—	.89	.66	—	—	Calm.	S	S S W	S 37 W	0.0	2.6	0.2	2.42	...	...
7	.658	.710	.744	.7087	35.9	49.7	36.6	40.92	+ 2.50	.201	.163	.160	.171	.96	.46	.74	.69	N W	S b W	Calm.	W 45 S	3.0	4.2	0 0	1.19	...	...
8	.837	.864	.808	.8350	30.9	53.7	39.0	41.72	+ 3.00	.152	.200	.161	.169	.88	.50	.68	.66	Calm.	S	E S E	E 30 S	0.0	3.8	0.4	2.37	...	...
9	.737	.515	.748	.6695	37.0	57.0	39.1	45.07	+ 6.03	.167	.258	.183	.206	.77	.57	.77	.69	Calm.	S W	N W b N	W 36 N	0.0	16.0	14.1	11.89	Inap	...
10	.989	.965	.900	.9440	31.6	42.1	32.8	35.75	— 3.67	.111	.146	.133	.129	.63	.55	.71	.62	N W	S b W	Calm.	W 22 N	12.2	7.4	0.0	4.42	...	...
11	.796	.631	.435	.6107	30.9	48.3	39.9	39.58	— 0.15	.137	.218	.165	.172	.79	.66	.67	.71	Calm.	S S E	E b S	E 32 S	0.0	1.7	3.0	2.17	.230	...
12	.174	.168	.600	.3250	40.2	39.9	30.9	36.67	— 3.47	.235	.202	.143	.183	.95	.83	.82	.83	Calm.	N	N	N 6 W	0.0	13.4	15.0	13.21	.545	...
13	.909	.924	—	—	23.9	34.8	—	—	—	060	.090	—	—	.46	.45	—	—	N b E	S b W	W N W	S 45 W	4.5	9.8	1.2	5.33	...	...
14	.731	.580	.525	.6025	33.2	39.8	36.3	36.58	— 4.15	.167	.158	.155	.161	.88	.65	.73	.75	S S W	S E b S	E b S	S 2 W	6.0	2.4	0.5	1.44	Inap	Inp
15	.545	.478	.487	.5008	37.7	38.9	41.6	39.95	— 1.10	.159	.224	.216	.205	.71	.95	.83	.83	Calm.	E	E	E 1 N	0.0	21.0	19.2	15.41	.705	...
16	.484	.475	.535	.4965	39.2	51.2	41.8	44.15	+ 2.67	.211	.288	.238	.249	.89	.78	.91	.87	S E b E	E N E	Calm.	E 6 N	12.5	9.8	0.0	6.01	...	...
17	.524	.421	.369	.4265	42.7	50.6	40.9	46.27	+ 4.52	.230	.314	.235	.257	.84	.86	.93	.82	S W b S	S b W	S b W	W 9 S	0.5	1.9	0.4	1.82	.015	...
18	.307	.354	.483	.3907	40.2	54.1	45.5	46.03	+ 3.97	.216	.263	.249	.241	.88	.64	.83	.80	Calm.	S W b S	W S W	W 25 S	0.0	4.0	0.9	3.84	.115	...
19	.612	.638	.662	.6448	41.8	46.9	44.7	44.20	+ 1.85	.240	.189	.097	.185	.92	.59	.32	.64	N N W	S E b E	N	N 23 E	0.6	6.0	23.0	8.91	...	...
20	.838	.761	—	—	32.7	44.9	—	—	—	.138	.173	—	—	.74	.58	—	—	N b E	N	N	N 7 E	12.8	21.5	9.5	14.16	...	...
21	.607	.533	.326	.4665	38.4	43.1	47.4	43.35	+ 0.25	.196	.191	.290	.227	.85	.69	.90	.81	N E	N E b N	N E b N	N 18 E	9.8	1.1	15.8	8.31	.315	Inp
22	.244	.195	.296	.2375	36.3	40.4	35.9	37.22	— 6.15	.208	.219	.175	.202	98	.88	.82	.91	N b W	S b W	Calm.	E 44 S	3.5	1.0	0.0	2.94	.070	...
23	.372	.411	.452	.4165	32.7	51.7	40.2	41.25	— 2.45	.164	.246	.204	.209	.89	.65	.83	.81	Calm.	E S E	Calm.	E 6 S	0.0	1.0	0.0	2.69	...	...
24	.490	.484	.604	.5355	40.4	46.7	42.9	43.55	— 0.45	.216	.262	.244	.233	.87	.83	.90	.83	Calm.	S E b E	N W b W	N 2 W	0.0	0.2	1.0	3.48	.035	...
25	.742	.788	.856	.7983	46.0	61.6	44.2	52.02	+ 7.62	.218	.290	.238	.251	.71	.53	.84	.66	N b W	S S E	E S E	E 9 N	4.5	4.0	0.7	2.97	...	...
26	.848	.765	.678	.7580	45.2	60.0	50.6	52.58	+ 7.88	.218	.297	.301	.269	.73	.59	.83	.69	N b E	E S E	N	E 4 S	5.0	7.7	2.0	4.67	...	...
27	.674	.548	—	—	48.8	63.5	—	—	—	.273	.346	—	—	.80	.61	—	—	E	E	Calm.	S 20 E	4.9	8.2	0.0	2.28	.025	...
28	.493	.401	.449	.4610	53.1	65.0	61.0	59.83	+ 14.43	.329	.253	.220	.271	.83	.42	.42	.56	Calm.	S S W	W N W	W 23 S	0.0	19.5	17.0	10.04	...	...
29	.580	.586	.701	.6283	47.7	61.7	45.8	53.10	+ 7.37	.233	.322	.215	.249	.72	.60	.71	.64	Calm.	S S W	N N W	N 28 W	0.0	8.6	5.0	7.76	...	...
30	.789	.852	.889	.8468	46.3	50.5	45.9	47.75	+ 1.70	.217	.219	.206	.212	.70	.61	.68	.65	N b E	E b S	E b N	E 7 N	8.8	11.5	10.6	14.24	...	...
M	29.5926	29.5589	29.5867	29.5790	37.57	47.81	40.53	43.27	+ 1.28	.191	.223	.195	.203	.83	.68	.77	.75	N 25 E	S 33 E	N 24 E	N 29 E	3.74	7.59	5.19	6.05	2.780	0.1

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR APRIL.

Highest Barometer .... 30.099 at 8 a. m., on 1st } Monthly range =
Lowest Barometer .... 29.081 at 8 a. m., on 12th } 1.018 inches.

Highest registered temperature......... 72°2 at p. m., on 28th } Monthly range =
Lowest registered temperature .... 14°2 at a. m., on 1st } 58°0

Mean maximum Thermometer......... 50°47 } Mean daily range = 17°08
Mean minimum Thermometer......... 33°39 }

Greatest daily range .... 29°4 from p. m. of 9th to a. m. of 10th.
Least daily range .... 5°3 from p. m. of 2nd to a. m. of 3rd.

Warmest day......... 28th ... Mean temperature......... 59°83 } Difference = 32°28.
Coldest day........... 1st ... Mean temperature......... 27°55 }

Greatest intensity of Solar Radiation ... 85°4 at p. m. on 29th } Monthly range =
Lowest point of Terrestrial Radiation ... 6°5 at a. m. of 13th } 78°9

Aurora observed on 4 nights, viz.: 8th. 22nd, 28th, and 29th; possible to see aurora on 18 nights; impossible to see aurora on 12 nights.

Snowing on 3 days, depth 0.1 inch—snowing 2.5 hours. Raining on 13 days, depth 2.780 inches—raining 62.6 hours.

Mean of cloudiness =0.60; most cloudy hour observed, 8 a. m, mean =0.71; least cloudy hour observed, midnight, mean, =0.47.

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

North.	West.	South.	East.
1887.42	1012.32	851.39	1576.10

Mean direction of the wind, N 29° E.
Mean velocity of the wind .... 6.05 miles per hour.
Maximum velocity .... 26 4 miles per hour, from 6 to 7 p. m., on 9th.
Most windy day.........................15th...Mean velocity 15.44 miles per hour.
Least windy day .... 7th...Mean velocity 1 19 ditto.
Most windy hour ...11 a. m. to Noon...Mean velocity 7.99 ditto.
Least windy hour......... 6 to 7 a. m....Mean velocity 4.35 ditto.
Mean diurnal variation = 3 64 miles.

2nd—First rain since 15th December, 1855.
7th—Butterflies first observed.
8th—Large and perfect Halo round Sun at 5h. 30m., p. m.
10th—Halo round moon (diameter, 46°) at 11h. 45m., p. m.
12th—First Thunder and Lightning of the Season.
13th—Halo round the Moon at 10, p. m., (very perfect).
15th—Thunderstorm, vivid lightning and heavy rain, from 10 p. m.
16th—Frogs first heard.
19th—Halo round Moon, at midnight.
19th—Ice disappeared from the Bay.
23rd—Lunar Rainbow at 2 a. m.. perfectly defined.
30th—Patches of drifted snow still remaining in the Ravine near the Observatory.

COMPARATIVE TABLE FOR APRIL.

Year	Temperature.					Rain.		Snow.		Wind.	
	Mean.	Diff. from Aver.	Max. obs'd.	Min. obs'd.	Range.	Days.	Inch's.	Days.	Inch's.	Mean Direc'n.	Mean Force or Velocity.
	°	°	°	°	°						
1840	42.4	+1.0	65.9	25.3	40.6	14	3.420	2	...	...	...
1841	39.2	−2.2	62.9	22.1	40.8	3	1.370	3	...	...	0.51 lbs.
1842	43.1	+1.7	89.5	21.6	67.9	8	3.740	2	...	...	0.57 "
1843	40.9	−0.5	70.0	15.1	54.9	7	3.185	3	0.1	...	0.46 "
1844	47.5	+6.1	74 5	17.2	57.3	10	1.515	1	Inapp	...	0.24 "
1845	42.1	+0.7	66.0	14.8	51.2	11	3.290	4	1.5	...	1.00 "
1846	44.0	+2.6	79.4	24.4	55.0	10	1.300	2	1.3	...	0.55 "
1847	39.2	−2.2	65.6	8.4	57.2	8	2.870	2	4.0	...	0.59 "
1848	41.3	−0.1	65.4	26.5	38.9	5	1.455	1	0.5	W 24 N	4.89 miles.
1849	39.0	−2.4	70.9	23.2	47.7	10	2.655	2	1.7	N 42° W	7.50 "
1850	37.9	−3.5	63.2	18.2	45.0	7	4.720	2	1.1	N 39° W	7.64 "
1851	41.3	−0.1	59.2	25.8	33.4	11	2.295	3	1.2	N 17° E	8.07 "
1852	38.2	−3.2	53.8	19.8	34.0	6	1.990	4	9.4	N 23° E	6.68 "
1853	41.9	+0.5	65.7	27.0	38.7	10	2.625	1	1.0	N 12° W	5.20 "
1854	41.0	−0.4	65.1	22.3	42.8	12	2.685	4	2.7	E 37° N	6.82 "
1855	42.4	+1.0	63.8	12.2	51.6	8	2.030	3	1.6	N 36° W	7.57 "
1856	42.3	+0.9	69.8	15.1	54.7	13	2.780	3	0.1	N 29° E	6.05 "
Mean	41.39	...	67.69	19.94	47.75	9.0	2.584	2.5	1.9	...	6.71 miles.

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

(NINE MILES WEST OF MONTREAL.)

BY CHARLES SMALLWOOD, M. D.

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

Day.	Barom. corrected and reduced to 32° Fahr. 6 A.M.	2 P.M.	10 P.M.	Temp. of the Air. 6 A.M.	2 P.M.	10 P.M.	Tension of Vapor. 6 A.M.	2 P.M.	10 P.M.	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	Direction of Wind. 6 A.M.	2 P.M.	10 P.M.	Mean direction of Wind.	Velocity in miles per hour. 6 A.M.	2 P.M.	10 P.M.	Snow in Inches.	Rain in Inches.	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0. 6 A.M.	2 P.M.	10 P.M.
1	0.241	30 101	30.14	10.7	42.3	27.5	.080	.208	.119	.84	.73	.08	s w b w	sw byw	s w b w	w 3 s	2.97	3.31	4.86	...	...	Clear.	Cir. Str 2.	Clear, Zod.Light
2	29,969	29.714	29.610	16.0	50.2	36.1	092	304	176	83	81	76	s s w	s s E	s s E	E 1 s	1.55	0 89	0.90	...	...	Do.	Cum Str 2.	Cum. Str 9.
3	.546	4.51	.52	38.0	49.5	38.0	210	336	23	86	90	95	s s E	s s E	s w	s 36 E	3.71	0.91	0.10	...	0 100	Cum. Str. 6.	Do. 9.	Do. 10, rain.
4	.532	.584	.64	34.4	45.9	35.1	201	262	203	96	80	91	swbyw	sw b w	w	w 33 s	1.33	1.12	0.13	...	0 (5	Rain.	Str. 10.	Str. 10, sli't rain
5	.649	.685	.74	35.2	45.0	38.4	203	255	22	91	81	91	w by s	w s w	w s w	w 22 s	0.62	0.37	4.51	...	Inp	Str. 10.	Do. 10.	Hazy.
6	.787	.757	.78	34.4	54.4	36.7	186	304	210	87	70	91	w	sE by E	s	w 15 s	0.60	0.62	0.00	...	...	Cum. Str. 8.	Cum. Str. 9.	Cum. 10.
7	.875	.763	.90	34.0	54.1	39.7	186	264	221	87	61	86	w by s	s w	s w	s 45 w	0.20	0.36	2.03	...	...	Clear.	Clear.	Do. 8.
8	.960	.959	.96	34.6	59.0	43.1	194	341	216	87	68	73	w s w	s w	s w	w 34 s	3.62	2.90	2.71	...	...	Do.	Do.	Clear.
9	.978	.678	.50	32.3	66.1	48.7	197	461	261	93	72	74	N N W	s	s s w	s 22 w	0.14	1.01	0.58	...	...	Cir. Str. 4	Do.	Cir. Cum. Str 4.
10	.881	.964	98	28.4	36.0	30.2	112	161	138	64	69	74	Nwbyw	w s w	w s w	w 4 N	27.40	11.20	1.25	...	...	Clear.	Do.	Clear, Au. Bor.
11	.900	.784	.64	11 2	51 1	39.6	140	274	179	70	70	71	w s w	s w	s w	w 45 s	3.02	5.01	12.90	...	...	Cir. Str. 4.	Do.	Do. [28°
12	.881	.271	.60	35.4	33.0	26.1	192	197	125	84	95	80	s by w	N E	N	w 10 N	0.75	0.41	9 75	...	0.800	Clear.	Rain & sleet.	Do. Lu. ha.dimn.
13	.980	.891	.96	15.0	32.4	29.2	086	169	161	79	82	89	w N w	w by s	w s w	w 31 s	15.96	9.32	23.01	...	...	Cir. Str. 4.	Clear.	Lt.Cir.L.H.dimn
14	.831	.673	.421	30.4	47.8	37.9	158	209	226	81	59	91	s w	s w	swbyw	w 40 s	11 21	18.16	7.07	...	Inp	Rain.	Cir. Cm. Str.8.	Rain. [24°
15	.751	.742	.88	30.6	54 2	36.7	178	349	199	90	81	83	swbyw	s s E	s w	w 22 s	2.51	2.60	0.01	...	Inp	Clear.	Clear.	Lt Cir.L.H.di.26.
16	.893	.872	.83	32.1	49 0	41.3	167	233	235	83	04	84	NEbyE	s s E	s s E	E15 N	2.60	0.07	8.47	...	...	Str. 4.	Cir. Cm. Str.4.	Rai s o m 3 p.m.
17	.674	.564	.43	37 8	53.1	45.9	207	537	282	84	81	86	N w b w	s w	w s w	w 22 s	0.40	.003	1.07	...	...	Clear.	Cir. Str. 10.	Cu.S.10. [C.C.S.9
18	.519	.570	.66	34.8	42.7	38.2	186	216	207	84	73	84	NEbyE	NE b E	s w	E 34 N	6.30	1.60	1.00	...	Inp	Do.	Shower 10 30	Cir. Cum. Str. 4.
19	.798	.743	.83	34.0	57.8	39.1	179	274	151	82	55	60	N	swbyw	N E b N	E 26 N	0 01	1.42	4.25	...	...	Cir. Str. 8.	Clear.	Light Cir. Cum.
20	.994	30.009	94	29.6	41.9	29.4	192	235	141	72	80	80	N by E	NE b E	N E b E	N 32 E	15.24	18 06	8.24	...	...	Do.	Cum. Str. 4.	Cir.Cum.Str. 4.
21	.950	29.810	.70	31.1	45.0	37.0	141	235	180	72	74	78	N E	NE b N	N E b E	E 34 N	33.14	30 51	33.00	...	...	Clear wh.frost	Do 6.	Nimbus 10.
22	.500	.493	.501	35.1	45 5	40.2	203	292	245	91	93	92	N E b E	NE b E	E N E	E 34 N	35.45	4.16	0.82	...	1.249	Cir. Str. 2.	Cum. 10.	Cum. Str. 8.
23	.592	.590	.9	34.3	58.2	43.9	205	367	252	92	75	82	s w b w	swbyw	N N E	s 32 w	0.12	1.20	0.2	...	...	Cum. Str. 6.	Cir. Str. 4.	Clear, faint Au.
24	.727	.685	.76	41.5	65.9	57.6	241	388	315	89	67	81	N E b E	N E b E	NE b E	E 28 N	0.71	6.31	4.50	...	...	Do. 4.	Cir.Cm.Str.4.	Cum.Str.10.[Bor
25	.934	.987	.96	47.1	59.9	43.0	234	297	19	69	57	68	N E	NE b E	N	E 39 N	21.82	13.80	13.41	...	...	Cir. Cm. St. 5.	Clear.	Clear.
26	30.117	.987	.86	40.0	68.4	52.8	199	422	315	67	62	76	E	s by E	s s w	E 10 N	12.24	2.00	8.22	...	...	Clear.	Do.	Do.
27	29.846	.814	.817	50 0	58 2	48.2	326	412	321	87	84	92	s	s by w	N E b E	s 34 w	4.06	1.95	11.52	...	Inp	Cum. Str. 10.	Cum. Str. 10.	Cum. Str. 4.
28	.740	.707	.65	39.0	41.0	38.0	236	247	231	92	89	94	NEbyE	N E	N E b E	E 34 N	29.98	29.92	1.74	...	0.550	Rain.	Do. 10.	Str. 10.
29	.684	.654	.850	38.4	62.2	49.1	235	421	312	96	75	86	w s w	w s w	N W	w 4 s	15.41	12.71	11.33	...	0.083	Cir. Str. 10.	Do. 4.	Cum. Str. 4.
30	.953	30.032	30.174	40.9	53.8	45.2	235	293	262	86	70	86	N w b w	N E	E s E	E 23 N	3.06	23.30	11.71	...	...	Str. 8.	Cir. Str. 2.	Str 2.

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

(NINE MILES WEST OF MONTREAL.)

BY CHARLES SMALLWOOD, M. D.

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

Day.	Barom. corrected and reduced to 32° Fahr.			Temp. of the Air.			Tension of Vapor.			Humidity of Air.			Direction of Wind.			Velocity in miles per hour.			Mean direction of Wind.	Rain in Inches.	Snow in Inches.	WEATHER, &c. A cloudy sky is represented by 10; A cloudless sky by 0.		
	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.				6 A.M.	2 P.M.	10 P.M.
1	30.163	29.986	29.928	34.0	68.1	49.9	.186	.384	.314	.87	.56	.84	N E by N	S by W	S by W	Calm	1.12	2.80	S 10° W	...	...	Clr. Wht. Fst.	Light Cir. 4.	Clr. Aur. Bor.
2	29.765	.726	.704	41.8	45.1	40.8	198	218	194	76	69	69	N E by E	N E by E	N E by E	2.30	12.95	12.50	E 34 N	Inp	...	Str. 9.	Slight Rain.	Str. 9.
3	.683	.630	.718	36.1	53.1	39.4	167	207	179	74	49	70	N E	N E by N	N by E	26.51	14.85	14.74	N 30 E	...	...	Clear Frost	Clear. [9 A.M.	Clear.
4	.706	.699	.717	35.0	40.7	40.3	167	217	245	74	79	91	N W b N	W	N W b N	7.50	10.97	9.72	W 40 N	Inp	...	Cir. Str. 8.	C.C.S. 10 S Sw.	Cir. Str. 10.
5	.863	30.012	30.098	36.4	54.2	40.6	201	326	210	87	76	79	N E by N	E by N	E by S	14.10	13.57	3.63	N 40 E	...	...	Cir. Str. 6.	Do. 4.	Clr. Aur. Bor.
6	30.121	.010	29.915	33.1	68.9	49.5	178	489	290	86	67	80	W N W	S E by S	S E by S	0.15	3.72	1.10	E 34 S	...	...	Clr. Wht. Fst.	Cum. Str. 4	Clear.
7	29.934	29.788	.785	46.3	65.8	49.1	243	323	290	74	52	80	E N E	N E	N E by E	12.40	9.60	3.13	N 54 E	...	...	Do.	Clear.	Do.
8	.752	.655	.722	35.4	70.6	54.3	170	400	29.	76	55	70	N E by E	N E by E	S by E	10.48	6.70	1.86	E 23 N	...	...	Do.	Cum. Str. 4.	Cum. Str. 10.
9	.748	.653	.654	49.0	58.0	51.4	280	290	338	76	59	61	E	N E by E	N by E	3.26	7.30	3.55	N 34 E	...	...	Cum. Str. 10.	Do. 8.	Do. 9.
10	.568	.600	.701	48.1	60.4	46.0	271	277	210	76	52	64	N by W	N E	W by N	5.23	20.94	1.75	N 36 E	Inp	...	Do. Slgt. Rain	Do. 10.	Clear.
11	.661	.546	.83.	50.3	75.6	53.4	230	428	29.	61	50	70	N E by N	S W by S	N E by E	0.63	0.41	1.01	E 35 N	...	...	Clear.	Clear.	Do.
12	.487	.674	.894	53.0	61.1	42.0	282	357	178	67	59	63	S W by W	W N W	N N W	1.15	14.74	11.40	W 24 S	0.100	...	Cir. Cm. St. 4.	Cir. Str.	Clear.
13	.990	30.106	30.043	33.5	62.0	45.3	195	397	202	90	71	66	E N E	S W by S	S	0.46	0.47	3.75	S 33 W	...	...	Clear Frost.	Clear.	Do.
14	30.139	29.912	29.871	50.5	76.0	64.2	283	515	379	75	58	63	S E by E	S S E	S	1.35	4.78	6.97	S 33 E	...	...	Do.	Light Cir. 1.	Cir. Str. 6.
15	29.804	.717	.60.	60.0	72.9	61.1	416	523	48.	79	67	89	S S E	S S W	S	6.40	9.30	4.18	S 11 E	0.330	...	Cir. Str. 8.	Cir. Str. 7.	Do. 10.
16	.815	.801	.921	58.2	66.6	49.7	412	394	290	84	61	80	W N W	W	N E by E	6.00	8.62	4.18	W 7 N	0.017	...	Do. 6.	Cum. 4.	Clear.
17	.781	.811	.719	43.9	66.1	57.6	226	354	335	70	55	70	N E by E	E N E	S E	9.21	9.99	6.07	E 31 N	...	...	Clear.	Cir. Str. 4.	Cir. Str. 4.
18	.714	.705	.694	48.2	54.9	53.1	324	400	58.	93	93	91	E N E	N E	E N E	8.07	4.52	3.30	E 34 N	2.850	...	Rain.	Do. 10.	Do. 4.
19	.546	.514	.487	50.3	64.3	54.2	379	544	37.	95	90	87	N E by E	W S W	S S W	5.32	2.93	5.32	W 1 S	Inp	...	Cir. Str. 10.	Cir. Str. 9.	Do. 10.
20	.412	.476	.621	54.9	55.0	50.0	419	361	240	95	80	64	W by W	N W	N W b N	0.21	12.50	10.60	W 10 N	0.015	...	Do. 10.	Do. 10.	Clear.
21	.747	.754	.782	47.6	61.0	69.6	234	304	23.	69	56	64	N by W	N by W	W N W	8.92	3.46	9.24	W 34 N	...	...	Clear.	Clear.	Clear.
22	.916	.780	.811	40.9	70.1	57.3	217	400	298	79	55	62	W by S	W S W	W S W	0.60	13.10	9.02	W 1 N	...	...	Do.	Hazy.	Cir. Str. 10.
23	.723	.604	.845	50.	78.9	70.5	304	559	515	81	55	70	S by E	S W	W S W	0.62	8.21	8.30	W 36 S	...	...	Do. [Shower	Hazy.	Dense Haze.
24	.512	.384	.564	58.4	72.2	48.9	351	638	281	79	82	69	N by S	W S W	N N W	0.03	4.85	7.80	W 9 S	1.250	...	C. Str. 10. Th.	Cir. Str. 4.	Cir. 8 Thu. Stm
25	.585	.848	.613	39.9	69.2	40.1	237	290	295	87	80	92	W N W	N W b N	N by E	18.12	7.77	4.07	N 11 W	0.456	...	Cir. Str. 2.	Do. 9.	Rain.
26	.627	.652	.650	41.1	67.0	54.4	263	386	173	87	58	88	N by W	N by E	S	7.08	8.20	2.23	E 23 N	...	...	Clear.	Clear.	Str. 2.
27	.564	.390	.39.	56.1	68.9	42.7	343	461	441	94	65	84	S	S W	S by E	0.71	1.76	Calm	S 21 W	...	...	Do.	Cir. Str. 10.	Cir. Str. 4.
28	.171	.092	.322	54.6	59.4	49.1	373	452	290	87	89	80	S E	W	N N W	0.03	1.46	12.42	W 25 N	0.396	...	Rain.	Do. 10.	Str. 9.
29	.464	.493	.512	40.8	46.5	60.4	210	243	207	79	74	79	W N W	W S W	N W b N	1.06	2.62	1.05	W 30 N	...	...	Str. 10.	Do. 9.	Cir. Str. 9.
30	.477	.462	.594	40.0	43.7	41.7	227	282	225	85	85	79	N N W	N W	N W	6.23	8.52	11.60	W 27 N	0.552	...	Rain.	Rain.	Cir. Str. 9.
31	.710	.687	.786	40.0	50.6	67.7	179	246	252	67	65	74	W by W	W by N	W S W	18.64	21.31	15.91	W 6 S	...	...	Clr. Slgt Snow	Cir. Str. 8.	Do. 2.

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

Barometer	Highest, the 1st day	30.241
	Lowest, the 12th day	29.271
	Monthly Mean	29.775
	Monthly Range	0.970
Thermometer	Highest, the 25th day	75° 1′
	Lowest, the 1st day	8° 5′
	Monthly Mean	41° 24′
	Monthly Range	69° 6′
Greatest Intensity of the Sun's Rays		107°10′
Lowest Point of Terrestrial Radiation		8°00′
Amount of Evaporation		1.94 in.
Mean of Humidity		.800

No snow fell during the month, which is the only April on record here.
Rain fell on 11 days, amounting to 2.830 inches; it was raining 37 hours 30 minutos.
The amount of rain which fell in the month is much below the usual quantity for April on record here, for in April, 1855, 4.194 inches of rain fell, and 4.34 inches of snow; and in April, 1854, 7.886 inches of rain fell, and 4·03 inches of snow; and in April, 1853, 3.586 inches of rain fell, and 1.50 inches of snow.
The first rain which fell since the 22nd of December, was on the 3rd of April, making a period of 103 days without rain. The amount of evaporation is + the average, and the relative humidity — the average amount.
The most prevalent Wind was N E by E—1699.00 miles.
The least prevalent Wind was S W by S—3.00 miles.
The most windy day was the 21st; mean miles per hour, 32.41.
The least windy day was the 6th; mean miles per hour, 0.40.
Most windy hour, from 5 to 6 A. M. on the 10th day—3.650 miles.
There were 247 hours calm during the month.
The whole miles traversed by the wind was 4579.10 miles, which being resolvéd into thé four cardinal points, gives—

N—234.00 S—116.00 W—1644.00 E—2585.10

Ozone—was in large quantity, amounting to saturation, on the 28th day.
Eclipse of the Moon visible on the morning of the 21st day.
The electrical state of the atmosphere has indicated rather high tension.
The *Rossignol* first heard on the 6th day.
Swallows first seen on the 19th day.
Frogs first heard on the 23rd day.

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

Barometer	Highest, the 1st day	30.163
	Lowest, the 28th day	29.092
	Monthly Mean	29.727
	Monthly Range	1.071
Thermometer	Highest, the 23rd day	83°.40
	Lowest, the 3rd day	30°.00
	Monthly Mean	52°.45
	Monthly Range	53°.40
Greatest Intensity of the Sun's Rays		110°.5
Lowest Point of Terrestrial Radiation		29°.6
Mean of Humidity		.735
Amount of Evaporation		3.79

Snow fell on 2 days, inapp.
Rain fell on 13 days amounting to 5.973 inches; it was raining 42 hours and 50 minutes. and was accompanied by thunder on 2 days.
Most prevalent Wind, the N. W. by N.
Least prevalent Wind, the E. by S.
Most windy day, the 3rd day; mean miles per hour 18.36.
Least windy day, the 27th day; mean miles per hour, 0.49.
Most windy hour from 11 to 12, A. M.. 31st day. 32.30 miles;—total miles traversed by the wind, 4540.00—which being resolved into the Four Cardinal Points, gives N 1415.00. S 481.00, E 1321.00, W 1323.00 miles,
Aurora Borealis visible on two nights.
There were 179 hours calm during the month, and 4 days perfectly cloudless.
The electrical stato of the atmosphere has been marked generally by moderate intensity.
Ozone—was in moderate quantity.

THE

CANADIAN JOURNAL

OF

INDUSTRY, SCIENCE, AND ART:

CONDUCTED BY

THE EDITING COMMITTEE OF THE CANADIAN INSTITUTE.

NEW SERIES. NUMBER V.

CANADIAN INSTITUTE ESTABLISHED 1849

SEPTEMBER, 1856

TORONTO:
PRINTED FOR THE CANADIAN INSTITUTE,
BY LOVELL AND GIBSON, YONGE STREET.

CANADIAN INSTITUTE.

The Canadian Journal is printed exclusively for gratuitous distribution among the Members of the Canadian Institute, and such Institutions and Societies as the Council may determine; but Members may purchase extra copies at 2s. 6d. per number, and Provincial Literary and Scientific Societies may obtain the Journal at the same rate, by an annual payment in advance.

*** *Communications for the Journal to be addressed to the General Editor,* DR. WILSON, *University College, Toronto.*

THE CANADIAN JOURNAL.

NEW SERIES.

No. V.—SEPTEMBER, 1856.

NOTES OF TRAVEL AMONG THE WALLA-WALLA INDIANS.

BY PAUL KANE, TORONTO.

Read before the Canadian Institute, 5th April, 1856.

In former selections from my notes, made during years of travel among the Indians of the North-West, I have communicated accounts of two Tribes presenting the most striking elements of contrast: the Chinooks, one of the numerous Tribes of the Flat Head Indians, inhabiting the tract of country at the mouth of the Columbia River; and the singular tribe of Half-breeds to be found in the Hudson Bay Company's Territory, in the vicinity of the Red River. For the present communication, I have selected from my Journal notes relating to the Walla-Walla and Kye-use Indians, as possessing a peculiar interest, from the fact that I was present at some of the scenes in which the present war between these Tribes and the settlers in Oregon originated.

On the 12th of July, 1847, on my return journey up the Columbia River, I arrived at Walla-Walla, about five hundred miles from its mouth. It is a small Fort, built of *Dobies*, or blocks of mud baked in the sun, which is here intensely hot. Fort Walla-Walla is situated at the mouth of the river of the same name, in the most sandy and barren desert that can well be conceived. Little or no rain ever falls here, although a few miles lower down the river it is seen from hence to pour down in torrents. Owing to its being built at the mouth of a gully, formed by the Columbia River through high mountainous land, leading to the Pacific Ocean, it is exposed to furious gales of wind, which rush through the opening in the hills with inconceivable violence, and raise the sand in clouds so dense and continuous as frequently to render travelling impossible. I was kindly received by Mr. McBain, a clerk in the Hudson Bay Company's service, who, with five men, had charge of the Fort. The establishment is kept up solely for the purpose of trading with the Indians from the interior, as those about the Post have few or no peltries to deal in.

The Walla-Walla Indians live almost entirely upon salmon throughout the whole year. In the summer season they inhabit lodges made of mats of rushes spread on poles. Owing to tho absence of trees in their vicinity, they have to depend for the small quantity of fuel which they require, upon the drift wood which they collect from the river in the spring. In the winter they dig a large circular excavation in the ground about ten or twelve feet deep, and from forty to fifty feet in circumference, and cover it over with split logs, over which they place a layer of mud collected from the river. A hole is left at one side of this roofing, only large enough for one person to enter at a time. A stick with notches reaches to the bottom of the excavation, and serves as a ladder by means of which they ascend and descend into the subterranean dwelling. Here twelve or fifteen persons burrow through the winter, having little or no occasion for fuel, their food of dried salmon being most frequently eaten uncooked, and the place being excessively warm from the numbers congregated together in so small and confined a space. They are frequently obliged, by the drifting billows of sand, to close the aperture, when the heat and stench become insupportable to all but those accustomed to it. The drifting of the sand is a frightful feature in this barren waste. Great numbers of the Indians lose their sight, and even those who have not suffered to so great an extent, have the appearance of labouring under intense inflammation of these organs. The salmon, while in the process of drying, also become filled with sand to such an extent as to wear away the teeth of the Indians, and an Indian is seldom met with over forty years of age whose teeth are not worn quite to the gums.

The day after my arrival at the Fort I procured three horses and a man, for the purpose of travelling into the interior of the country, and visited the Pavilion and Nez-perces Indians. The weather was excessively hot, and we suffered much from the want of water. About two o'clock P. M. on the evening of the eighteenth, in our circuitous route back to the Fort, we arrived at Dr. Whitman's Presbyterian Mission, situated about twenty-five miles up the Walla-Walla River, where I was received very kindly by the Missionary and his wife. Dr. Whitman's duties included those of Superintendent of the American Presbyterian Missions on the West side of the Rocky Mountains. He had built himself a house of unburnt clay, for want of timber, which, as stated above, is here extremely scarce. He had resided at this locality, on the banks of the Walla-Walla River, upwards of eight years, doing all in his power to benefit the Indians in his mission. He had brought forty or fifty acres of land, in the vicinity of the river, under cultivation, and had a great many head of domestic cattle, affording greater comfort to his family than one would expect in such an isolated spot. I remained with him four days, during which he kindly accompanied me amongst the Indians. These Indians, the Kye-use, resemble the Walla-Wallas very much. They are always allies in war, and their language and customs are almost identical, except that the Kye-use Indians are far more vicious and ungovernable. Dr. Whitman took me to the lodge of an Indian called To-ma-kus, that I might take his likeness. We found him in his lodge sitting perfectly naked. His appearance was the most savage I ever beheld, and his looks by no means belied his character. It was only a short time before my arrival at the mission that he killed an Indian out of mere wantonness. His victim was taking care of some horses for another Indian, when he rode up to him and enquired why he was hiding them. The Indian denied that he was doing so, when Tomakus, without further remark, sent an arrow through his heart. He was so cruel and merciless in his revenge, and so greatly dreaded, that no one dared resent the murder. At another time he attempted the life of one of the Doctor's servants for the most trifling cause, and was only prevented by the man's escaping, while the Doctor, who was a powerful man, forcibly held him. He was not aware of what I was doing, until I had finished the sketch. He then asked to look at it, and enquired what I intended doing with it, and whether I was not going to give it to the Americans, against whom he bore a strong antipathy, superstitiously fancying that their possessing it would put him in their power. I, in vain, told him I should not give it to them; but, not being satisfied with this assurance, he attempted to throw it in the fire, when I seized him by the arm and snatched it from him. He glanced at me like a fiend, and appeared greatly enraged, but before he had time to recover from his surprise, I left the lodge and mounted my horse, not without occasionally looking back to see if he might not send an arrow after me, a circumstance which would not have been at all pleasant, considering that the Kye-use Indians are most unerring marksmen.

Usually, when I wished to take the likeness of an Indian, I walked into the lodge, sat down, and commenced without speaking, as an Indian under these circumstances will generally pretend not to notice. If they did not like what I was doing they would get up and walk away; but if I asked them to sit they most frequently refused, supposing that it would have some injurious effect upon themselves. In this manner I went into the lodge of Til-aw-kite, the Chief, and took his likeness without a word passing between us.

Having enjoyed the kind hospitality of Dr. Whitman and his lady for four days, I returned to Fort Walla-Walla. On the day after my arrival at the Fort, a boy, one of the sons of Peo-Peo-mox-mox, the Chief of the Walla-Wallas, arrived at the camp close to the Fort. He was a few days in advance of a war party headed by his father, and composed of Walla-Walla and Kye-use Indians, which had been absent for eighteen months, and had been almost given up by the tribes. This party, numbering two hundred men, had started for California, for the purpose of revenging the death of another son of the Chief, who had been killed by some California emigrants; and the messenger now arrived, bringing the most disastrous tidings not only of the total failure of the expedition, but also of their suffering and detention by sickness. Hearing that a messenger was coming in across the plains, I went to the Indian camp and was there at his arrival. No sooner had he dismounted from his horse, than the whole camp, men, women and children, surrounded him, eagerly enquiring after their absent friends, as they had hitherto received no intelligence beyond a report that the party had been cut off by hostile tribes. His downcast looks and silence confirmed the fears that some dire calamity must have happened, and they set up a tremendous howl, while he stood silent and dejected, with the tears streaming down his face. At length, after much coaxing and entreaty on their part, he commenced the recital of their misfortunes. After describing the progress of the journey up to the time of the disease (the measles) making its appearance, during which he was listened to in breathless silence, he began to name its victims one after another. On the first name being mentioned, a terrific howl ensued, the women loosening their hair and gesticulating in a most violent manner. When this had subsided, he, after much persuasion, named a second, and a third, until he had numbered upwards of thirty. The same signs of intense grief followed the mention of each name, presenting a scene which, accustomed as I was to Indian life, I must confess affected me deeply. I stood close by them, on a log, with the interpreter of the Fort, who explained to me the Indian's statement, which occupied nearly three hours. After this the excitement increased, and apprehensions were entertained at the Fort that it might lead to some hostile movement against the establishment. This fear, however, was groundless, as the Indians drew the distinction between the Hudson's Bay Company and the Americans. They immediately sent messengers in every direction, on horseback, to spread the news of the disaster among all the neighbouring tribes, and Mr. McBain and I both considered that Dr. Whitman and his family would be in great danger. I therefore determined to go and warn him of what had occurred. It was six o'clock in the evening when I started, but I had a good horse, and arrived at his house in three hours. I told him of the arrival of the messenger and the excitement of the Indians, and advised him strongly to come to the Fort, for a while at least, until the Indians had cooled down; but he said he had lived so long amongst them, and had done so much for them, that he did not apprehend they would injure him. I remained with him only an hour, and hastened back to the Fort, where I arrived at one o'clock, A. M. Not wishing to expose myself unnecessarily to any danger arising from the superstitious notions which the Indians might attach to my having taken some of their likenesses, I remained at Fort Walla-Walla four or five days, during which the war party had returned, and I had an opportunity of taking the likeness of the great Chief Peo-peo-mox-mox, or the Yellow Serpent. Nothing of consequence occurred whilst I remained at the Fort, and in a few days I resumed my journey to the mountains.

It was about two months afterwards that I first heard news from Fort Walla-Walla, by some men of the Hudson's Bay Company, who had overtaken me; and my grief and horror can be well imagined when they told me the sad fate of those with whom I had so lately been a cherished guest. It appeared that the war party had brought the measles back with them, and that it spread with fearful rapidity through the neighbouring tribes, but more particularly amongst the Kye-uses. Dr. Whitman, as a medical man, did all he could to stay its progress; but, owing to their injudicious mode of living, which he could not prevail on them to relinquish, great numbers of them died. At this time the Doctor's family consisted of himself, his wife, and a nephew, with two or three servants, and several children whom he had humanely adopted, left orphans by the death of their parents, who had died on their way to Oregon, besides a Spanish half-breed boy, whom he had brought up for several years. There were likewise several families of emigrants staying with him at the time, to rest and refresh themselves and cattle. The Indians supposed that the Doctor could have stayed the course of the malady had he wished it, and they were confirmed in this belief by the Spanish half breed boy, who told some of them that he had overheard the Doctor and his wife conversing after they retired for the night, and that he heard him say he would give them bad medicine, and kill all the Indians, that he might appropriate their land to himself. They accordingly concocted a plan to destroy the Doctor and his wife and all the males of the establishment. With this object in view, about sixty of them armed themselves and came to the house. The inmates, having no suspicion of any hostile intention, were totally unprepared for resistance or flight. Dr. and Mrs. Whitman, and their nephew, a youth about seventeen or eighteen years of age, were sitting in their parlour in the afternoon when Til-aw-kite the Chief, and To-ma-kus entered the room, and addressing the Doctor, Til-aw-kite told him very coolly that they had come to kill him. The Doctor, not believing it possible that they could entertain any hostile intentions towards him, told them as much. But while in the act of speaking, To-ma-kus drew a tomahawk from under his robe and buried it deep in his brain. The unfortunate man fell dead from his chair. Mrs. Whitman and the nephew fled up stairs, and fastened themselves into an upper room. In the meantime Til-aw-kite gave the war whoop as a signal to his party outside to proceed in the work of destruction, which they did with the ferocity and yells of so many fiends. Mrs. Whitman, hearing the shrieks and groans of the dying, looked out of the window, and a son of the Chief shot her through the breast, but did not kill her at the moment. A party then rushed up stairs, and despatching the nephew on the spot, they dragged her down by the hair of her head, and taking her to the front of the house they mutilated her in a shocking manner with their knives and tomahawks. There was one man who had a wife bedridden. On the commencement of the affray he ran to her room, and, taking her up in his arms, carried her, unperceived by the Indians, to the thick bushes that skirted the river, and hurried on with his burden in the direction of Fort Walla-Walla. Having reached a distance of fifteen miles, he became so exhausted, that, unable to carry her further, he concealed her in a thick hummock of bushes on the margin of the river and hastened to the Fort for assistance. On his arrival, Mr. McBain immediately sent out men with him, and brought her in. She had fortunately suffered nothing more than the fright. The number killed, including Dr. and Mrs. Whitman and nephew, amounted to fourteen. The other females and children were carried off by the Indians, and two of them were forthwith taken as wives by Til-aw-kite's son and another. A man employed in a little mill, forming part of the establishment, was spared to work the mill for the Indians.

The day following this awful tragedy, a Catholic Priest, who had not heard of the massacre, stopped on seeing the mangled corpses strewn round the house, and requested permission to bury them, which he did with the rites of his own Church. The permission was granted the more readily as these Indians are friendly towards the Catholic Missionaries. On the Priest leaving the place, he met, at a distance of five or six miles, a brother Missionary of the deceased, a Mr. Spalding, the field of whose labours lay about a hundred miles off, at a place on the River Coldwater. He communicated to him the melancholy fate of his friend, and advised him to fly as fast as possible, or in all probability he would otherwise be another victim. He gave him a share of his provisions, and Mr. Spalding hurried homeward full of apprehensions for the safety of his own family; but unfortunately his horse escaped from him in the night, and after a six days' toilsome march on foot, having lost his way, he at length reached the banks of the river, but on the opposite side to his own house. In the dead of the night, and in a state of starvation, having eaten nothing for three days, everything seeming to be quiet about his own place, he cautiously embarked in a small canoe and paddled across the river. He had no sooner landed than an Indian seized him and dragged him to his house, where he found all his family prisoners, and the Indians in full possession. These Indians were not of the same tribe with those who had destroyed Dr. Whitman's family, nor had they at all participated in the outrage, but having heard of it, and fearing that the whites would include them in their vengeance, they had seized on the family of Mr. Spalding for the purpose of holding them as hostages for their own safety. The family were uninjured, and he was overjoyed to find that things were no worse. Mr. Ogden, the Chief Factor of the Hudson's Bay Company on the Columbia, immediately on hearing of the outrage, came to Walla-Walla, and although the occurrence took place in the Territory of the United States, and of course the parties could have no further claim to the protection of the Company than such as humanity dictated, he at once purchased the release of all the prisoners, and from them the particulars of the massacre were afterwards obtained. The Indians, in their negotiations with Mr. Ogden, offered to give up the prisoners for nothing, if he would guarantee that the United States would not go to war with them, but this, of course, he could not do. Immediately on the receipt of the news in Oregon, four hundred volunteers started for the Walla-Walla River to punish the Indians, but they met with very bad success, losing more men than they killed of the enemy. Since that time a sanguinary war has been kept up without a prospect of any other result but that of extermination to the Indians. From time to time the newspapers furnish some stirring or bloody incidents of the Oregon war, and this winter I read in an American paper an account of the death of my old acquaintance, Peo-peo-mox-mox, the Chief of the Walla-Wallas, who had been taken prisoner, and was shot while attempting to escape.

THE SUPPOSED SELF-LUMINOSITY OF THE PLANET NEPTUNE.

BY COLONEL BARON DE ROTTENBURG.

Read before the Canadian Institute, 29th March, 1856.

The following observations upon the Planet Neptune are offered for consideration, in compliance with the request of the Council of the Canadian Institute for communications from the general body of the members. They refer more especially to ideas advanced regarding the supposed luminous atmosphere of that recently discovered planet, on which so many circumstances have combined to confer a peculiar scientific interest. These views regarding the self-luminosity of Neptune may not have fallen under the notice of the members generally, as they appeared originally in the "British Quarterly Review,"—a periodical not re-printed, or generally circulated on this continent,—and have not, even at home, attracted the attention they might seem to merit. They are to be found in that Review, for the month of August, 1847, in an article on "Recent Astronomy." After referring to the remarkable series of labours and deductions which finally revealed the unseen, yet known planet, to the eye of astronomers, the reviewer thus proceeds:—

"There are two facts connected with the newly-discovered planet, —the one certain, and the other all but certain, which merit particular attention. The first of these is its deviation to a far greater extent than any one of those bodies heretofore known, from what is known as Bode's law of the distances. According to this law—or rather rule, seeing it simply expresses a fact of which no explanation whatever can be given,—the various planets are placed at distances bearing a certain and uniform relation to each other: this proportion being that, the interval between Mercury and Venus being assumed as unity, the intervals between the successive orbs each double upon the one before it. Had the newly-discovered orb conformed to this rule, it would have been found at a distance of 3,600,000,000 miles from the sun. Its actual distance is about seven-ninths of this amount. And such a deviation, important and interesting in itself, as the first example of departure from a rule hitherto found universal, derives additional interest from the fact, that, chiefly on it, conjectures have already been founded relative to the possible existence of a second unknown orb, situated as much beyond the distance indicated by the law, as the present one falls within it. This conjecture, however, must be left to time to verify. It is more than probable that, if such an orb exist, the means which have guided our telescopes with such unerring aim towards this one, must again be employed for its discovery: its disturbing action be watched and waited for; and direct observation, almost powerless at such a distance, be guided and led out by theory towards a mind-seen result.

"The second of the two facts we have referred to is one of yet higher interest and importance, and certainly one more unexpected still. It is believed that the planet is self-luminous. This inference has been deduced from its high degree of visibility and great clearness of light, not only as compared, or rather contrasted with Uranus, but beyond what is comprehensible in conformity with the known principles of optics. It is, indeed, conceivable, that the physical organisation of the orb may be such, as shall give to its surface a light-reflective power very far beyond all we have experience of, at least among the other orbs of the system; but it is very questionable whether any amount of this, within the limits of probability, would account for a planet receiving little more than a third of the sunlight which Uranus receives, nearly equalling it in visibility, and far surpassing it in vividness of light. Here, too, at all events, we are called on to 'stand still and see': to rid the mind of every bias, and of all pre-judgment, and to esteem the treasure-house of physical variety still unexhausted, and the phases of physical appearance still not all seen. And should this most unexpected and important fact be hereafter established, we shall then be presented with a startling and striking converse to the fact arrived at by the masterly induction of the lamented Bessel, with regard to the stars Sirius and Procyon—the first, one of the most majestic orbs which our firmament can claim,—that each is associated in binary combination with masses yet mightier than themselves, like our planets opaque and non-luminous; suns of darkness, whose light, if ever they shone, has waned and gone out for ever. And, on the supposition of the planet in question being self-luminous, it becomes an interesting object of inquiry whether, from any adjacent system, our sun can appear with it to constitute a double star."

Such is the reviewer's statement. Now, opinions have lately been set forth with great skill and plausibility tending to the belief that this earth is the only planet fit for the habitation of intelligent beings, and that the other planets of the Solar System being either too near the sun, or too remote from it, receive either too great or too little an amount of light and heat to fit them for the abodes of creatures constituted like ourselves.

If, however, future observation should confirm this statement that Neptune is itself luminous, it must somewhat modify these views, for it will prove that a planet even at the great distance which Neptune is from the sun may after all not be such a dark world, and not quite so miserable as it has been represented. And this self-luminosity of Neptune may also account for its less complicated arrangements for compensation by means of moons for the small amount of light it receives from the sun. For it has only one satellite—at least Mr. Lassel, who has lately moved his celebrated Reflecting Telescope to Malta where the atmosphere is peculiarly well adapted for astronomical observations, states that he is satisfied there is only one satellite belonging to Neptune—or at least if there be others, there is no prospect of discovering them with our present telescopes. The suspicion entertained by Mr. Lassel and Mr. Bond that there is a ring round Neptune has since been abandoned. I may here mention that Mr. Lassel also states as the result of his late observations that he is satisfied there are only four satellites belonging to Uranus.

Now, these facts give rise to some reflections—and it may not be out of place here to offer a few observations upon the varieties which exist amongst the planetary bodies as regards their physical conditions, and to take a cursory view of the Solar System generally; from which examination we shall see that whilst certain general characteristics belong to the two great divisions of the primary planets, yet when these are examined in detail there is by no means an uniform agreement amongst them individually.

The eight primary planets composing the Solar System are divided into two groups of four each, separated by the space which comprises the orbits of the Asteroid planets. The four interior planets, viz: Mercury, Venus, the Earth, and Mars have greater densities than the exterior Planets, are of less size, and with one exception are unprovided with moons. They rotate on their axes in rather more than double the time of the exterior planets—they move round the sun with far greater velocity. Their year varies from about three months, the year of Mercury, to a year and eleven months, the year of Mars, (in round numbers), and their day is about twenty-four hours long.

The four exterior planets, viz., Jupiter, Saturn, Uranus, and Neptune have less densities than the interior ones; but their size is vastly greater. They move round the sun much slower—their year varies from nearly twelve years, which is the length of the year in Jupiter, to one hundred and sixty-four years, which is the length of the year in Neptune; their day, as far as has been ascertained, is about ten hours long. Thus we see that increased velocity of axial rotation, and, consequently, increased centrifugal force, with its corresponding diminished force of gravity at the surface, is a characteristic of the four superior planets.

But these greater bodies have also increased means for compensating the reduced amount of light they receive from the sun, for they are all provided with moons in greater or lesser numbers; Jupiter has four moons; Saturn has eight, and several rings; Uranus four, and Neptune but one. There are many other differences existing between these two groups which I have not time to dwell upon.

But with regard to the differences in density, size, &c., amongst the particular bodies of these two great divisions of the Solar System—although Mercury, the nearest to the sun, is the densest body of the Solar System, yet Mars, which is outside the Earth, is denser than Venus which stands next to Mercury in proximity to the Sun, and Neptune which is the "outsider" of the system is denser than either Uranus or Saturn—Saturn being the lightest body in the System.

Again, the Earth has a moon, but Mars, which is outside the Earth, has none. Venus was long supposed by Cassini, Short, and other astronomers to have a moon, but the fine telescopes of our time have failed to discover it, and, therefore, Venus must be deemed moonless.

The Earth and Venus, which are very nearly the same size, are both larger than Mercury, but Mars, outside the Earth, is much smaller than the Earth, its diameter being only 4,100 miles: the Earth's equatorial diameter being 7925 miles. Jupiter is the largest body in the system, except the Sun; Saturn, next in size, is next in distance; but Uranus and Neptune are much smaller than either Jupiter or Saturn, their diameter in round numbers being severally about 35,000 miles.

We might also naturally expect to see the number of moons belonging to the outside planets increased in proportion to their distances from the Sun—but this is not the case, for although Jupiter has four moons and Saturn eight, and several rings, yet Uranus, which is outside Saturn, is now known to have only four satellites, and Neptune, the most remote body in the system from the Sun, (as far as yet known) being 2,700 millions of miles more distant from the Sun than our Earth, has, like our globe, but one moon. Thus we see that although the denser bodies are nearest the Sun generally, yet they are not uniformly so; that whilst the larger bodies of the system are those most remote from the Sun, yet increase of size is not uniformly proportioned to increase of distance, and that although the planets most distant from the Sun as a general rule are those which have the greater number of moons, still the number of moons belonging to any planet is not necessarily contingent on its distance from the Sun. Variety in physical condition is therefore a characteristic of the planetary bodies, as it is indeed of every other work of the Creator, and in all probability not any two of the planets are in any way similarly constituted.

But if this self-luminosity of Neptune be confirmed by further observation, it will certainly be an unique feature in the Solar System. It has always occurred to me that one great difficulty, of which I have never met any explanation, attends what is called the Nebular Theory. This is—if all the bodies of the system had a common origin, being formed from a rotating Nebula throwing off rings and planets, &c., why in such a case should the luminous atmosphere be confined to one of these bodies only, viz., the central one? and why should the others have very different atmospheres or envelopes?

But if Neptune's atmosphere is self-luminous, it will at any rate shew that it is not incompatible with the conditions of the Solar System, for one body besides the central one to be provided with a Photosphere. I must observe here that I have not seen any confirmation of the self-luminosity of Neptune in astronomical works to which I have access; but the recentness of the discovery of this planet; as well as the difficulties interposed in consequence of its remote distance from our earth, must necessarily render the absolute determination of all its peculiar phenomena a work of time. Meanwhile it may be permitted us to reason that, if Neptune is self-luminous, this condition may enable it, with its solitary satellite, to possess a sufficiency of light for the existence and enjoyment of life by creatures of a higher organization than some feel disposed to accord to it, should life indeed exist upon it at present.

With regard to the temperature of these remote bodies which must necessarily be dependent upon a variety of considerations, I cannot but think some allowance should be made for the greater amount of internal heat which may *possibly* be a condition of the superior planets; for if, as some are disposed to consider, the Solar System had a common origin, and the planets originally were in an incandescent state, then under such circumstances the larger bodies would take longer to cool down than the smaller ones—and if any degree of probability is to be attached to such speculations, our friends on the confines of the system, (if such there be) may still be warmer than we give them credit for.

I am not, however, going to inflict on the members of the Institute any dissertation on the plurality or non-plurality of worlds, which subject has assuredly been sufficiently discussed of late years, leaving us all much of the same opinion still, although some of us may have been convinced against our will. But if any feel disposed to view this vexed question under a new aspect, and see much that is valuable, original and interesting, presented in a very condensed form, I strongly recommend them to peruse a little work called "The Chemistry of the Stars," written by Dr. George Wilson, the recently appointed Professor of Technology, at Edinburgh; and I think they will come to the conclusion, that it contains as much as need be said upon the subject to convince us all, that it is not probable there is any planet in the Solar System adapted for the residence of beings constituted *precisely* as we are.

I may add that when Neptune was discovered by Dr. Galle, it appeared as a star of the 8th magnitude; its apparent diameter is about 2″·8 when in opposition, that of Uranus in the same position is about 4″. If we had a first class telescope attached to this Institute, or to one of the Universities, we might have opportunities of satisfying ourselves by personal inspection of the comparative light given forth by these two planets. The acquisition of such an instrument is, I regret to say, still a consummation devoutly to be wished.

INFLUENCE OF RECENT GOLD DISCOVERIES ON PRICES.

BY E. A. MEREDITH, LL.B., ASSISTANT PROVINCIAL SECRETARY.

Read before the Canadian Institute, 19*th April*, 1856.

The general rise in the prices of commodities in the old as well as the new world, within the last four or five years, is one of the most striking and important economic phenomena of the present century.

June, 1848—the date of the first discovery of gold on the Sacramento River in California—may be taken as the commencement of the era of high prices. California and Australia, when they became the centres of cheap gold for the world, became of necessity, at the same time, the centres of high prices. From these centres the tide of gold has flowed over the civilized world in all directions, and wherever it has flowed it has raised in a greater or less degree the level of prices.

Looking to the statistics of prices for the sixty years preceding 1848, we find that the former half of that period is marked by a high, and the latter half, say from 1819 to 1848, by a low level of prices. The causes, however, which kept up a high range of prices during the thirty years preceding 1819, will, I think, be found to differ in some essential features, from those which, since 1848, have operated to produce a similar result.

In the former period, the high prices (as Tooke has conclusively proved in his elaborate work on the History of Prices,) were due to the combined effects of the great war in which Europe was then involved and of a series of unfavourable seasons. Whereas the general advance of prices since 1848, although no doubt in some degree intensified by the recent war and by other causes, is, as I hope to shew, mainly due to the unparalleled influx of the precious metals from California and Australia into Europe and the rest of the civilized world, and to other causes more or less intimately connected with and growing out of the gold discoveries in those countries. That these discoveries are destined to bring about not only great economic and commercial changes, but also materially to affect the social, political, and moral condition of the world, cannot, I think, be questioned. As to the general bearing of these various changes on the well-being and happiness of mankind, thinking men indeed entertain widely different views: while many see in the consequences of the gold discoveries nothing but unmixed good; a few, including among their number the ingenious and acute De Quincey, look more than doubtfully to the future, and seem disposed to believe that it had been better for the world if the gold nuggets had remained for ever buried in the bowels of the earth.

Into the large and tempting field of enquiry which the discussion of the probable moral and social results of the modern gold discoveries would carry us, it is not my design to enter. I shall confine myself exclusively to the economic bearings of the discoveries; and consider only the effect of those discoveries on the prices of commodities. This indeed is only one (doubtless the most important,) of the many interesting phases which the subject presents, considered in an economic point of view.

Strange as it may appear, this subject, although practical and important, has not hitherto received any considerable share of public attention, or been discussed on general principles and with reference to the admitted truths of Political Economy.*

To connect the gold discoveries and high prices together as cause and effect, and to indicate the process by which the rise in prices has been brought about, as well as the probable permanency of their present level, are the principal objects of the present paper.

It can hardly, I conceive, be necessary to adduce elaborate statistics to establish the fact assumed as the ground work of my remarks—that the general level of prices on this continent and in Great Britain as well as in California and Australia has, within the last six or eight years, been considerably raised.

The extraordinary advancement of the prices of the necessaries of life, and of the wages of labour, in the two countries last mentioned, immediately after the first discovery of their mineral treasures, is yet fresh in the recollection of us all. The influence of the golden tide, which then began to set in from those remote lands to Great Britain and the States, soon also made itself apparent in the latter countries.

During the last four years the Congress of the United States, in consequence of the admitted depreciation of the value of money throughout the Union, was compelled to raise, from 25 to 40 per cent, the salaries of the officers and servants of the Government. In England in 1854, the rise of wages and prices according to Mc-

* Sterling's Work on "Gold Discoveries," to which frequent reference is made in subsequent parts of this paper, is certainly an exception to this remark—I may add that I had not seen this work until a large portion of this article had been written.

Culloch was not less than from 12 to 35 per cent., while in Ireland it was much more.*

On the continent of Europe a similar rise in prices, though not perhaps to the same extent, could be shewn to have taken place;† while, as regards Canada, any statistics to prove the advance of prices within the last six years, would be considered, I am sure, as quite superfluous. Six years ago Canada was rightly considered as one of the cheapest countries of the world; now, assuredly, it is one of the most expensive. Here, as in the States, the Legislature has been compelled to interfere to rescue the civil servants and officers of the Government from the ruinous effects of the enhanced prices of labour and of the necessaries of life. Within the last two years, accordingly, the salaries of almost all public officers in this country have been augmented, and the indemnity allowed members of Parliament, the salaries of the Executive Councillors, as well as as the salaries of most of the employés of the Government, have been raised. The scale of increase, however, varies somewhat strangely in the different cases. In the case of Members of Parliament and Executive Councillors, 50 per cent. has been added, while the incomes of the great mass of Government officials, (where any addition whatever has been made to their salaries,) have been augmented at rates varying from 12 to 25 per cent. These several advances being all grounded on the increased cost of the necessaries of life, we might perhaps '*a priori*' have anticipated that the augmentation would have been in the inverse ratio of the salaries, in other words, that the lowest salary should have had the largest per centage, inasmuch as the smaller the whole salary the greater the proportion of it spent in the purchase of mere necessaries. The Legislature however would appear to have judged differently, and from the graduated scale adopted by them, we are forced to conclude that the pressure of high prices is most acutely felt by Executive Councillors and Members of Parliament, and but slightly, if at all, by the subordinate officers and servants of the Government. Had the increase of salaries been made on the ground of the decline in the value or purchasing power of money, as compared with all other commodities, then all salaries large and small should have been raised in the same ratio; assuming of course, that

---

* McCulloch's Commercial Dictionary, p. 1055, Edition of 1854, see also "Statistical Journal," for 1854, p. 1055.

† In the "Annuairé de L'Economie Politique"—for 1855, published at Paris, we read at the commencement of the article entitled 'Coup d'œil sur l'année 1854'—

"L'année 1854, a vu sœvir à la fois trois fléaux; la guerre, le Choléra et la cherté des subsistances." In another part of the same article it is stated that the price of meat in France in 1854 was 25 per cent. above the average price of preceding years.

before the decline in the value of money they had been fairly adjusted.

To return, however, from this digression. I think that sufficient has been said to establish the fact that a considerable advance in prices has within the last five or six years taken place not only in California and Australia, but in this country and throughout the Continent generally, as well as in Great Britain and the rest of Europe.

To what causes, then, is this phenomenon due? I answer—firstly, and chiefly, to the recent gold discoveries; secondly, and in a lesser degree, to the war and other local and temporary causes.

It is with the former of these causes only that we have now to do. Before entering, however, on a discussion as to the degree of influence or mode of operation of the gold discoveries in effecting the results which I assign to them, it may not be out of place to make some brief remarks in reference to the general fundamental laws regulating prices.

The relative values of commodities are commonly estimated by referring them to the common measure or standard of value—money; in other words, by their relative prices—the price of every commodity being its value in money. The relative prices of different commodities at any given time are of course an accurate index of their relative values at that time. And if our standard of value were (like our standards of weights and measures) invariable, the relative prices of the same commodity, at different times, would also indicate accurately its relative values at those times. The fall or rise in the price of any article would shew precisely the fall or rise in its value. But our standard of value is not thus invariable, nor indeed can it be, inasmuch as the precious metals, which form the standard, are themselves liable (though not to the same extent as most other commodities) to fluctuate in value.

It is obvious then that a change of the price of any article may arise from two distinct classes of causes, either those affecting the intrinsic value of the article itself, or those affecting the value of the money with which it is compared.

Now the values of all commodities (gold and silver included) are determined ultimately and permanently by their cost of production, temporarily and proximately by the relation existing between their demand and supply. The value of any article, considered as determined by the relation existing between the demand and supply, is styled its "market value;" while its value, considered as regulated by its cost of production, is termed its "natural value." The market value of most commodities is constantly changing, now rising above and now sinking below its natural value—which latter is happily described by Adam Smith as that "centre of repose and continuance" which the former is ever struggling to attain. The extent and frequency of these fluctuations of the market value of a commodity must depend on the degree and manner in which the relation of its supply and demand is liable to disturbing influences.

In this respect the precious metals differ from almost all other commodities. While most other commodities are exposed to sudden and very great variations in value, the changes in the value of the precious metals have generally been very slow and gradual.* And it is this quality which eminently qualifies them to act as a general standard of value. So accustomed, indeed, are we to witness continued fluctuations in the market values of most commodities, arising wholly from accidental causes affecting their demand and supply, and so seldom do we witness any change in the value of gold or silver, that when in reality the value of gold and silver is changed and the price of all other commodities thereby affected, we are slow to admit the fact, and persuade ourselves that the change in prices is due to any cause save the real one. And yet a little reflection will serve to convince us that, when the rise or fall of prices is general and affects all commodities to the same extent or nearly so, the natural inference is that such a change must be due to an alteration in the value of money and to nothing else.

To resume the argument. It is plain that the rise in the general level of prices of commodities must result either from a general increase of the cost of production of commodities or a reduction in the cost of production of the precious metals—or, again, from some cause or causes increasing the demand for commodities generally, or diminishing the demand for the precious metals. Of these four supposable causes by which (in theory at least) the phenomenon under consideration might possibly be occasioned, it will, I think, be shewn in the sequel that the efficient causes really are—

1st. A reduction in the cost of production of the precious metals consequent on the recent gold discoveries.

2nd. A diminution in the supply and simultaneous increase in the demand for many of the most important staples of commerce—the result partly and indirectly of the gold discoveries, and partly and more directly of the war and other causes.

---

* The comparative uniformity and steadiness in the value of the precious metals arises from this, that the existing supply of the metals is so great and the demand for them so universal, that the relation between the demand and supply is not liable to be materially affected by any accidental disturbances of either.

Let us turn now to California and Australia, and briefly examine the leading economic phenomena which have developed themselves in those countries since the commencement of the gold discoveries; a review of these facts will I think enable us to understand the manner in which the depreciation of the metals has taken place there, the measure and extent of that depreciation, and the steps by which similar effects are now being extended in ever widening circles over the whole of the commercial world. The events which followed the first announcement of gold on the banks of the Sacramento are too striking and too recent to be forgotten. From every quarter of the globe, including the Celestial Empire, flocked thither crowds of adventurers. Thousands of excited gold seekers perished miserably before reaching the looked for El Dorado, but their places were soon filled by others, and wave after wave of this living tide of motley pilgrims broke in succession upon the shores of California. In a few months the population rose from a few hundreds to many thousands. In less than two years and a half it had reached 200,000; and now it is supposed to number nearly half a million. Meanwhile the prices of all the necessaries of life and the money wages of labour had reached an almost fabulous height, and notwithstanding the efforts made by the States and other countries to meet the sudden and extraordinary demand for goods in this new market, prices maintained an unexampled level. What occurred in 1848 in California, was repeated in 1851 in Australia—the phenomena in both places being essentially the same. I have selected Australia for more particular examination in reference to the present enquiry, inasmuch as all the details regarding Australia are fully given in official documents—which is not the case as respects California.

The Sydney papers of the summer of 1851 brought to England the first intelligence of a new gold region in the Eastern world, and of the delirious excitement with which the discovery was received in the Colony.

The then Lieut. Governor of Victoria, Mr. Latrobe, in a despatch of December of that year, represents the whole structure of society as being disorganized by the effect of the discoveries, and concludes by remarking: "It really becomes a question how the more sober operations of society, and even the functions of Government, may be carried on."

The immediate effects of the discovery on the money wages of labour and on the prices of provisions, points which more immediately concern us in the present enquiry, are also given by the Lieut.

Governor in a paper referred to in a despatch of January, 1852. In this paper it is stated "that the wages of shearers rose from 12s. in 1850 to 20s. in 1851; of reapers from 10s. to 20s. and 25s. per acre; of common labourers, from 5s. to 15s. and 20s. per day; of coopers, from 5s. to 10s.; of shipwrights, from 6s. to 10s.;" and of all others at the same rates.

From December, 1850, to December, 1851, it is added that the prices of provisions had risen as follows: *Bread*, 4 lb. loaf, from 5d. to 1s. 4d. and 1s. 8d.; butter from 1s. 2d. to 2s. or 2s. 6d. Fresh meat doubled in price, and vegetables were raised from 50 to 100 per cent.

Mr. Sterling, from whose admirable work on the gold discoveries I have copied the foregoing extracts, in commenting on them, in 1852, observes:—"The phenomena, in as far as they have yet developed themselves, have occurred exactly in the order that might have been expected. First of all, we have had a rise in the money prices of colonial labour, next in the prices of provisions and the other direct products of that labour, and lastly and after a greater interval, we may expect to witness an elevation of the money value of commodities imported into the Colony, with a corresponding rise of prices in England and the other countries whence those imported commodities are derived."

What Mr. Sterling confidently looked forward to in 1852 has now actually taken place in England, the States, and Canada.

From the figures furnished in Mr. Latrobe's despatches, it appears that the money wages of labour rose more than 100 per cent., and that the rise in the price of provisions was equally great. In other words, the purchasing power, or the value of gold, as compared with the things enumerated in that list, suddenly fell on the average about 50 per cent. The cause and the measure of this fall in the value of gold was the reduction of its cost of production in the Colony. The average quantity of gold which a labourer could earn at the diggings became in an incredibly short time the measure of the value of a day's labour, and that quantity of gold would, therefore, only exchange for the produce of a day's labour applied in any other way—an allowance, of course, being made for the severity and uncertainty of the gold digger's toil.

The average sum gained at the gold fields was estimated, at the period referred to in Mr. Latrobe's despatches at £1 per day, and consequently this sum appears to have been but little above the average amount paid to a common day labourer. It is, indeed, worthy of remark that the wages of common labourers ranged, at least for some time, higher than those of skilled labourers. This probably arose from the fact that at the diggings all labourers, skilled and unskilled, were put nearly upon an equal footing. The mechanic or tradesman could not use the pick, the cradle, or rinsing box, better, probably not as well, as the hardy labourer accustomed to toil in the fields. The natural consequence would be that the gold digging would prove especially attractive to the unskilled labourer, and consequently that very little labour of that kind would be left disposable in the Colony for other necessary purposes. Hence the extraordinary rise in the money wages of common labourers as distinguished from artisans or mechanics.

We have thus shewn that the immediate effect of the gold discoveries in Australia, (and the same is true of California,) was a fall in the value of gold in the Colony, as compared with labour and provisions, a fall in value proportioned to and measured by the *reduction of its cost of production.*

When we pass from the gold raising to the gold importing countries and attempt to trace the operation of those discoveries in the latter, the results are not, perhaps, quite so obvious.

The reduction in the cost of production of gold in Australia and California does not immediately and necessarily affect the value of labour and its products in other countries, because the labour of those countries cannot be at once applied to the production of gold on the same terms as the labour in the neighbourhood of the mines. Ultimately, indeed, the value of gold everywhere must be regulated by its cost of production in Australia and California, assuming always, that the latter countries can continue to supply an unlimited quantity of the metal at a lower rate than the mines previously in use.

Those foreign countries, whose commercial relations with the new gold raising countries are the most intimate and extensive, will be the first to feel the effects of the increase of the precious metals.

The immediate and direct effects of the discoveries in those countries, will, it seems to me, be—

To diminish the supply, and consequently raise the value of labour (and therefore of all its products), by withdrawing from those countries to the gold fields a large portion of its available stock of productive labour.

To increase the demand for and consequently "pro tanto" raise the prices of all commodities exported thence to the gold regions.

To lower the value of the precious metals by suddenly increasing the quantity of the currency and consequently the proportion which it bears to the commodities in circulation.

All countries which have contributed a quota of their citizens to swell the number of settlers in the gold regions (and what country has not?) or which supply them with any portion of their goods, must, in greater or less degree, feel the effects of each and all of these processes, all of which are silently but constantly at work, and have already, I feel satisfied, extended much farther and operated much more powerfully than is generally imagined.

England and the United States were, as might have been anticipated, the countries most speedily and directly affected—England from her connection with Australia, the States from their connecnection with California—and through England and the States the effects were necessarily propagated by a species of commercial *conduction* to this country and to others.

We have thus indicated some of the processes by which the influence of the gold discoveries extended itself to foreign countries.

As to the existence of these processes, or as to their tendencies there is no room for doubt. It is, however, absolutely impossible to measure their precise share either individually or collectively in the general result. The forces which come under consideration in the domain of practical political economy (unlike those with which the mechanical philosopher has to deal) refuse to submit to rigid measurement, and we must content ourselves with seeing the general result towards which they severally contribute without hoping to ascertain how much of the effect is due to each force separately.

Within a very few years California has withdrawn from the producing classes of the States probably more than 50,000 able bodied men. Australia in the same way has absorbed in a few years a large portion of the productive labor of Great Britain. The entire emigration from Great Britain to Australia, since the discovery of gold there, is probably little short of a quarter of a million of souls.

In both cases the sudden subtraction from the labour market of the parent states of so considerable portion of the whole stock must have had a direct and obvious tendency to raise the value of labour, and consequently of all the products of labour, in those countries. But more than this, the labourers thus transplanted to the gold countries change their economic character—from being, for the most part, producers of commodities in and for the home market, they suddenly become consumers, and generally extravagant consumers, of those very commodities. They enter the home markets, in fact, as formidable competitors with the consumers they have left behind.

The truth of the last remark is forcibly illustrated by Australian statistics; from official statements of the imports to Sydney, we find that the average amount of the imports for the ten years preceding the gold discoveries was little more than £1,000,000 sterling, while in 1853 and 1854 the annual imports to that port averaged fully £6,000,000.

The prices of labour and of commodities in Great Britain and the States must therefore have been raised in virtue of both the causes which I have pointed out; for whilst the supply of labour and commodities in those countries was reduced, the demand for labour and commodities was actually increased.

We now come to consider the third, and, doubtless, the most influential as well as the most obvious of the assigned causes of the fall of the value of gold in the gold importing countries. I mean the sudden and extraordinary augmentation in the mass of the precious metal as compared with the mass of commodities in those countries. No one can doubt that if the mass of the precious metal in the world became suddenly doubled or trebled, the prices of all commodities would at once be doubled or trebled as the case might be. Such sudden changes in the mass of the precious metals are of course impossible; changes in the amount of the metallic currency when they do occur, are generally, as has already been observed, the gradual result of years, and when this is the case the ultimate effect of the increase of the precious metals on prices may be materially modified by the change which has taken place simultaneously in the value of the aggregate of commodities.

Prices (so far as they are affected by the cause under consideration) would rise or fall according to the relative increase in the mass of metal and commodities. If the mass of the precious metals had outstripped in its growth the mass of commodities, prices would be raised. If, on the other hand, commodities had increased more rapidly than the metals the prices of commodities would be lowered.

There can be little doubt, I imagine, that since the gold discoveries in California and Australia, gold has been increasing much more rapidly than commodities, and consequently (in obedience to the law just stated), the prices of commodities must, as a matter of course, have been raised during that period.

At the beginning of the present century the annual value of the precious metals raised from all the mines of the world, was, according to the calculation of Humboldt, somewhat under £10,000,000 sterling. From 1800 to 1810 (owing to the increasing yield during that period of the American mines), the total annual produce steadily increased until in the latter year it was rather over than under £11,000,000. From 1810 to 1830 the total produce of the precious metals would seem to have fallen off somewhat, but from the latter date up to the time of the discovery of the gold in California (owing mainly to the increased yield of the Russian mines and washings) it again advanced, and at the epoch of the gold discoveries on the Sacramento was about £12,000,000 sterling per annum. In 1850, the second year after the discovery of gold in California, the total produce of the precious metals was, as computed by McCulloch, £27,000,000; in 1851, Australia began to add her treasures to the mass, and in 1853 the combined yield from the new and the old mines was estimated at the enormous sum of £47,000,000. I believe we would be safe in assuming the total produce of the year which has just closed at upwards of £50,000,000 sterling.*

In order to estimate even in a rude way the probable effects of this unprecedented and sudden influx of the precious metals, we should know the whole amount of bullion previously used as currency, and the portion of the annual yield required to supply the wear and tear of coin and bullion, due allowance being made under this latter head for the additional amount of bullion which the reduction of its value would cause to be used in various branches of manufactures and the arts. The surplus portion of the annual yield, which would be forced, as it were, upon the currency of the world, over and above its legitimate wants, would afford an exponent or measure of the depreciation of the whole mass, so far, at least, as that depreciation may not have been counterbalanced by the operation of other causes.

The value of the metallic currency of the world at the epoch of the gold discoveries has been very variously estimated. McCulloch (after a careful comparison of the calculations of Jacob, Humboldt and others,) puts it down at £380,000,000.

The same author estimates the wear and tear and loss of the precious metal at $1\frac{1}{2}$ per cent. of the whole mass, or about £5,700,000 per annum.

The probable annual addition to the currency, required by the rapidly increasing population in the gold countries and elsewhere, he

* The produce of California has been estimated officially at $60,000,000 or upwards of £12,000,000 sterling. The quantity exported from Melbourne alone during the year must have been at least £12,000,000 sterling. From Sydney up to the 10th December it was close on £10,000,000. Taking into consideration the quantity retained in the country and the quantity sent home by private persons and of which no account was taken, we think the total yield of Australia during the past year cannot have fallen short of £20,000,000. The Australian newspapers received since the above note was penned confirm my conjecture as to the last year's yield of gold in that Colony.

calculates at 3 per cent. of the whole, or upwards of £11,400,000 per annum.

Again, the annual consumption of the precious metals in the arts he estimates at £11,200,000.

Wear and tear and loss of coin	£ 5,700,000
Increase of currency	11,400,000
Used in the arts	11,200,000
Total	£28,300,000

In reference to the last item, McCulloch remarks, "this quantity, however great it may appear will be increased with the increase of population and the spread of refinement and the arts; and it will, also, be certainly increased by any thing like a considerable fall in the value of bullion." Indeed I believe there can be little doubt that already the decline in the value of gold bullion has caused it to be employed in various new branches of manufactures and the arts, and the tendency of this increased demand for gold will be of course, "pro tanto" to check the decline in its value.

From a careful examination of all the authorities to which I have had access on the matter, I have arrived at the conclusion that the whole amount of gold raised since 1848 to the beginning of the present year is not much under 300 millions, and that the whole amount coined during the same period may be estimated at upwards of 180 millions.

Had the whole of this enormous amount of coin been suddenly thrown upon the currency of the world, the effect would have been (assuming as before the whole mass of the currency of the world to be £380,000,000,) an average decline in the value of gold throughout the world, of nearly 50 per cent.

But as in reality the rate of influx of the new gold is very different in different countries, and as the effect of this cause in any particular country is directly proportioned to its rate of influx into that country, as compared of course with the amount already in existence there, the decline in the value of gold in some countries would have been above and in others below this average.

The addition to the coin has, however, not been instantaneous, it has been spread over a period of 8 years, and during that time, (owing to the extraordinary impulse given to commerce from the gold discoveries themselves, from free trade and other causes) the production of commodities has been going forward with a constantly increasing energy, so that the whole mass of commodities in the world in 1856 far exceeds in value the mass of commodities in 1848, and therefore the depreciation of the metals or the rise in the prices of the commodities is not so great as, looking merely to the unparalleled augmentation of the metallic medium of exchange, one might have been led to anticipate. It is hardly necessary to state that it is not in my power to verify from authentic returns the calculation I have made as to the probable amount of bullion coined since 1848. The following table, however, giving the gold coinage of Great Britain, France, and the States, from the period in question, has been compiled carefully from reliable sources, and will serve, I think, to shew that I have not over estimated the whole amount of the coinage of the world since 1848:

	Great Britain.	France.	United States.	Total.
	£	£	£	£
1848	2,451,999	1,234,472	786,565	4,473,036
1849......	2,177,000	1,084,382	1,875,158	5,136,540
1850......	1,491,000	3,407,691	6,662,854	11,561,545
1851......	4.400.411	10,077,252	12,919,695	27,397,358
1852......	8,742.270	13,023,160 (1852–1853)	11,641,000	58,23[illegible],521 (1852–1853)
1853......	11,952.391		12,871,700	
1854......	4,152,183	16,594,000	12,171.110	32,917,293
1855......	9,008.663	17,200,000	11,262,500	37,471,163
Total	£44,375,915	62,620,957	70,190,582	177,187,456

The preceding table shews that the gold discoveries did not produce any very marked effect on the gold coinage of the countries enumerated until 1851, when a sudden and unprecedented augmentation took place in the coinage of each of those countries. The average annual coinage of the three countries taken together for the last four years, exceeds, as appears from the foregoing table, thirty-two millions sterling, an amount which appears almost incredible when compared with their average annual coinage before 1848.*

It seems, indeed, not unlikely that the mint recently opened at Sydney will coin this year as much as the total annual coinage of England, France, and the States together, before 1848; for we find from recent Australia papers that the weekly coinage at the Sydney Mint in November last was 45,000 sovereigns, or at the rate of £2,340,000 per annum; and we learn further that the increasing

* According to Mr. Birkmyre, (during at least the first 30 years of the present century,) the average annual united coinage of the three countries was only £3,055,000, or about one-eleventh of their present annual coinage.

pressure of business was such as to render an increase in the engineering staff of the establishment necessary.

A late ingenious writer* on this subject has, it appears to me, needlessly complicated the question as to the effect of the recent increase of gold on prices, by a minute consideration of the processes by which the new gold gets into the currency of a country. That it does so is tolerably plain, nor indeed does there seem to me to be any great mystery as to the processes by which the result is brought about. A recent American writer on this matter truly says that "currency, like water, seeks a level, and the gold of California thus becomes mingled with the metallic currency of the world. If prices rise here, because our gold is falling below its value in Europe, some of it will be taken away to Europe till prices will cease to rise with us." It may, however, be argued that although the gold portion of the currency of a nation or of the world may be shewn to have been considerably increased, yet it by no means follows that the general mass of the currency (bank notes and every other kind of paper money being included in the term) of that nation or of the world at large has been augmented in the same ratio. It is found, however, in practice that the proportion that the metallic part of the currency bears to the paper is in a given country nearly constant; so that, in truth, any increase of the precious metals brings with it a corresponding increase in the whole mass of the currency of the country.†

It is asserted, however, by some, that the influx of the precious metals from the recently opened gold fields, whatever effects on prices they may be destined ultimately to produce, could not possibly in so short a time have made any sensible alteration in the general level of prices. This impression, one very commonly received, seems to be the result of an erroneous view of the consequences which flowed from the discovery of the silver mines of Mexico towards the close of the fifteenth century. It is taken for granted that there is a strict analogy between that case and the present, and that the effects then produced may therefore be expected to be repeated now in precisely the same way and at the same time. A brief review, however, of the facts connected with the influx into Europe of the

* John Lalor.

† In Ireland we find that the circulation of Bank notes in 1849 was only £3,811,445, while in 1854 it had reached £6,846,000. From the August number of "Hunt's Merchants' Magazine," which came into my hands while these sheets were in press, I find that in 1849 the entire currency of the Union was $325,922,038, and in 1856 $665,122,393, an increase of more than 100 per cent. See page 167.

silver of Mexico during the sixteenth and seventeenth centuries, will show that the supposed analogy fails in the only important point. The silver mines of Mexico had been at work for many years before the discovery of the rich mines of Potosi in 1545, and yet it was not until 1574 that the general level of prices was sensibly raised in Europe. From 1574 prices steadily advanced until about 1650, when they reached their maximum, at least for a time, and remained stationary or nearly so for a century, at the end of which time, or about 1750, another marked advance in prices took place. The argument deduced from these facts, by those who assert that the recent discoveries of gold cannot yet have produced a sensible alteration in prices, is this, that if the extraordinary increase of silver which followed the discovery and working of the Mexican mines required a period of more than fifty years to produce a sensible effect on European prices generally, we may from analogy expect that as long a time, or nearly as long a time, must elapse from the opening of the California and Australia mines before any material effect on prices from that cause can be expected.

Mr. Sterling has examined very fully and exposed, I think very ably, the fallacy of this reasoning. The analogy between the cases is only apparent. The value of silver was lowered in 1574 and 1750, and at those epochs *only*, at least to any considerable extent, because at those two epochs, and at those only, the cost of production of silver was sensibly diminished. In 1574 a reduction in the cost of production of silver was effected by the introduction of the principle of amalgamation in place of that of smelting the silver ore, and by the facilities afforded for the adoption of the new method (in which quicksilver is largely employed,) through the discovery of the quicksilver mines of Huancavaleca. Again, in 1750, a still further reduction of the cost of production of silver was caused by the comparative cheapness and abundance of mercury from and after that date.

At both the epochs in question, therefore, the *reduction of the cost of production* of the metal was followed by an *immediate* and a permanent elevation of prices. And so it must be with gold. The law in both cases is the same; a reduction of the cost of production of either must necessarily occasion (provided of course an indefinite supply can be obtained at that cost) a permanent fall in its value as compared with other commodities. But from the different conditions under which the two metals are produced, the *time* required for the development of the phenomena is materially altered. Silver requires for its production the application of extensive capital and skill, and the employment of complicated mechanical and chemical processes. Gold, on the contrary, requires neither capital nor skill, but is, as it were, the immediate and direct result of manual labour. In the case of silver, its cost of production will be reduced by any improvement in the mechanical or chemical processes employed, or by any cheapening of the materials made use of in its manufacture. In the case of gold, there is no room for the operation of these causes. The cost of production, if lowered at all, must be lowered simply because the unskilled labour employed in the gold diggings (the very term implies the rudeness of the operation) is comparatively more productive than the labour previously applied to the same object. The reduction must, therefore, be, at least in the country where it is produced, instantaneous, and so it has been in both California and Australia. "We must not, therefore," says Mr. Sterling, "rashly conclude that because the increase of silver from the Mexican mines did not materially affect general prices in Europe for more than half a century, the same or anything like the same time must elapse before (the present increase of) gold will create a great permanent and universal elevation of prices in all the markets of the world."

As this paper has already extended considerably beyond the limits within which I had hoped to compress it, I shall now briefly recapitulate some of the conclusions which appear to me to be plainly deducible from the foregoing facts and arguments.

That the immediate effect of the gold discoveries in California and Australia was a very great reduction of the cost of production of gold in those countries respectively.

That the value of gold, as compared with labour and the products of labour in those countries, immediately fell, and that the fall in its value was due to and measured by the reduction in its cost of production.

That the surplus gold of California and Australia, being carried by the thousand channels of commerce to other countries, has already produced in the latter a decline in its value proportioned pretty nearly to the extent of their commercial dealings with the new gold producing countries.

That in the gold importing countries the fall in the value of gold is still going on, and that it is not likely to reach its ultimate limit for some years to come.

That assuming, as I believe we may safely do,* that the new gold

* The most recent accounts from Australia and California agree in stating that the supplies of gold in those countries are perfectly inexhaustible. There appears to be, moreover, a great probability that new auriferous regions will ere long be added to the list.

regions are capable of supplying an indefinite quantity of gold, the value of gold will not sink universally to its permanent or natural value, until the whole of the annual yield is merely sufficient to meet the demands of commerce.

That when that time shall arrive the value of gold in any country will be determined solely by the cost of obtaining it in that country, and nothing else.

In the preceding remarks I have not discussed the influence of the late war, (for we may happily now speak of it as past), or of many other circumstances which are admitted by all to have exercised a very considerable effect in raising the prices of many commodities both in Canada and elsewhere during the last two or three years.

As regards particular localities or particular classes of commodities the influence of these causes may no doubt have been considerable. Glancing, however, at those co-operating causes, I may, observe that their influence on prices, whatever its amount may be, is essentially different in its character from that of the gold discoveries, inasmuch as the effects of the former are merely temporary and local, whereas those of the latter are permanent and co-extensive with the commerce of the world.

REVIEWS.

Report on the exploration of Lakes Superior and Huron. By the Count De Rottermund.

(*Printed by order of the Legislative Assembly, April,* 1856.)

In the Report of this exploration, undertaken at the public expense by the Count de Rottermund, we look in vain for a single new fact of any practical or scientific value. This might indeed have been predicted, *a priori:* the ground having been already traversed and reported upon by the Officers of the Geological Commission. When we affirm, however, that the Report of the Count de Rottermund contains nothing new, nothing previously unknown, in the way of facts, we do not mean to imply that it is altogether destitute of new announcements. Some of these, if we are to look upon the work as an exponent of Canadian Science, are not exactly calculated to add to our reputation in the geological world. It is now well known, from the researches of Sir William Logan and Mr. Murray, that the principal rock formations along the northern shores of Lakes Huron and

Superior, belong, apart from the intrusive and overlying traps, to two distinct groups: the Cambrian or Huronian, underlying the Lower Silurians; and the Gneissoid or Laurentian formation of still older date. So far as present researches go, neither of these groups* have yielded a single trace of fossils. The Count in his Report, however, in reference to this, tells us, that "a most important fact is the discovery of fossils about Lake Superior." An important fact it would be, truly, were the fossils discovered there, *in situ;* but when we state that the Count's fossils—and we have seen them—are simply Upper Silurian forms obtained from drifted limestone boulders, the pretended discovery, so ostentatiously announced, might be subjected to a somewhat undignified comparison.

Our mention of the Huronian rocks reminds us of another illustrative trait of a very similar kind, occurring almost at the commencement of the Report. It is there stated, that the rock formations will be divided "for the present into two distinct classes, namely into palæozoic and azoic rocks, following in this, Mr. Murchison. These terms are already in use among the learned of Europe. I shall arrange the palæozoic rocks according to the fossils which I discovered in the different localities, whether of Lake Superior or Lake Huron. This classification demands great attention, and very minute discrimination to avoid the solecism of giving names according to individual fancy, not used in the scientific world. Such are the names applied to formations in Canada, of Huronian, Sillery, Laurentine, Richelieu, peculiar to the localities which they indicate, substituted for Jurassic, Carboniferous, Cambrian, Devonian, &c., which are so well classified, defined and admitted throughout the scientific world." This is, of course, an attempted hit at Sir William Logan. On reading it, a stranger to our Geology would naturally infer that Sir William had substituted the term Huronian for that of Jurassic, Sillery for Carboniferous, and so on; and, perhaps, that is really what the Count means to imply; since by reference to another of his Reports,† we find him quite ready to acknowledge the presence of Jurassic rocks in Canada. The facts were these: Sir Wm. Logan had mentioned the occurrence of an oolitic limestone near Quebec, and the Count—forgetful apparently of the elementary fact that oolitic limestones are not confined to the so-called Oolitic or Jurassic period, but are common to various epochs—jumped at once

* We refer, of course, to the localities now under consideration. It yet remains to be seen if our Huronian rocks be really the equivalents of the European Cambrians.

† Rapport Géologique de M. De Rottermund, addressé à Son Honneur le Maire de Québec, Mars, 1855.

to the conclusion that Sir William's statement respecting the silurian age of the Quebec rocks, must be altogether wrong. It is but fair that we should quote the Count's own words: here they are—"M. Logan avoue qu'il a vu le calcaire oolitique.* Le calcaire oolitique appartient au terrain jurassique, lequel est au-dessous de la formation supercrétacée, et immédiatement au-dessus du terrain carbonifère." We need scarcely say that the graptolites and other fossils in the rocks about Quebec would enable the merest tyro to determine their general Silurian character; and that no Jurassic rocks are known within the province.

But to return to the Count's charge against Sir William, of applying local names to rock groups. Where a rock formation can be strictly paralleled with another well-recognised group in Europe or elsewhere, the original name is, of course, always retained, provided this be not in itself a mere local designation; but, except so far as regards the broader subdivisions, and especially in the case of localities far distant from one another, it is very rarely that these exact parallels can be determined in anything like a satisfactory manner. Hence, in place of the forced comparisons of former times, which so greatly retarded the progress of Geology, observers are now everywhere agreed as to the desirableness of temporary local names. If the Count de Rottermund had fully comprehended this, and followed a plan so universally adopted, he might have been spared the committal of a very glaring and mischievous error: namely, the announcement in his Report of the occurrence at the north-east corner of Lake Superior, of both Old and New Red Sandstone—that is to say, of formations lying respectively below and above the great Carboniferous system. We search in vain for the data on which this startling announcement is founded. No structural details, no sections are given; and not a single fossil is cited. Little matters of this kind were no doubt unnecessary. The only wonder is, that the entire rock series was not discovered, when proceeding in so convenient a manner. Indeed, now that we think of it, the Count must have come across the Cretaceous system also. He does not mention this, it is true; but then he provides us here with some fossil evidence which admits of no other conclusion. At least if Cretaceous rocks were not met with, all we can say is, that these fossils are inconvenient things, and had better be let alone. In a list of rocks,

* This is not exactly the case. Mr. Logan's words, as quoted by the Count himself, were:—"Il s'y rencontre beaucoup de dislocations sur une puissante assise de calcaire gris oolitique, etc. The article makes all the difference.—E. J. C.

metals, minerals, and some half-a-dozen fossils, given at page 5 of the Report, the genus *Hippurites* (or *Hyppurites* according to the orthography of the report) is enumerated. Now, although the true zoological affinities of the extinct hippurite have yet, perhaps, to be determined, the geological age of these characteristic fossils—restricting them entirely to the Cretaceous epoch—is fixed beyond a doubt. Hence on the authority of this Report, issued as it were under the sanction of the Canadian Government, we may expect before long to find some foreign author quoting these rocks as occurring amongst the formations of Lake Huron.

With reference to the Old and New Red Sandstones mentioned above, our author states :—"The sulphurets are found north and north-east from the lake. I discovered in old Red Sandstone, copper in a native state. In coming down Lake Huron [Superior], between Batcheewauanong and Goulais Bay, we find a new red sandstone and variegated sandstone; I should not feel surprised, if on minute search we should find coal in rear of Gros Cap, above Sault Ste. Marie. I discovered no evidence characteristic of the current of polarization ; that is to say, of that current, which, passing through the centre of the earth to the Zenith, ensures the existence of deep veins, and I should be therefore slow to affirm that the veins of copper extend to any great depth." We know not, for on that point the Report is dumb, how this last operation was effected; neither, in our scientific darkness, can we venture to guess at the nature of the process employed, unless the whole thing were done off-hand by the same kind of intuitive perception which seems to have been so successfully concerned in the determination of the sandstone ages. But seriously, we ask, in a scientific report of 1856, can such things be ? And yet, the curious current of polarization alluded to above, is quite a moderate idea compared with some of the peculiar views enunciated in the more purely theoretical portions of the Report. In one place, for example, we have the following original view of the origin of the copper and other ores of the district in question :—

"Copper ore and ores of all other descriptions are the results of the decomposition of primitive rocks, but on Lake Superior the copper, in its native state is due to the deposit of certain species of organic matters which have a tendency to increase the electro-chemical action, and which decompose the sulphurets, oxides, &c., which the abundant deposit of matter containing traces of talc serpentine and chlorites, has brought together or concentrated in a certain limited space. For nearly all the rocks contain in the crystalline cleavage, and also in the veins, these matters which appear sometimes to be a sort of cementation, if, indeed, it be not the state of combination of detritus, of desintegration of primitive rocks which have arrived at the state of sandstone and greywacke."

In another part of the Report, we find some still more astonishing theories gravely set forth in elucidation of that vexed question, the production of metallic veins. In order to avoid the charge of garbled quotations, and as an example of our author's logic, and peculiar treatment of his subject, we give the extract entire. We quote, as before, from the authorized English version of the Report:—

"Caloric is known to be a species of fluid which in certain bodies generates electricity, and the smallest friction produces heat, and therefore generates electricity. Electricity produces magnetism. Metals are distributed in the direction of the electric and magnetic currents as they assume a position in relation to each other depending on their specific gravity, their bulk and the force to which they are subjected being the same.

"As the terrestrial globe turns from west to east, and the sun's rays therefore travel from east to west, the friction of the atmospheric air, the production of electricity, and the generation of the magnetic fluid towards the north and south poles, cause minerals to assume a direction consentaneous to the influence of these several forces. Taking for granted the earliest epoch of the globe, when its nature must have been homogeneous, all mineral matters must necessarily, after certain periods of electro-magnetic action, assume a position which is the result of the perpetual action of these two forces; and in those periods the globe must have undergone a decomposition more or less homogeneous according to the intensity of these forces, when once the different kinds of matter have found their relative positions according to their power of attraction or repulsion under the influence of the electro-chemical, magnetic and other fluids.

"The body of the globe has therefore undergone a change in its mode of resistance in certain directions, and it is probable that mountains must have been formed either by the force of expansion in gases produced by internal heat, occasioned by the action of electricity and evolved during the combination and decomposition of bodies, or in other places by the action of depressing causes, sometimes even by their own weight, owing at one time to the disappearance of certain bodies, at another to a certain condition of atomic separation, previously incident to rocks; and the formation of mountains must therefore have their greatest dimensions of length in the same direction; nothing could turn them aside; for the matters which offered the greatest power of resistance must have also been the most homogeneous possible, at the period when the revolution of the terrestrial globe on its axes was first established.

"The displacement of bodies, depending on their adaption to the action of fluids (*la nature qu'ils possèdent pour l'action des fluides*) must have produced some effect in changing the centre of gravitation in the globe. This being changed, the direction of the poles must also have been altered ; but in its constant rotation the rays of the sun communicating to the terrestrial globe the generative action of the fluids, the metals must have undergone a new arrangement differing from that of the first era, but ever conformable to the combined result of the forces, *viz:* from east to west, from north to south and occasionally from pole to pole (*celle des polarisations.*) But the fluids meeting in their transit bodies endowed with various degrees of fitness as conductors, the direction of the aggregate power of the active forces, to effect the combination and decomposition of bodies, must necessarily have undergone modification, and have effected combinations, greatly varying in their nature.

"As an effect of the various revolutions which the terrestrial globe has undergone, whether by the alteration of the centre of gravitation and the formation of mountains, by earthquakes, the result of an accumulation of fluid arrested in their transit by an obstruction (*digue*) composed of bodies of various degrees of fitness as conductors, or finally, by the partial action of volcanoes, or by an inundation of greater or less duration contemporaneous with the primitive formation, the decomposition of terrestrial matter must have proceeded irregularly (*a dû subir des lignes brisées*) and the terrestrial globe must therefore in subsequent revolutions have become less and less homogeneous, in regard both to the nature of its component parts, to their power of resisting expansive forces and to the depression produced by the weight of masses. The mountainous formations must have been greatly shortened and of unequal height, and metals must, during subsequent changes have been subjected to many various influences, and have performed an almost exceptional part among the more direct and general operations, acting on the great mass of the terrestrial globe.

"In the present day, after the lapse of many periods characterised by various formations, there is a great difficulty in anticipating the true position, direction and circumstances of combination in which we may expect to find minerals. In order to form a just conclusion, sufficient leisure is necessary to enable the geologist to observe the locality with accuracy, and to study the different action and effect of bodies on each other, in the peculiar circumstances in which they exist. For at different periods, metals must have been arrested by the direct and intense action of certain fluids, and by the proximity of large masses of other substances; and the progress of combination on decomposition in the several stages of varying activity may have impelled them to take a direction more or less partial, or altogether exceptional."

We submit the above, without comment, to the discrimination of the industrious reader. If his powers of endurance have carried him fairly through its perusal, he will be able to form for himself a just estimate of the character and value of this new Report on our mining districts of the West. Before closing, however, the present notice, we wish, in justice to ourselves, to state distinctly, that we have searched the Report again and again, with a view to obtain for quotation in favor of its author, the mention of even a single important fact previously unknown, or any piece of information whatever, of a really useful or scientific character. But we declare in all honesty, that we have been unable to meet with anything of the kind. Our judgment, nevertheless, and we truly hope so, may have been here at fault.

E. J. C.

Memoirs of the Life, Writings and Discoveries of Sir Isaac Newton. By Sir David Brewster, K. H., &c., &c. Edinburgh: Thomas Constable & Co., 1855.

In the year that saw the death of Galileo and the outburst into shot and steel of the quarrel between Charles Stuart and the Commons of England, there was born a premature and weakly infant, little enough to go into a quart mug, and momently expected to die before the gossips could return with tonics; the child of a widow whose husband had died a few months before, having been a well-to-do yeoman in the Lincolnshire hamlet of Woodthorpe, which has lain in its quiet valley from Saxon times till now, within sight of Grantham's tall steeple. Not death, however, but a long and glorious life was this child's destiny, for this was he for whom the world had been waiting some thousands of years to open up the deeps of Philosophy: he of whom in after-time Pope sang,

"Nature and Nature's laws lay hid in night,
"God said 'Let Newton be!' and all was light."

The steps of his public career from boyhood to the summit of human greatness may be briefly traced. A quiet dreamy boy, not over-fond of school, but always working in his own way, with a turn for painting, and active fingers to construct all sorts of little knick-nacks and miniature machinery, water-clocks, mill-wheels, Merlin's carriages, kites of out-of-the-way shapes; making a mouse his miller, and driving pegs into the wall to mark out the hours ("Isaac's dial" is quite a lion in that rustic neighborhood;) too sickly to mix much in the rough sports of his playmates, yet not without plenty of spirit on occasion, as witness the big boy whom he thrashes, then rubs the vanquished nose against the church-yard wall; and, not content with this physical triumph, sets vigorously to work in school till he can take down his enemy in the class. At the age of fifteen he is re-called to take charge of his mother's farm, and the next year, when "that wild wind made work" in which Oliver's great soul passed to its account, Isaac was jumping backwards and forwards to measure its velocity. The farm in such hands is not likely to pay; he much prefers lying under a hedge with a mathematical problem while the servant goes on to Grantham market, and so, though the problem proceeds to solution, the farm affairs verge towards dissolution, and it is finally settled that he shall try his fortune at Cambridge, then, as now, the gathering point for the mathematics of England. So in his nineteenth year he enters Trinity as a Sizar and speedily wins golden opinions from his tutors; hardly a record is left of his life as an undergraduate; but it is impossible to doubt that he was a steady hard-worker, yet not without occasional fits of relaxation, if we may judge from such entries in his diary of expenses as the following, *otiose et frustra expensa* "Supersedeas, China ale, cherries, tart, bottled beere marmelot, custards, sherbet and reaskes, beere, cake;" and again, "Chessemen and dial, 1s. 4d.; effigies amoris, 1s.; my bachelors' ac-count, 17s. 6d.; at the tavern several other times, £1; lost at cards twice 15s.,' and the like. Most provokingly the Tripos list for the year when he took his degree is missing, but who can doubt that he was Senior Wrangler? Scholar and then Fellow of his College, he succeed-ed the famous Barrow in the Lucasian Chair in the year 1669, being then twenty-seven years old, and having by that time achieved nearly all his grand discoveries, which, however, were not given to the world for nearly a score of years. The first thing which brought Newton into public notice was the exhibition before the Royal Society of the reflecting telescope invented by him and made with his own hands, which elicited from that body warm approval, and led to his election as a Fellow thereof; this was followed by a short account of his splendid discovery of the composite character of sunlight, read be-fore the Society, and the publication of his treatise on Optics, the substance of which had already been delivered in his lectures from the Lucasian Chair, but do not seem to have previously made their way to the knowledge of the public. These discoveries, now universally accepted, met with attacks from various quarters to which Newton replied with much patience and good temper, but which seem to have aggravated his almost morbid sensitiveness and led him more than ever to shrink from publishing to the world under his own name, so that for many years we find him only writing anonymously, or under cover of correspondence with his friends; yet through this means it now began to be current among the London Philosophers that Mr. Newton of Cambridge, a fine geometer, and who had published an ingenious treatise on Optics, was in possession of some unknown and powerful method by which he had solved the problem of 'curvilinear motion' that had been baffling them all; which coming to the ears of Edmund Halley, who had himself broken his teeth over this hard nut, and suspected that Wren and Hooke were in like case, off he goes to Cambridge to consult Mr. Newton, and asking him the question point-blank, receives an answer which takes away his breath, "Why," says Newton simply, "I have calculated it," and Halley finds that he has done this and a great deal more, and urges his friend to lay these results before the Society, exacting after some trouble a promise to this effect. Accordingly Newton sets to work at this task, and on April 28th, 1686, the first instalment of his treatise is read before the Society, and thanks being returned to the author, his work is referred to Halley to report on, touching the printing, and at a subsequent meeting it is ordered to be printed forthwith, and, of course, at the Society's expense; but whether from the want of funds, or informality causing delay, Halley is driven to undertake the editing and printing *at his own expense*—all honor be to his name! At length about midsummer of 1687, the work comes out under the modest title of "Philosophiæ Naturalis Principia Mathematica." To attempt any analysis of this work, or even to convey the faintest notion of the grandeur of the discoveries, both physical and analytical, contained in it, would be quite futile within the limits of a review; in the words of Laplace, it is "pre-eminently above all the other productions of human genius;" the lapse of time has only increased the reverence with which succeeding generations regard it, and it stands imperishably the greatest memorial of godlike intellect that has ever been reared on this earth. From the date of this publication Newton's fame rose rapidly; in four years not a copy of the work was to be had; it took time before the age assimilated the new philosophy, but the progress was certain, and before his death Newton had the pleasure of seeing his doctrines triumphant in all schools. Meanwhile his life went on at Cambridge: as one of the Commission of the Senate when James wanted to intrude his monk for a degree, he took the lead in withstanding the brow-beating of Jeffreys and the cajoleries of friend William; was returned as member for the University to the Convention Parliament, and ultimately received the appointment of Master of the Mint which he retained till his death, and in which office he carried out successfully that tremendous operation of reforming the coinage, so graphically described by Macaulay; a similar plan for Ireland was defeated by the factious malignity of Swift in the well-known Draper Letters. Thus, then, for the last half of his long life, Newton lived in London attending to the duties of his office, and devoting his leisure to philosophy and kindred subjects, living in ease and affluence, dispensing a golden mean of hospitality, knighted by his Sovereign, President of the Royal Society, (annually re-elected for twenty-five years,) in familiar intercourse with the Princess of Wales (afterwards wife of George II.,) entertaining distinguished foreigners who came on pilgrimage to him, in correspondence with all that was good and great in that age, generously assisting struggling talent, and dying peacefully at the age of eighty-five with that remarkable utterance of his death-bed, "I do not know what I may appear to the world, but to myself I seem to have been only like a boy playing on the sea-shore, and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great ocean of truth lay all undiscovered before me." His body lay in state in the Jerusalem Chamber, was buried in Westminster Abbey, Dukes and Earls bearing the pall, and the Bishop of Rochester officiating; a splendid monument to him rises in the Abbey with an epitaph which is truthful because for him exaggeration is impossible; a medal to his honor is struck at the Tower; Roubillac carves the glorious statue (his masterpiece) which stands in the ante-chapel of Trinity, and the bust which side by side with that of Bacon, adorns their Library, contrasting with the plaster-cast from the face after death that lies beside it, (in which the phrenologist will note the lumps, like pigeons' eggs, that cluster on the lower brow, and which Roubillac has softened into beauty and vacancy;) the telescopes made by his own hands are cherished by Trinity and the Royal Society as their choicest treasures; his image is familiar in the Pantheons of all countries, and his name is borne alike by a French war vessel and one of the floating palaces of the Hudson, and in connection with that philosophy of which he laid the foundations deep and wide, never to be shaken, has become a household word in all languages and among all peoples.

Of such a man we should be glad to learn even the pettiest details of his every day life—how he looked and lived, and in what way he did all this work; but unfortunately our information is very scanty, for though a bulky correspondence survives, it is mostly on scientific matters, and Boswells as yet were not. We learn, however, that there was nothing remarkable in his person or appearance; his face of no very promising aspect, (though we suspect a phrenologist would have told a different tale,) speaking little in company, seeming full of thought, but languid in look and manner: in disposition, kindly and generous; careless of money though amassing considerable wealth: liberal almost to excess: excessively modest in the height of his greatness: not eager after fame, but on the contrary shrinking from publicity with a bashfulness almost painful, yet jealous of his reputation, and, when roused, standing spiritedly on defence and using his weapon harshly enough. We must also confess that at times he was irritable, peevish and prone to suspicion; as Locke said, "Newton is a *nice* man to deal with." We may also notice the singular and total deficiency of anything like mirthfulness or humour about him: he is said never to have laughed but once, and in all his writings and familiar letters we cannot see the slightest approach to jocosity. The prime of his life was wholly devoted to science; and when engaged in a speculation, he would concentrate himself wholly on this, indifferent to the outer world, forgetting to eat and drink, sleeping little, and immersed for weeks in the "patient thought" to which alone he himself humbly ascribes all his successes: yet he could break off in the midst of his profoundest labours to go to the sick bed of his mother and tend her with assiduous care, and afterwards, when undertaking the drudgery of the Mint, he abandoned his unfinished investigations on the plea of their interfering with his duty to his sovereign. Labour so incessant in his early life produced its natural results in failing health and weariness of spirit, and we find him once complaining of mathematical studies as being "dry and barren," and thinking of betaking himself to law! which can only remind us of the tailor who turned light-house-keeper because "he did not like confinement;" but this distrustful mood did not last long; "his own thought drove him like a goad," and he goes on in his career: *wie das Gestirn, ohne Hast, aber ohne Rast.* His conscientiousness and love of truth were singularly strong, and he carried the same into his scientific researches, abandoning a theory, whatever trouble its construction had cost him, if he found a fact against it. "It may be so," he said, "there is no arguing against facts and experiments," when Molyneux thought he had discovered a phenomenon which would upset the whole Newtonian system, and told Sir Isaac of it; and this only the year before his death. The sum of his moral character may be given by Bishop Burnet's words—"He had the whitest soul I ever knew." Such is Newton as we see him through the mist of a century and a half, the Atlas of Philosophy, and as good as great.

Popular tradition (or rather that pseudo-poetry which sneers at the hard sciences and girds at Newton as the model mathematician) has preserved some anecdotes of him, curiously contradicted by historic fact; thus every one has heard how Newton, having read through the Paradise Lost, only asked, "What does it all prove?" We find, however, that Newton confesses to having been "a capital hand at versifying," and to have had a fondness for poetry when young, which, however, he lost in after-age, this latter being an experience not confined to philosophers. So also we have read much of Newton's utter insensibility to female charms, and how the fair young lady, whom his friends wished him to marry, found her finger used as a tobacco-stopper: in fact, Newton was in love with a Miss Storey, when quite young, and though circumstances prevented their marriage, he behaved very kindly to her in after-life: nay, even we find him at sixty years of age writing a real love-letter and offer of marriage, though whether for himself or a friend has not been ascertained: it is certainly a most curious production, but is not the first nor will it be the last example of "wit turned fool" in such a case. The story about the apple, whose fall on his head is said to have suggested gravitation, seems apocryphal; and so also, we fear, is that other touching story about dog Diamond and the burning of the papers; and indeed we rather suspect that if such an event had occurred, dog Diamond would have been sent flying through the window.

It appears the function of our time to be the iconoclast of brilliant reputations, the whitewasher of stained ones; it was not, therefore, to be expected that Newton should escape. Among his contemporaries and successors, in all the furious controversies that raged about him, none ever disputed the grandeur and originality of his discoveries, the purity of his motives, the uprightness of his conduct; this enviable task has been reserved for some among us, and first stands S. T. Coleridge, who, as usual, plagiarising in the fulness of ignorance from German metaphysicians, thinks Newton much over-rated, that he has unfairly appropriated Kepler's due, and that it would take three Newtons to make one Kepler: and him indeed, dogmatising in this foolish fashion, we may whistle down the wind without more concern.

Not so can we dismiss Professor de Morgan, a profound mathematician and painful investigator, but withal afflicted so with an itch of impartiality as to make him most partial *against* the side to which he might be expected to lean. Certain insinuations against Newton's fairness or truthfulness in the Leibnitzian controversy he has found it necessary to withdraw, and we think it probable that after he has written, *more suo*, half a dozen treatises on the matter, he will find that, after all, the English and foreign disputants on Newton's side are not so thoroughly and utterly disingenuous as he now believes. Touching this celebrated controversy we may observe, that Newton's claim to the original and first invention of the fluxional calculus, (or the Differential, which is the same,) is undoubted; while Leibnitz's claim to the invention at all, is, at the best, doubtful, since he may have had (indeed had many opportunities of getting) the idea from Newton, and the contrary statement rests only on his own assertion, which no one who has read his character would value a straw. The lately discovered exercises on which de Morgan lays so much stress, seem to us rather the attempts of one who is trying to make out a borrowed idea than the track of original thought. No blame, however, can attach to Professor de Morgan for his opinions on this score, but we take leave to think that his revival of Voltaire's forgotten and groundless scandal about Newton's niece and the Earl of Halifax is simply disgraceful. More serious are the charges brought against Newton by Mr. Baily, in his life of Flamstead: for a complete refutation of them we are indebted to Sir David Brewster, in the work which stands at the head of this article, and we presume nothing more will ever be heard of them. In that saddest period of English History, when only not all men were base, it is an inexpressible relief to turn to the lives of men like Locke, Wren, Halley and Newton, shining mirrors which not the breath of all the rattlesnakes in Virginia can dim.

The work above cited, by Sir David Brewster, is professedly an account of the life, writings and discoveries of Newton. In some respects Newton is happy in his Biographer, for Sir David is the "prince of experimenters," and moreover wields a caustic and vigorous pen, and has an enthusiastic love for the great master; but in other respects, we are sorry to say, his performance has deeply disappointed us. In the perfect philosopher there are three distinct characters united: first, the experimenter who has to provide the raw material; next, the natural philosopher, who classifies phenomena and deduces the laws or principles which govern them; and last, the analyst, who has to work out results from such laws, and to invent the machinery for doing this. Seldom, indeed, is it that we find in any one individual more than one of these distinct functions eminently developed, yet Newton takes foremost rank in all. There have been experimenters who have equalled, perhaps surpassed him in fertility of device and acuteness of observation, but in both the other classes he stands unrivalled; and taken in conjunction, not only is there no one like him, but hardly second to him, perhaps Laplace the nearest, but that only *longo post intervallo.* To write then a full account of the discoveries of such a man would require for the task one who is able to appreciate him in all these departments. Now, Sir David Brewster is undeniably a splendid experimental Philosopher, but we are not aware that he has ever laid claim to eminence in pure, (and, by consequence, in applied) mathematics; accordingly, while a great portion of his bulky volumes is devoted to matter we cannot help considering irrelevant, such as the lives of Tycho Brahe, Galileo, and Kepler, Lord Rosse's Telescope, the discovery of Neptune, and a good deal of ambitious writing, which we could well have spared, there are but about ten pages devoted to an analysis of the Principia, and those disfigured by blunders, (slips we would willingly call them) which we can hardly credit our eyes on reading. Still worse do Newton's inventions and researches in pure mathematics fare, numbers of them being passed over without comment, some not even mentioned. To make up for this omission we have nearly a third of the work taken up by the optical researches of Newton and of others, both before and after him. Now, Newton's discoveries in optics, though enough to make half-a-dozen reputations, are those on which his fame least rests, for, though he discovered the composition of colours in white light, by an accident of manipulation he missed its corollary, the irrationality of dispersion; and though his experiments on the colours of plates and in diffraction and interferences, were beautiful and valuable, yet by an accidental mismeasurement he was confirmed in referring them to a theory which is now universally rejected. The relation between Newton and his Biographer is here somewhat curious. Newton's analysis of the solar spectrum was met at first by much opposition and controversy, though it speedily triumphed over assault, and has been accepted by all down to the present time, (except, indeed, by Göethe, of whom we need not here speak) when it has found an assailant in Sir David himself. The substitute proposed by him he has been unable to persuade his contemporaries to accept, and thus in the present work we find a running parallel implied between Newton and his detractors on the one hand, and Sir David and the present generation on the other. Newton condescended to reply with great temper and patience to his inane objectors, but Sir David flinging his triple spectrum in the face of the world with sarcasms 'peu spirituelles,' as Moigno designates them, reminds us rather of Ajax defying the lightning. Nor is this all the situation. Newton's hypothesis of emission has been abandoned by every philosopher of eminence except Sir David Brewster, who remains its sole and sturdy defender, but there is this difference between them: Newton's objection to the opposite Huyghenian doctrine was a solid and plausible one, to which no answer, in his day, was or could be given; he asks and reiterates the question, why, if light were propagated by undulations like sound, it should not spread in all directions on passing through an aperture, as sound does, instead of only illuminating the space in front. It required higher analysis than Hooke or Huyghens possessed, to give the real answer to this, but the answer has since been given completely, and there is small doubt that if Newton had seen this, he would have discarded his own hypothesis, (as indeed he seems sometimes half inclined to do), in favour of the undulatory. We can willingly excuse Sir David for cutting very short all the circumstances that make in favour of the theory he rejects, but one hardly knows whether most to admire the audacity or feel shame for the infatuation of a sentence like the following, in which, be it observed, the 'disciples of Hooke' are just the whole present generation of philosophers.

"In the present day, the disciples of Hooke, who 'split pulses' with more success than he did, and whose theory of light has attained a lofty pre-eminence, have not scrupled to imitate their master in measuring optical truths by the undulatory standard, and in questioning and depreciating labours that it cannot explain, or that run counter to its deductions. There is fortunately, however, a small remnant in the Temple of Science, who, while they give to theory its due honours and its proper place, are desirous, as experimental philosophers, to follow in the steps of their great master."

In estimating rightly the grandeur of Newton's discoveries, it is just to consider the circumstances under which they were made: the magnificent temple he erected, marvellous in itself, becomes immeasurably so when we consider that he had not only to build, but to make the bricks, find the straw, and fashion the ladder and trowel. From a Mechanics, for which he had to supply the fundamental laws—through the planetary and cometary motions—up to the Lunar Perturbations and universal gravitation; from an Algebra, to which he gave the Binomial Theorem—through the differential and integral calculus which he invented—up to the calculus of Variations

—what gigantic strides are these! It was the fashion of the age to hide processes, and offer results without demonstration: the propositions in the Principia are all geometrical (indeed they would otherwise not have been understood for a century,) but there is little doubt most of them were obtained originally by analysis—singularly unfortunate both for Newton's fame and for the sake of us who should reap the benefit of his labours. One proposition given without demonstration proves that he had mastered the calculus of variations, the invention of which afterwards became the centre-stone of Lagrange's chaplet: in his "rectification of curves" he must have passed through the integrals which now bear Euler's name: a single construction for conic sections would seem to shew that he had anticipated one of the most recent and beautiful processes in analytical geometry invented by M. Chasles. Nothing can be more startling than thus, in the apparently unpenetrated forest, to come across a mighty tree felled, with "Newton—his mark" plain upon it: some of his propositions remain undemonstrated to this day; for instance, the general properties he asserts of curves of the third order, (the classification of which is not the least remarkable of his labours,) and also some strange properties of the roots of algebraic equations. In other cases no one has even guessed at the methods by which he obtained his results; as in the case of that ratio of the oval axes of the moon's orbit, and of the axes of the earth's figure, where he boldly contradicted the then universal opinion that the equatorial was shorter than the polar; or again, consider this sentence from the 23rd proposition of the third book, when speaking of the progression of the moon's perigee: "Diminui tamen debet motus augis sic inventus in ratione 5 ad 9 vel. 1 ad 2 circiter, ob causam quam hic exponere non vacat"—"for a cause which here I have not leisure to explain;"—this very inequality nearly drove subsequent calculators to reject altogether the Newtonian theory of gravitation, and it was not till the third trial that Clairaut in despair carried his process to a closer approximation and found the next term give him the required result. Equally wonderful is the way in which Newton sets about doing things that would seem to require a century of preparation to solve: nothing seems to stop him—his tread is that of a lion:—"Ex ungue leonem," as Leibnitz said: if he wants an equation solved, he invents a method of approximation for it; if he wants an algorithm for annuities, he makes one; if he wants to explain the precession of the equinoxes, and suspects it to arise from solar and lunar action on the earth's equatorial protuberance, he considers this latter a belt of satellites, and does it; if he wants to find an expression for the velocity of sound, he applies a theory "wholly inapplicable in all its parts," (the words are Sir John Herschel's, but we doubt the assertion,) and obtains the right expression, confirmed in after-time. When we reflect also that his analysis and the germs, at least, of his great physical discoveries were all obtained by the time he reached the age of twenty-three, we can only bow in awe and reverence before this intellect, which is more divine than human.

Of Newton's labours in other fields we can only speak very briefly: strange to say, he was an alchemist, and devoted much time to the practical pursuit of this study, keeping his furnace going night and day for six weeks at a time: of the precise nature of his pursuits no trace is left. He also devoted much attention to theology, and concerning his opinions hereon, his biographer treats very tenderly; perhaps it would have been as well to say at once, that, in common with most of the great men of that age, he approximated to Arianism: several theses of his are here published for the first time, but we suspect the most important are still suppressed. He also published on the interpretation of the Prophecies: Coleridge calls his speculations "ravings:" they do not seem to differ much in character from those of other writers on that subject. Many other minor works we have not space to notice, but may refer to his examination of the famous text in the First Epistle of St. John, as a masterpiece of classical criticism.

In conclusion, we may notice the very singular fact that the mantle of Newton's genius did not descend on any of his countrymen; for nearly a century after his death, there is no English name enrolled on the annals of scientific fame, while in France a splendid constellation of illustrious *savans* shone in his wake. This is sometimes attempted to be accounted for by the fact of the English adhering to the geometrical methods of Newton, (which, however, he had used only for dressing up his results for publication,) while the French, discarding these, had betaken themselves to perfecting the analysis he had invented. Sir David Brewster inclines to attribute it rather to the want of encouragement from Government to Science. Neither one nor the other cause seems to us a satisfactory explanation: as to the latter, English science *now* flourishes without the fostering care of paternal Government; and, besides, the splendid endowments of the English Universities have surely offered material help enough: for the former, we may remark that the tools were not so much in fault as the want of workmen to handle them: what *can* be done with Newton's geometry has been clearly enough shewn latterly by Whewell in his Dissertations on Lib. III.; by Herschel in the Perturbations, and by W. Thomson in Potentials. The fact seems to be that in every nation there are epochs whether of science, literature, statesmanhip, even morality. Why have we had no dramatist since Shakspere? Why that long dearth of poetry between Pope and Wordsworth? The fact seems indisputable though the cause may be obscure. In 1830 Sir John Herschel wrote: "In mathematics we have long since drawn the rein and given over a hopeless race." Even then, that assertion was more modest than exact, considering the names of Airy, Peacock, Babbage, Lubbock, and Herschel himself. At the present day, however, a great revival has begun: England supports by voluntary subscription *two* journals devoted exclusively to mathematics, a feat unparalleled in any country: the British Association and the various Societies are displaying great vigour; and a long list of English names could be cited to compare with any continental celebrities: when we say English, we of course include Scotch, for Scotland has contributed far more than her share to this list, though, owing to the poorness of her University prizes, her sons all repair to Cambridge, still, as in the days of Newton, the citadel of science. Our little sister of Dublin, so long silent, now discourses eloquent music, and even Oxford has discovered that great men have lived since Aristotle, and that the voyage of scientific discovery did not end when the ark stranded on Mount Ararat. Many signs combine to lead us to believe that we are on the verge of grand discoveries: the new methods of analysis lately invented (notably by George Boole and Sir W. Hamilton) seem converging to a machinery which will surpass that of Newton as Newton's surpassed that before him; and the experimental discoveries of Faraday and others remind us of those of Kepler, which only wanted the Newton to give them the breath of life. May we live to hail the advent of one on whose tomb shall be inscribed an epitaph more glorious even than that which we here translate:*

Here lies
ISAAC NEWTON, Knt.,
Who, by an almost divine power of mind,
Was the first to demonstrate
The motions and figures of the Planets,
The paths of Comets, and the tides of Ocean,
Mathematics of his own invention lighting him the way.
The different refrangibilities of the rays of light

* In his "literal translation" of this epitaph, Sir David Brewster has omitted two sentences. for what reason we cannot conjecture.

And the properties of the colours thence arising,
Which none before had even suspected, he investigated thoroughly.
An assiduous, sagacious, faithful Interpreter
Of Nature, Antiquity, Holy Scripture,
By his Philosophy he vindicated the Most High God in his majesty,
By his life he exhibited the Gospel in its simplicity.
Let mortals congratulate themselves
That there has existed such and so great
An honour of the human race.
Born, 25th Dec., 1642, Died 20 Mar., 1727.

J. B. C.

Modern Geography, for the use of Schools. By Robert Anderson, Head Master, and Lecturer on Geography, Normal Institution, Edinburgh. London, and New York: T. Nelson & Sons. 1856.

This constitutes one of a set of works prepared with great care, as an educational series, designed—as the title expressly states—for the use of Schools. The purpose of the volume in question is further defined as furnishing a work calculated to "prove serviceable to the intelligent teacher, in making Geography a more intellectual, and at the same time a more interesting study than it has hitherto generally been in our schools." Such an object is one well deserving of commendation even as an attempt; but, in this compact and carefully condensed volume, the success is unquestionable.

Many features in this work are novel and ingenious; and when we consider the very questionable character of such American works as that of Morse, at present in almost universal use throughout Canada, we do not regard it as the least of the various attractions of this work that it is, more than almost any other we know of, a *British School Book.* These will be apparent from an enumeration of some of its most characteristic peculiarities. For example: what may be designated as a geographical base line is adopted for comparing the latitudes of countries in the Old and New Worlds. This consists of the countries which, lying most nearly in a line north and south of Britain, occupy the western shores of the Old World; and these elements of comparison are rendered still more practically available by an ingenious diagram, appealing to the eye, and greatly assisting the memory of the young student. Using this method of geographical comparison, here are a few of the results:

Newfoundland is shown to be in the same latitude as the South of England and the North of France. New Brunswick is in the same latitude as the middle of France; Nova Scotia, in the same as the South of France; and Canada as from the middle of England to the middle of Spain.

In like manner the sizes of all countries are measured by the British Isles, either n whole or in part: a very definite idea of the sizes of England, Scotland, Wales and Ireland, having been previously given. The direct distances from London of all the capitals in the world add another concise and practical feature: *e. g.* St. John's, Newfoundland, 2,300 miles S. W. of London; Montreal, 3,250 miles S. W., &c. The principal seas of Europe are measured by the like standard; and the relative size of British Colonies and Foreign possessions are brought out by similar comparisons. Thus New Zealand is described as about the size of Britain; Ceylon is stated to correspond very nearly to that of Scotland; and British America, embracing the Hudson Bay Territory, as having an area equal to a square of 1,600 miles: more than three-fifths the size of Europe; Canada, with an area of 400,000 square miles, equal to a square of 632 miles, or four and a half times larger than Great Britain, &c. So also minuter subdivisions find a similar treatment. Thus all the counties of England are measured by the size of Middlesex, and practically the same comparison suffices for the whole British Isles: the counties of Edinburgh and Dublin being so nearly of the same size with the Metropolitan County of England, as to avert all risk of arousing Scottish or Irish jealousies by any undue pre-eminence being given to the ancient area of the Middle Saxons of England.

These are only a few of the peculiar and novel features of the work. In others, countries, and their districts and counties, are classed according to their river basins. The rivers, again, are grouped under the oceans and seas of which they are tributaries; the towns according to certain proximate ratios of population; and in many other ways intelligent aids to memory are substituted for the old unreasoning and laborious method of learning by rote.

When we consider the fashion in which such American School Book manufacturers as Morse or Mitchell convert a geographical manual into a Yankee penny trumpet for the glorification of that one great nation of the universe, and the strong anti-British feeling which so frequently accompanies such fanfaronade, the practical and altogether unboastful British character of this useful school book, ought to commend it for general adoption in Canada, as in other parts of the British Empire.

In Morse's Geography a larger space is devoted to some single States of the Union than to the whole British Isles; and while the glories of "Bunker Hill," and the feats of arms of the "Green Mountain Boys" of Vermont, in the Revolutionary War, find a prominent place, the most characteristic feature that this American trainer of the young idea can discover in relation to the geography (!) of Ireland is "*distraining for rent*," which is accordingly illustrated by means of a wood-cut representation of a policeman driving off a poor peasant's cow; his wife on her knees, his son, nearly naked, and all vainly imploring mercy from the stony-hearted embodiment of British law! Yet this book is to be found in use, we believe, throughout the majority of our Canadian schools. Or, taking into consideration the less objectionable feature of the predominance naturally given by the geographers of the Union to their own Republic, we find in Mitchell's "Manual of Geography"—another American school book, which has displaced that of Morse in some of our Provincial schools—nearly *forty* pages devoted to the United States, while *one page and a half* suffices for all British North America. In the same work more than one State of the Union monopolises a larger space than England, and the whole Geography of Europe actually occupies less than two-thirds of the amount of room devoted to the Great Republic! The object held in view in such teaching is abundantly apparent, so far as Americans are concerned; and its influence on the character and idiosyncracies of the people of the States has already developed itself in a very unmistakable manner. Its true wisdom, as an element of national mental culture, even for them, may well be questioned; but for us, there can be no doubt that such a system of Americanising our youth is the very last thing which any wise or patriotic Canadian would advocate as the training calculated to make them either well instructed geographers, or useful citizens.

We are informed that it is in contemplation to prepare a special edition of Anderson's "Modern Geography" for the use of Canadian and other Colonial Schools: we shall hail such as a contribution of no slight value to the educational materials required to complete the Provincial system of education which already reflects so much credit on Upper Canada.

D. W.

Report on Victoria Bridge. By Robert Stephenson, Esq., M. P.

December, 1855.

Canadians have been so accustomed to look with profound respect upon the achievements of their American neighbours in the art of bridge building, and have been so habituated to consider their railway structures as models of the most successful adaptation of means to the accomplishment of desired ends, that they may be pardoned when they point with exultation to the immense structure now in progress at Montreal, or in a similar spirit claim their full share of credit in the completed one that spans the chasm between the Niagara Frontier and the State of New York; for both surpass in magnitude and in boldness of conception any similar works in America, we may say in the world.

Notwithstanding, however, the natural pride in the material advancement of the country indicated by these works, the expenditure involved in the completion of one of them is not contemplated without misgiving, nor are we justly chargeable with captiousness if we regard with enquiring doubt the soundness of the policy which designed a work of such magnitude as the Victoria Bridge to serve a traffic so little developed as that of the Grand Trunk Railway; and at the same time substituting in its construction, as well as in the construction of lesser bridges and viaducts, a material so expensive as iron, for timber, which is found in such abundance in the vicinity of nearly all the works. To have advanced so far at one bound as to erect in Canada bridges and viaducts equal in cost,—as they doubtless are in durability,—to the best structures in Britain, argues a confidence in the ability of this country to supply a traffic sufficient to justify such expenditures, which many believe will not be borne out by the result; and there are not wanting those who, while admitting that the durable fabrics now drawing to completion on the Grand Trunk Railway are well calculated to endure for ages, and to reduce working expenses; yet point to the structures of the United States as models of works that would be infinitely better suited to the immediate wants and resources of a country so young as Canada.

On the other hand those who have initiated, and support the policy of so building as to require no re-building, argue that a more careful estimate of the cost of maintenance of permanent way as affected by the system of construction adopted, will dissipate these doubts, and teach us that true economy is best subserved by securing a permanent way that shall be, in as far as structures are concerned, that which its name indicates. They argue moreover that as between structures of indestructable material and those of a material obnoxious to all the causes of destruction to which timber is liable, the question is entirely one of finance in the supply of capital and not of dividends in the future.

By way of illustrating this question we will assume that the foundations and masonry for abutments, piers &c., are to be the same whether the superstructure is to be of wood or iron, and base our calculations on a length of 5,000 lineal feet of bridge superstructure, varying in spans of from 50 to 250 feet which may be taken to represent the bridges on a line of 300 miles.

Basing our estimate for wooden superstructures on the known cost of such works built on McCallum's patent, and which, for such spans as we contemplate in this estimate, would average £8 10s. 0d. Cy. per lineal foot, and estimating the cost of the iron superstructure of similar spans at an average of £40 per foot, (that of the Victoria Bridge is set down in Mr. Ross' report at £57 Stg. = £71 5s. 0d. Cy.) the following amounts will represent the first cost of each:

5,000 feet of Timber superstructure at £8 10s. Cy. £42,500.

5,000 lineal feet of Iron superstructure at £40. Cy. £200.000.

The former at 6 per cent. would absorb an annual revenue of £2,550, and the latter a revenue of £12,000. But to the first must be added an amount annually sufficient to cover depreciation, repairs, risk from fire, and the cost of constant vigilant supervision, which would perhaps be not less than 15 per cent. per annum, and under some circumstances might amount to 20 per cent. these contingencies not being applicable to the iron superstructure would bring the annual charge for the wooden bridge up to £8,925 Cy. being within £3,075 of the like charge for the more desirable one; a difference, however, which being capitalized, will represent an item of upwards of £50,000 in the capital account. It is difficult therefore to resist the conclusion that the introduction of Iron Railway Bridges into this country is premature.

The enhanced cost above indicated is still more apparent if we apply the comparison to the Victoria Bridge. Spans of the dimensions adopted in that work have frequently been executed in wood in the most reliable manner at a cost of $35 per foot; and with every provision against fire, for protection against the weather, for ventilation, &c., the cost would not exceed $45 or £11 5s. Cy. the whole cost of the 7,000 feet which Mr. Ross estimates in iron at £400,000 would not therefore exceed £78,750 Cy. it would consequently be cheaper to build in wood even if it demanded an entire *renewal every five years*. Mr. Stephenson, however, has dismissed all thought of a wooden superstructure in a very summary manner, and as it appears to us for no very sufficient reason,—he says in his Report:

"In all that has been said respecting the comparative merits of the different systems of roadway, you will perceive that a *complete wooden structure* has not been alluded to, because, in the first place, when the design for the Victoria bridge was at first being considered, *wood* was deemed not sufficiently permanent; in the second place, the structures alluded to in the report, as being inferior to that now in progress, are proposed to be constructed of stone and iron work; and as a third reason, the construction of the tubular roadway is already so far advanced that any alteration, to the extent of abandoning *iron* and adopting *wood*, must involve monetary questions of so serious a nature as to render the subject beyond discussion, or even being thought of in this report.

From this it would appear that the construction of the tubes has been so far advanced as to preclude all thought of any other description of superstructure now; while wood was discarded in the previous consideration of the subject as not being "*sufficiently permanent*" an assumption perfectly true where it desirable to emulate the builders of the Pyramids, but not entitled to implicit faith when measured by a commercial standard suited to these provinces. Mr. Stephenson has probably omitted to draw the needful distinction between England, where iron and capital are abundant and wood scarce, and Canada, where precisely the reverse of these conditions exists; in fact he appears to have adopted the same reasoning in relation to the Victoria bridge as he did with reference to the Britannia, forgetful of the innumerable opportunities afforded in this country for the employment of capital in a much more productive manner, and more beneficially not only for the railway but for the country at large.

In dealing with questions of stone and iron, however, Mr. Stephenson has shewn himself quite at home; and in comparing the various methods of construction with those materials both he and Mr. Ross leave nothing to be desired. We entirely adhere to the views expressed by them. "The approaches" says, Mr. Stephenson:

"Extending in length to 700 feet on the south, or St. Lambert side, and 1300 feet on the Point St. Charles side,—consist of solid embankments, formed of large masses of stone, heaped up and faced on the sloping sides with rubble masonry. The up-stream side of these embankments is formed into a hollow shelving slope, the upper portion of which is a circular curve of 60 feet radius, and the lower portion, or foot of the slope, has a straight incline of three to one, while the down-stream side, which is not exposed to the direct action of the floating ice, has a slope of one to one. These embankments are being constructed in a very solid and durable manner, and from their extending along that portion of the river only, where the depth at summer level is not more than two feet, six inches; the navigation is not interrupted, and a great protection is, by their means afforded to the city from the effect of the "shoves" of ice which are known to be so detrimental to its frontage.

For further details on this subject, I beg to refer you to the Report made by Mr. Ross and myself on the 6th of June, 1853, to the Honorable the Board of Railway Commissioners, Quebec."

We have not at hand the report referred to, but in his report of 3rd November Mr. Ross goes over the reasons which influenced him in deciding on the dimensions of the abutments, and justifies the manner of their construction. He says of them:

"These it appears, are considered unnecessarily large, and more costly than the tubes, and it is suggested that they may be reduced by making openings in, or by shortening them. These abutments are not in reality what, upon paper, they appear to be, a solid mass of masonry: *they are hollow*—each having eight openings or cells, 48 feet in length, and 24 feet in width, separated by cross walls five feet in thickness. The flank wall on the down stream side rising nearly perpendicular, is seven feet in thickness, and that on the upper stream side is sloping from its foundation upwards to an angle of 45°: its thickness is twelve feet, and presents a smooth surface to facilitate the operations of the ice, on which account its form had thus been determined; and to ensure greater resistance to the pressure of the ice, the cells are filled up with earth, stone and gravel, so that one solid mass is thus obtained at a moderate cost. The subjoined plan and section of this work will better explain its form and proportions.

The idea of introducing any other description into the abutments than those described, is altogether inadmissable; passages through it where ice could accumulate, would ensure its inevitable destruction upon the first hydraulic pressure it had to encounter.

I have observed in this immediate neighborhood the effects of swift currents created by obstructions in the river on a recently formed causeway constructed of timber connecting a small island below the bridge with the shore, having openings about 12 feet in width at intervals of about 30 feet.

In the autumn of last year, these openings were partly covered by heavy timber and planking strongly secured by iron work, and the consequence has been, that during last winter, the first crush of the ice, in forcing its passage through, destroyed every timber, plank, and bolt, that opposed it—having got under, it was immediately blocked up, and the pressure of water still forcing its way, the jam became at length so tight, that it burst with an explosion.

It is stated that the length of the abutments is unnecessary and greatly in excess. Upon paper this may seem so, and a recollection of the idea conveyed to my own mind subsequent to the earlier considerations of this subject which led me to the conclusion of adopting their dimensions, prevents my attaching so much importance to such a view as I otherwise might do. You will recollect that the bridge is approached from the north shore by an embankment 1200 feet, and from the south shore 800 feet in length, the river being thereby narrowed to this extent; the waters thus far embayed, have now to find their way through the bridge, and the current, overcharged with ice, sweeping its way along the front of the embankment into the nearest passage, attains, ere reaching it, a velocity which nothing but the most substantial masonry could resist. This, it will be seen, bears on the question of the length to which such masonry should extend, and I am more than ever convinced that I have not exceeded the limits which prudence dictates—thus confirming my original view in reference to this particular and very important point. I think you will readily admit that I have given ample reasons in justification of the extent of the abutments, bearing in mind that the form of *construction* contributes more to their apparent magnitude than a cursory glance at their appearance upon paper would justify one in supposing."

Proceeding with a description of the masonry of the Piers and of the details of their foundations, Mr. Stephenson continues:

"Advantage has also been taken of the shallow depth of water, in constructing the abutments, which are each 242 feet in length, and consist of masonry of the same description as that on the piers, which I am about to describe, and, from their being erected in such a small depth of water, their foundations do not require any extraordinary means for their construction.

The Foundations as you are aware are fortunately on solid rock, in no place at a great depth below the summer level of the water in the river.

Various methods of constructing the foundations suggested themselves and were carefully considered, but without deciding upon any particular method of proceeding, it was assumed that the *diving bell*, or such modifications of it on a larger scale, as have been recently employed with great success in situations not very dissimilar, would be the most expedient. The contractors, however, or rather the Superintendent, Mr. Hodges, in conjunction with Mr. Ross, after much consideration on the spot, devised another system of laying the foundations, which was by means of floating "Coffer-dams," so contrived that the usual difficulty in applying coffer-dams for rock foundations would be, it was hoped, in a great measure obviated. When in Montreal, I examined a model of this contrivance and quite approved of its application without feeling certain that it would materially reduce the expense of construction below that of the system assumed to be adopted by Mr. Ross and myself in making the estimate. In approving of the method proposed by Mr. Hodges, I was actuated by the feeling that the Engineers would not be justified in controlling the contractors in the adoption of such means as they might consider most economical to themselves, so long as the soundness and stability of the work were in no way affected.

This new method has been hitherto acted upon with such modifications, as experience has suggested from time to time, during the progress of the work, and although successfully, I learn from the contractors that experience has proved the bed of the river to be far more irregular than was at first supposed,—presenting, instead of tolerably uniform ledges of rock, large loose fragments which are strewed about, and cause much inconvenience and delay.

They are therefore necessitated to vary their mode of proceeding to meet these new circumstances; and it may be stated, that all observations up to this time shew the propriety, notwithstanding the difficulty with dams, of carrying the ashlar masonry of the piers, down to the solid rock—and that any attempt at obtaining a permanent foundation by means of concrete, confined in "caissons" would be utterly futile;—however, if it were assumed to be practicable, there would be extreme danger in trusting such a superstructure of masonry upon concrete, confined in cast iron "caissons" above the bed of the river: indeed, considering the peculiarities of the situation and the facts which have been ascertained, this mode of forming foundations is the most inappropriate that can be suggested, as it involves so many contingencies, that to calculate the extreme expense would be utterly impossible.

These considerations lead me therefore to the conclusion that the present design for the foundation is as economical as is compatible with complete security."

A legitimate conclusion, which we apprehend will not be gainsayed.

Mr. Ross gives a graphic description of the difficulty of putting in these foundations:

"Any diminution in these piers (referring to a proposal to reduce the dimensions of the centre piers) which I might according to my own views of the case be induced to adopt, I should treat as some compensation, as far as it went, for the increased depth of the foundations generally, which are found greatly to exceed our anticipations: although every pains had been taken to ascertain what these would be, we find in the progress of the works that the bed of the river in most parts is formed of large boulders heaped together in large masses, the interstices being filled up with gravel, sand and mud, in many instances forming a hard concreted mass, and in others the reverse; beds of quick sand and mud being as frequent as any other. Three thousand tons of such material we had to clear out of the foundation of No. 5 pier, as you will see indicated on the diagram already referred to, below the level at which our previous examination would lead us to expect the foundation we sought. One of the boulders taken out, by admeasurement would weigh about eleven tons; masses of three and four tons are strewed as thickly as pebbles on the sea shore. The shallows in the river are evidently formed by these deposits, and I have no doubt in every instance where these shallows appear we shall have to encounter similar difficulties. In pier No 3 we found a depth of four feet at one end, and nine feet at the other, to clear out ere we reached the rock. These unlooked for contingents have materially retarded our season's operations, otherwise we should by this time have Nos. 3, 5 and 6 nearly completed, as it turns out we require another season to accomplish this. And here I think it well to observe that up to No. 6 inclusive, the expensive outlays have already been incurred; the dams have been completed, and in all except No. 4 the water has been pumped out and the machinery erected for setting the stone, but No. 5 is the only one where we have been able to complete any masonry, owing to the unlooked for causes I have already described. These contingents render it impossible to complete one pier in less than two seasons, though, as in the case of No. 1 pier, where no such unlooked for difficulty arose, the whole was begun and completely finished in one season, thus saving the removal and re-erection of all the machinery and appliances necessary, besides the reparation of such damages as the winter operations may produce."

Of the spans, and the considerations which led to their adoption, Mr. Stephenson says:

"These considerations lead me therefore to the conclusion, that the present design for the foundation is as economical as is compatible with complete security.

We are now brought to the question, as to whether the upper masonry is of a more expensive description than necessary, or whether it can be reduced in quality. This question is exceedingly important, since the cost of the masonry constitutes upwards of 50 per cent. of the total estimated cost of the bridge and approaches. The amount of the item of expenditure for the masonry is clearly dependent upon the number of piers, which is again regulated by the spans between them.

The width of the openings in bridges is frequently influenced, and sometimes absolutely governed, by peculiarities of site. In the present case, however, the spans, with the exception of the middle one, are decided by a comparison with the cost of the piers; for it is evident that so soon as the increased expense in the roadway, by enlarging the spans, balances the economy produced by lessening the number of piers, any further increase of span would be wasteful.

Calculations, based upon this principle of reasoning, coupled to some extent with considerations based upon the advantages to be derived from having all the tubes as nearly alike as possible, have proved that the spans which have been adopted in the present design for all the side openings, viz.: 242 feet, have produced the greatest economy. The centre span has been made 330 feet, not only for the purpose of giving every possible facility for the navigation, but because that span is very nearly the width of the centre and principal deep channel of the stream.

The correctness of the result of these calculations obviously depends upon the assumption that the roadway is not more costly than absolutely necessary; for if the comparison be made with a roadway estimated to cost less than the tubular one in the design, then the most economical span for the side openings would have come larger than 242 feet, and the amount of masonry might have been reduced below what is now intended. In considering the quantity of masonry in the design, you must, therefore, take it for granted for the moment that the *tubular roadway* is the cheapest and best that could be adopted, and leave the proof of this fact to the sequel of these remarks."

The Ice Breakers are next considered, and the value of the plans adopted as compared with the unwieldy "*islands*" of timber and stone at first proposed, as well as the comparative economy of the masonry, is made sufficiently apparent:

"It may perhaps appear to some in examining the design, that a saving might be effected in the masonry, by abandoning the inclined planes which are added to the up-side of each pier, for the purpose of arresting the ice, and termed 'Ice breakers.'

In European rivers, and I believe in those of America also, these 'Ice-breaker's are usually placed a little way in advance of, or rather above, the piers of the bridges, with a view of saving them from injury by the ice shelving up above the level of (frequently on to) the roadway.

In the case of the Victoria Bridge, the level of the roadway is far above that to which the ice ever reaches; and as the ordinary plan of "Ice-breakers" composed of timber and stone would be much larger in bulk, though of a rougher character, than those which are now added to the piers, I have reason to believe that they would be equally costly, besides requiring constant annual reparation; it was therefore decided to make them a part of the structure itself, as is now being done."

The comparison which Mr. Stephenson draws (relative to economy) between the "*Boiler Plate Girder*" as adopted for the Victoria

Bridge, and other methods of constructing iron superstructures, is exceedingly interesting:

"At present there may be regarded as existing three methods of constructing wrought-iron girders or beams for railway purposes.

FIRST,—The *Tubular Girder*, or what is sometimes called the *Box Girder*, when employed for small spans, with which may also be named the *Single-ribbed Girder*,—the whole belonging to the class known as '*Boiler Plate Girders.*'

SECOND,—The *Trellis Girder*, which is simply a substitution of iron bars for the wood in the trellis-bridges, which have been so successfully employed in the United States, where wood is cheap and iron is dear.

THIRD,—The *Single Triangle Girder*, recently called 'Warren,' from a patent having been obtained for it by a gentleman of that name.

Now in calculating the strength of these different classes of girders, one ruling principle appertains, and is common to all of them. Primarily and essentially the ultimate strength is considered to exist in the top and bottom,—the former being exposed to a compressive force by the action of the load, and the latter to a force of tension; therefore, whatever be the class or denomination of girders, they must all be alike in amount of effective material in these members, if their spans and depths are the same, and they have to sustain the same amount of load.

On this point I believe there is no difference of opinion amongst those who have had to deal with the subject. Hence, then, the question of comparative merits, amongst the different classes of construction of beams or girders, is really narrowed to the method of connecting the top and bottom *webs*, so called. In the tubular system, this is effected by means of continuous plates riveted together; in the trellis girders, it is accomplished by the application of a trellis-work, composed of bars of iron forming struts and ties, more or less numerous, intersecting each other, and riveted at the intersections; and in the girders of the simple triangular, or 'Warren' system, the connection between the top and bottom is made with bars,—not intersecting each other, but forming a series of equilateral triangles,—these bars are alternately struts and ties.

Now, in the consideration of these different plans for connecting the top and bottom *webs* of a beam, there are two questions to be disposed of; one is—which is the most economical? and the other—which is the most effective mode of so doing? But while thus reducing the subject to simplicity, it is of the utmost importance to keep constantly in mind that any saving that the one system may present over the other is actually limited to a portion, or per centage, of a subordinate part of the total amount of the material employed.

In the case now under consideration, namely, that of the Victoria tubes, the total weight of the material between the bearings is 242 tons, which weight is disposed of in the following manner:

		Tons.
Top of Tube	76	
Bottom of Tube	92	
		—168
Sides of Tube		84
Total tons		252

Assuming that the strain per square inch, in the top and bottom, is the same for every kind of beam,—say four tons of compression in the top, and five tons of tension in the bottom,—the only saving that can by any possibility be made to take place being confined to the sides, must be a saving in that portion of the weight which is only about 34 per cent. of the whole. How, therefore, can 70 per cent. of saving be realized, as has been stated, out of the total weight, when the question resolves itself into a difference of opinion on a portion which is only 34 per cent. of such weight?

I am tempted to reiterate here much that was said by several experienced Engineers on the subject, during the discussions already alluded to, at the Institution of Civil Engineers; but the argument adduced on that occasion could only be rendered thoroughly intelligible by the assistance of diagrams of some complexity, and I think sufficient has been said to demonstrate that no saving *of importance* can be made in the construction of the roadway of the Victoria Bridge, as it is now designed by the substitution of any other description of girder. Yet, lest this should be considered mere assertion, permit me to adduce one or two examples, where the close-sided tubular system, and the open-sided system, may be fairly brought into comparison with each other in actual practice.

The most remarkable parallel case which occurs to me is the comparison of the Victoria tubes under consideration, with a triangular or 'Warren' bridge, which has been erected by Mr. Joseph Cubitt over a branch of the river Trent, near Newark, on the Great Northern Railway.

The spans are very similar. and so are the depths. In calling your attention to the comparison, you must bear in mind that all possible skill and science were brought to bear upon every portion of the details of the Newark Dyke Bridge, in order to reduce the total weight and cost to a minimum.

The comparison stands thus:

VICTORIA BRIDGE AS BEING ERECTED.

Span, 242 feet; weight, including bearings, 275 tons, for a length of 257 feet.

NEWARK DYKE BRIDGE AS ERECTED.

Span, 240 feet 6 inches; weight, including bearings, 292 tons, for a length of 254 feet,

which shews a balance of 17 tons in favor of the Victoria tubes.

The Newark Dyke Bridge is only 13 feet wide, while the Victoria tube is 16 feet, having a wider guage railway passing through it.

This is a very important case, as the spans and depths are all but identical, and it will therefore enable you to form a judgment upon that point which has caused so much controversy at the discussion alluded to. It is true that in the Newark Dyke Bridge a large proportion of the weight is of cast iron, a material I have frequently adopted in the parts of tubular bridges subjected to compression only, but from its brittle character I should never recommend it for exportation, nor for the parts of a structure that are liable to a lateral blow.

It has been suggested that there is much convenience in the arrangement of the trellis, or 'Warren' bridge, as it may be taken to pieces, and more conveniently and economically transported overland than 'boiler plates;' this may be correct under some circumstances, but it cannot hold good for a work like the Victoria Bridge over the St. Lawrence.

* * * * * * * * * * * * *

Another example may be mentioned of a tubular beam, somewhat similar in dimensions to the last described, and one which is actually erected on a continuation of the same line of railway, as that on which the Newark-Dyke Bridge is situated, namely, over the river Aire at Ferry Bridge. Although the similarity is not so great with this as with the Victoria tube, yet I believe it is sufficiently so to form another proof that the advantage is in favor of the solid side.

As before:

NEWARK-DYKE BRIDGE.

Span, 240 feet, 6 inches; weight, 292 tons.

FERRY BRIDGE.

Span, 225 feet; weight 235 tons.

The difference between these weights is more than sufficient to compensate for the difference of span; besides which, in the Ferry bridge, made according to my designs and instructions, I was lavish in the thickness of the side-plates, and the bearings which are included in the above weight were stiffened by massive pillars of cast iron.

For a further example, let me compare the Boyne Trellis bridge (held by some to be the most economical) with the present Victoria tubes.

The Boyne Bridge has three spans, the centre one being 264 feet, and the height is 22½ feet. It is constructed for a double line of way, and is 24 feet wide. The total load, including the beam itself, the rolling load at two tons per foot, and platform rails, &c., amount to 980 tons, uniformly distributed.

The bridge is constructed upon the principle of "continuous beams," a term which signifies that it is not allowed to take a natural defection due to its span; but being tied over the piers to the other girders, the effective central span is shortened to 174 feet; in fact, this *principle* changes the three spans into five spans. Now the effective area given for compression in this centre span is 113½ inches, which gives a strain for the 174 feet span of nearly 6 tons to the inch in comparison.

The Victoria tubes are so dissimilar in form and circumstances, to the Boyne bridge, that it is a troublesome matter to reduce the two to a comparative state. However, the Victoria tubes are known to be 275 tons in weight—242 feet in span, and of 19 feet average depth, the strain not being more than 4 tons per inch for compression, with a uniform load of 514 tons, which includes its own weight, sleepers and rails and a rolling load of one ton per foot.

The Victoria Bridge has not been designed upon the principle of continuous beams for practical reasons, including the circumstance of the steep gradient, on each side of the centre span, and the great disturbance which would be caused by the accumulated expansion and contraction, of such a continuous system of iron-work, in a climate where the extremes of temperature are so widely apart; otherwise the principle alluded to, was first developed in tubular beams, namely in the Britannia bridge.

But since we are only now discussing the merits of the sides, let the Boyne bridge be supposed to have sufficient area in its top to resist 4 tons per inch, (the proper practical strain) and let the spans be not continuous; it will be found by calculation that the area required at top will be 364 inches, instead of 113½ inches, and the weight of the span would be found by calculation to come out little short of 600 tons; whereas it is now 386 tons; and if we suppose the Victoria tube to carry a double line of *way* and 24 feet wide with a depth of 22½ feet, even if we double the size in quantity, the whole amount of weight will be certainly very little more than 500 tons for 242 feet span.

It will be necessary to conclude my remarks, with some further observations relative to the comparisons under our notice, which are of vital importance in considering the design of such a bridge as that to be erected for the Grand Trunk Railway of Canada.

Independently of the comparative weights and cost, which I believe have been fairly placed before you, the comparative merits as regards efficiency have yet to be alluded to.

You may be aware that at the present time, theorists are quite at variance with each other, as to the action of a load in straining a beam in the various points of its depth, and the fact is not known, that all the received formulæ for calculating the strength of a beam subjected to a transverse load require remodelling; therefore, at present it is far beyond the power of the designers of *trellis* or *triangular* bridges, to say with precision what the laws are which govern the strains and resistances, in the sides of beams, or even of *simple solid beams*, yet one thing is certain, which is, that the sides of all these trellis or "Warren" bridges are useless, except for the purpose of connecting the top and bottom and keeping them in their proper position; they depend upon their connection with the top and bottom webs, for their own support, and since they could not sustain their shape, but collapsed immediately they were disconnected from these top and bottom members, it is evident that they add to the strain upon them; and consequently to that extent reduce the ultimate strength of the beams.

In the case of the Newark Dyke Bridge, when tested to a strain of 6⅘ tons to the inch, its deflection was 7 inches in the middle, and when tested with its calculated load of one ton per foot run, the deflection was 4⅝ inches. The deflection of the Victoria tubes by calculation will not be more with the load of one ton per foot, than 1·6 inch; and we have sufficient proof of the correctness of this calculation in existing examples. That of the Boyne bridge with a uniform load of 530 tons, was 1·9 inch with the spans shortened in effect as described.

Much misapprehension has existed in reference to Mr. Stephenson's estimate of the fitness of bridges built on the suspension principles for railway traffic, and opinions have been attributed to him quite adverse to their safety or practicability for railway purposes. The present success of the bridge over the Niagara River is pointed to as a refutation of his supposed opinions, and as evidence that a cheaper structure on similar principles might have been adopted for the Victoria Bridge.

We doubt whether Mr. Stephenson ever entertained opinions such as we have alluded to. He certainly did not express any doubt of their *practicability*, either in his evidence before the Committee of the House of Commons in relation to the Britannia Bridge, nor in his published history of the design for that work. On the contrary, he at one time contemplated using the Menai Bridge for the Railway, and was deterred from so doing by considerations apart from those of safety,* and we do not believe that any of the reasons

* "I thought also that that span (360 feet) could only be exceeded by the adoption of the Chain Bridge, which I do not approve of for the passage of locomotive engines" * * * "I have thought of adopting another plan in connection with suspension which would render the platform quite rigid; and if the platform be quite rigid, then I think the sus-

which influenced his decision on that occasion have been in any degree weakened by the successful use of the Niagara Bridge.

Whatever opinions may be entertained on that point, there can be only one in relation to the superior fitness of the "tubular" plan for the Victoria Bridge, as compared with the suspension principle, after reading the subjoined portion of Mr. Stephenson's report:

"Having given you my views with respect to the comparative merits of the different kinds of roadway, consisting of "beams" that may be adopted in the Victoria bridge, I now proceed to draw your attention to the adaptation of the "suspension" principle, similar to that of the bridge which has been completed within the last few months by Mr. Roebling, over the Niagara River, near the great "Falls."

You are aware that during my last visit to Canada I examined this remarkable work, and made myself acquainted with its general details, since then Mr. Roebling has kindly forwarded to me a copy of his last report, dated May 1855, in which all the important facts connected with the structure, as well as the results which have been produced since its opening for the passage of railway trains, are carefully and clearly set forth.

No one can study the statements contained in that report without admiring the great skill which has been displayed throughout in the design; neither can any one

---

pension principle may be applied; but until it is made rigid, I have my doubts about it." In answer to the question, "Do you think the present Menai Bridge could be so altered and improved and strengthened as to be made able to support a Railroad?" Mr. Stephenson replied, "I think it might; but it would leave it merely a Suspension Bridge, which I do not like."—*Minutes of Evidence before the Select Committee on Railway Bills*, 1845.

In his history of the design of the Britannia Bridge, alluding to the difficult position in which he was placed by the requirements of the Admiralty, he says: "In this position of affairs I felt the necessity of reconsidering the question whether it was not possible to stiffen the platform of a suspension bridge so effectually as to make it available for the passage of railway trains at high velocities." * * * * "Amongst a variety of devices for the accomplishment of this object, the most feasible appeared to be the combination of the suspension chain with deep trellis turning, forming vertical sides traversed by the suspension rods from the chains, with cross bearing frames top and bottom to retain the sides in the proper position, thus forming a roadway surmounted on all sides by strongly trussed framework."

"A structure of this kind would no doubt be exceedingly stiff vertically, and has indeed been applied and successfully employed in America on a large canal aqueduct, and is clearly described in the 'Mechanics' Magazine' for 1846."

"The application, however, of this principle to an aqueduct is perhaps one of the most favourable possible, for there the weight is constant and uniformly distributed, and all the strains consequently fixed both in amount and direction: two important conditions in wooden trussing constructed of numerous parts. In a large railway bridge it is evident so far from these conditions obtaining under any circumstances, they are ever varying to a very large extent; but when connected with a chain which tends to alter its curvature by every variation in the position of any superincumbent weight, the direction and amount of the complicated strains throughout the framing become incalculable, so far as all practicable purposes are concerned." * * * * * "It was reverting to this bridge" (a small wrought iron box girder) "that led me to apply wrought iron with a view to obtaining a stiff platform to a suspension bridge, and the first form of its application was simply to carry out the principle described in the wooden suspended structure last spoken of, substituting for the vertical wooden trellis turning and the top and bottom cross beams, wrought iron plates riveted together with angle iron. The form which the iron now assumed was consequently a high wrought iron rectangular tube, so large that railway trains might pass through it, with suspension chains on each side."

who has seen the locality fail to appreciate the fitness of the structure for the singular combination of difficulties which are presented.

Your Engineer, Mr. Alexander Ross, has personally examined the Niagara Bridge since its opening, with the view of instituting, as far as is practicable, a comparison between that kind of structure and the one proposed for the Victoria Bridge; and as he has since communicated to me by letter the general conclusions at which he has arrived, I think I cannot do better than convey them to you in his own words, which are subjoined below:

"'I find from various sources that considerable pains have been taken to produce an impression in England in favour of a Suspension Bridge in place of that we are engaged in constructing across the St. Lawrence at this place. This idea, no doubt, has arisen from the success of the Niagara Suspension Bridge, lately finished by Mr. Roebling, and now in use by the Great Western Railway Company, as the connecting links between their lines on each side the St. Lawrence, about two miles below the great 'Falls,' of the situation and particulars of which you will no doubt have some recollection. I visited the spot lately, and found Mr. Roebling there, who gave me every facility I could desire for my objects. Of his last report on the completion of the work he also gave me a copy, which you will receive with this: I have marked the points which contain the substance of his statement. I also enclose an engraved sketch of the structure. Mr. Roebling has succeeded in accomplishing all he had undertaken, viz.: safely to pass over railway trains at a speed not exceeding five miles an hour; this speed, however, is not practiced,—the time occupied in passing over 800 feet is three minutes, which is equal to three miles an hour. The deflection is found to vary from 5 to 9 inches, depending on the extent of the load, and the largest load yet passed over is 326 tons of 2000 lbs. each, which caused a depression of ten inches. A precaution has been taken to diminish the span from 800 to 700 feet, by building up, underneath the platform at each end, about forty feet in length intervening between the towers and the face of the precipice upon which they stand; and struts have also been added, extending ten feet further. The points involved in the consideration of this subject are, first, *sufficiency*, and second, *cost*. These are, in this particular case, soon disposed of. First, we have a structure which we dare not use at a higher speed than three miles an hour; in crossing the St. Lawrence at Montreal we should thus occupy three-quarters of an hour; and allowing reasonable time for trains clearing and getting well out of each other's way, I consider that twenty trains in the twenty-four hours is the utmost we could accomplish. When our communication is completed across the St. Lawrence, there will be lines (now existing, having their termini on the south shore) which, with our own line, will require four or five times this accommodation. This is no exaggeration. Over the bridge in question, although opened only a few weeks, and the roads yet incomplete on either side, there are between thirty and forty trains pass daily. The mixed application of timber and iron in connection with wire, renders it impossible to put up so large a work to answer the purposes required at Montreal; we must, therefore, construct it entirely of iron, omitting all perishable materials; and we are thus brought to consider the question of cost. In doing which, as regards the Victoria Bridge, I find that, dividing it under three heads, it stands as follows:

First,—the approaches and abutments, which together extend to 3000 feet in length, amount in the estimate to........................£200,000

Second,—the masonry, forming the piers which occupy the intervening space of 7000 feet between the abutments, including all dams and appliances for their erection £800,000

Third,—the wrought iron tubular superstructure, 7000 feet in length, which amounts to..£400,000

(About £57 per lineal foot.) ———

Making a total of £1,400,000

"By substituting a Suspension Bridge the case would stand thus:—The approaches and abutments extending to 3,000 feet in length being common to both, more especially as these are now in an advanced state, may be stated as above at £200,000.

"The masonry of the Victoria bridge piers ranges from 40 to 72 feet in height averaging 56 feet and these are 24 in number, the number required for a suspension bridge admitting of spans of about 700 feet, would be 10, and these would extend to an average height of 125 feet.—These 10 piers, with the proportions due to their height and stability, would contain as much (probably more) masonry as is contained in the 24 piers designed for the Victoria bridge, and the only item of saving, which would arise between these, would be the *lesser* number of dams that would be required for the suspension piers; but this I beg to say, is more than doubly balanced by the excess in masonry, and the additional cost entailed in the construction, at so greatly increased a height. Next as to the superstructure, which in the Victoria bridge costs £57 per lineal foot.—Mr. Roebling in his report states the cost of his bridge to have been $400,000 which is equal to £80,000 sterling. Estimating his towers and anchor masonry at £20,000 which I believe is more than their due:—We have 60,000 left for the superstructure, which for a length of 800 feet is equal to £75 per lineal foot, giving an excess of £18 per foot over the tubes of which we have 7,000 feet in length.—By this data, we show an excess of nearly 10 per cent. in the suspension as compared with the tubular principle, for the particular locality with which we have to deal, besides having a structure perishable in itself, on account of the nature of the materials; and to construct them entirely of iron, would involve an increase in the cost which no circumstance connected with our local or any other consideration at Montreal, would justify. We attain our ends by a much more economical structure, and what is of still greater consequence a more permanent one; and as Mr. Roebling says, no suspension bridge is safe without the appliances of stays from below, no stays of the kind referred to could be used in the Victoria Bridge,—both on account of the navigation and the ice, either of which, coming in contact with them, would instantly destroy them. No security would be left against the storms and hurricanes so frequently occurring in this part of the world.

"'No one, however, capable of forming a judgment upon the subject, will doubt for one moment the propriety of adopting the suspended mode of structure for the particular place and object it is designed to serve at Niagara. A gorge 800 feet in width and 240 in depth, with a foaming cataract racing at a speed from 20 to 30 miles an hour, underneath, points out at once that the design is most eligible; and Mr. Roebling has succeeded in perfecting a work capable of passing over ten or twelve trains an hour, if it should be required to do so. The end is attained by means the most applicable to the circumstances; these means, however, are only applicable where they can be used with economy, as in this instance.'

"My own sentiments are so fully conveyed in the above extract from Mr. Ross' letter, that I can add no further remark upon the subject, except perhaps that there appears to be a discrepancy in that part which relates to cost.

In dividing the £80,000 into items, Mr. Ross has deducted £20,000 for masonry, and left the residue, £60,000, for the 800 feet of roadway. Now it appears evident that this amount should include the cost of the "land chains;" and assuming their value at about £15,000, there would be only £45,000 left for the 800 feet of roadway, thus reducing the cost per lineal foot to about that of the tube. But in the application of a suspension bridge for the St. Lawrence the item £15,000 for "land chains" would of course have to be added to the cost of the 7,000 feet of roadway, which would swell the amount per foot to a little over that of the tubes."

* * * * * * * * *

"I entirely concur in what Mr. Ross says respecting the propriety of applying the suspension principle to the passage across the Niagara gorge; no system of bridge building yet devised could cope with the large span of 800 feet which was then absolutely called for, irrespective of the other difficulties attended to.

"Where such spans are demanded, no design of beam with which I am acquainted would be at all feasible. The tube, trellis, and triangular systems are impracticable in a commercial sense and even as a practical engineering question the difficulties involved are all but insurmountable.

"Over the St. Lawrence we are fortunately not compelled to adopt very large spans. none so large in fact as have been already accomplished by the simple '*Girder*' system It is under these circumstances that the suspension principle fails, in my opinion, to possess any decided advantage in point of expense, whilst it is certainly much inferior as regards stability for railway purposes. The flexure of the Niagara Bridge, though really small, is sufficiently indicative of such a movement amongst the parts of the platform as cannot fail to augment where *wood* is employed, before a long time elapses.

"I beg that this observation may not be considered as being made in the tone of disparagement; on the contrary, no one appreciates more than I do the skill and science displayed by Mr. Roebling in overcoming the striking enginnering difficulties by which he was surrounded; I only refer to the question of flexure in the platform as an unavoidable defect in the suspension principle, which from the comparatively small spans that are available in the Victoria Bridge may be entirely removed out of consideration."

It may be questioned whether the circumstances of the railway traffic demanded the immediate construction of a railway bridge at Montreal of any description, but it is not our purpose to discuss that question here. We feel confident, however, that the exceedingly expensive structure now being erected cannot be justified while a much less costly one was within reach. While fully admitting the force of all Mr. Stephenson's arguments in favour of the tubular principle, as in comparison with other principles of construction in iron, and as compared with the suspension principle for the particular case in question, we regret that he did not more fully consider the fitness of a wooden superstructure, which we feel convinced would have met every exigency of the case ; and under careful supervision and due watchfulness against fire, if properly constructed, would have been free from all the objections as to flexure, and consequent decay, which Mr. Stephenson urges against wood as applied to suspension bridges, and would have endured until a more complete development of the railway traffic might warrant the enormous expenditure now being incurred ;—thus saving a present outlay of upwards of £300,000.

A. B.

SCIENTIFIC AND LITERARY NOTES.

GEOLOGY AND MINERALOGY.

NEW CRUSTACEANS FROM THE SILURIAN ROCKS OF SCOTLAND.

The February Number of the Quarterly Journal of the Geological Society of London, contains a series of papers of much interest on several new forms of Crustacea from the Parish of Lesmahago in Lanarkshire. These were discovered by Mr. Robert Slimon. The beds in which they occur have been examined by Sir Roderick Murchison and Professor Ramsay, who consider them to belong to the top band of the Upper Silurians—the equivalents of the "Tilestones" or Upper Ludlow series, previously unrecognised in that part of the country. The fossils discovered by Mr. Slimon have many apparent affinities with Eurypterus or Pterygotus. As shewn by Mr. Salter, however, they constitute no less than five distinct species of a new genus, named by him, *Himantopterus*, from the peculiar thong-like aspect of the swimming feet. The eyes are apparently situated on the extreme lateral margin of the anterior portion of the head-shield : a character serving to distinguish these new forms very readily from Eurypteri, which, otherwise, in general appearance they much resemble. Of the chelate antennæ, however, there appears to have been only a single pair. The largest of the discovered species is considered to have been at least three feet in length. Professor Huxley has appended some very able remarks to Mr. Salter's descriptions, in which he points out many striking relations between this new genus Himantopterus, and a particular section of the Stomapods on the one hand, and certain larval forms of Macroura (the "zoæa" of a few years' back) on the other. Amongst the Lanarkshire specimens also, discovered by Mr. Slimon, were some very complete forms of the genus *Ceratiocaris* of M'Coy, previously very imperfectly known

ASAPHUS CANADENSIS.

Specimens of *Asaphus platycephalus*—the *Isotelus gigas* of many authors, are well known to abound amongst the trilobites from the Utica Schist of Whitby, Port Hope, &c., in Canada West. After *Triarthrus Beckii*, the species in question is perhaps the most abundant fossil of these localities. The principal feature in *Asaphus platy-*

cephalus, at least in adult individuals, is the comparatively undivided character of the caudal shield. In the Whitby schists, however, trilobites occur, over seven or eight inches in length (if not longer,) with the caudal extremity not only distinctly trilobed, but also marked with numerous and distinct pleuræ extending almost to the edge of the striated limb; whilst at the same time, they agree in all other respects with *A. platycephalus*. In the union of the facial suture above the glabella, for example, the two are alike; and in the peculiar character of the body-segments and pleuræ, not the slightest difference is perceptible. As no figure of this trilobite is given in Hall's Palæontology, and as the form appears to differ from the figured European species, we propose to confer upon it provisionally the name of *Asaphus Canadensis.* If it be really new, it may be placed as the type of a particular sub-division of the Asaphidæ, in accordance with the following scheme:—

Asaphidæ with facial sutures united:

§1. *Pygidium, undivided*:—Type, *A. platycephalus.*

§2. *Pygidium with grooved axis*:—Type, *A. expansus.*

§3. *Pygidium with grooved axis and pleuræ*:—Type, *A. Canadensis.* A drawing of this latter species will be given in the second part of our Paper on the Trilobites.

MINERALOGICAL NOTICES.

Dufrenoysite:—Ch. Heusser has communicated to Poggendorff's Annalen (1856, No. 1.) some additional information on the crystallization of Dufrenoysite [2 (PbS) + As^2 S^3] from the dolomite of the Binnenthal. He confirms the Monometric character of the mineral; but, in addition to the forms hitherto discovered, *viz*:—the rhombic dodecahedron, and the leucitoid 2-2, he announces the cube, the octahedron, a second leucitoid 6-6, and a trisoctahedron $\frac{3}{2}$. Hardness, 4·5

Binnite:—Heusser has also subjected to a detailed examination, the steel-grey metallic sulphide which often accompanies the Dufrenoysite at the above locality. This mineral has been known in Switzerland for some time under the name of Binnite. It occurs in very small and longitudinally striated prisms of extreme brittleness. Streak, dark-red, much darker than that of Dufrenoysite; specific gravity (according to an earlier determination of Von Waltershausen on specimens taken by him for Dufrenoysite) = 4·477. These latter specimens, according to Uhrlaub, contained sulphur, arsenic and copper, with a mere trace of lead. The system of crystallization of Heusser's specimens, was apparently Trimetric, but the prism-angle could not be obtained, owing to the striæ on the faces. The measured angles, those of a series of domes, but whether macrodomes or brachydomes not determinable, did not accord with the measurements obtained by Von Waltershausen. An examination of further specimens is consequently desirable.

Hyalophane:—The dolomite of this same locality furnished to Von Waltershausen another mineral, which he described as new, under the name of Hyalophane. It was thought to contain: SiO^3, Al^2O^3, CaO, MgO, NaO, BaO, SO^3, and HO. Heusser has shewn, however, that it is simply an adularia variety of Orthoclase, containing accidental particles of Iron pyrites, and interpenetrated by Dolomite and Heavy Spar. Seven distinct crystals carefully freed from these impurities, and tested respectively by the blowpipe, did not yield the slightest trace of sulphur.

Rhodonite:—Crystals of the Silicate of Manganese, or Rhodonite, are, it is well-known, of rare occurrence. From those hitherto met with, and from the cleavage planes of massive specimens, the crystallization of the mineral has been long considered identical with that of Augite or Pyroxene: a supposition apparently confirmed by the similarity of atomic constitution exhibited by these bodies. An examination of some very perfect specimens, however, obtained from Phillipstadt in Sweden, has shewn Mr. R. P. Grey (Phil. Mag. March, 1856) that the crystallization is triclinic. The inclinations of the three assumed pinacoids (or terminal pairs) gave, respectively :—87°20′, 86°10′, 110°40′.

Voigtite:—Under this name (in honor of Voight, a writer who obtained some notice at the close of the last century, as an opponent of the Wernerian doctrines,) Schmid has described a micaceous mineral from a granitic mass, forming part of the Ehrenberg, in the Duchy of Saxe-Weimar. It occurs in small scales, of a brown colour, and opaque; but is usually much weathered. H. a little over 2·0; Sp. gr. =2·91. Readily fusible. The analysis yielded:—SiO^3 33·83, Al^2O^3 13·40, Fe^2O^3 8·42, FeO 23·01, MgO 7·54, CaO 2·04, NaO 0·96, HO 9·87, = 99·07. It may be regarded, perhaps, as simply a ferruginous variety of Chlorite.

Volknerite:—Rammelsberg has examined the substance originally named Hydrotalcite by Hochstetter—the Volknerite from Snarum in Norway. He confirms Hermann's statement as to the accidental nature of the carbonate of magnesia present in the mineral; but his analysis leads to the formula Al^2O^3. 3 HO + 5 (MgO, 2HO,) or nearer still, to MgO, Al^2O^3+4 (MgO, 3HO,) in place of Al^2O^3, 3HO + 6 (MgO, 2HO) given by Hermann.

Boronatrocalcite or Ulexite:—Rammelsberg has also analysed the supposed Borocalcite from the plains of Iquique in Southern Peru. He finds that soda is really one of its constituents; and that when freed from impurities, its composition may be expressed by the following formula: [NaO, $2BO^3$ + 2 (CaO, $2BO^3$)] + 18HO. This corresponds to BO^3 45·63, CaO 12·26, NaO 6·79, HO 35·32. As the present mineral is thus distinct from Hayesine, Dana's original name of Ulexite should be re-conferred upon it.

Schaumkalk:—This substance has been hitherto regarded as a pseudomorphous variety of calc spar after fibrous gypsum. G. Rose has lately shewn, that it belongs properly to Arragonite; and he calls attention to the fact that it constitutes the first recognized example of an arragonite pseudomorph. Fossil shells converted into arragonite, are, however not unknown.

Torbane-Hill Mineral:—The substance, thus named, still continues to attract, from time to time, the attention of the scientific world. Geuther in his Inaugural Dissertation (Ueber die Natur und Distillationsproducte des Torbanehill-minerals: Gottingen, 1855,) declares, as the result of an elaborate series of experiments, that the matter in question is simply a bituminous shale. This, is the view almost universally adopted in Germany: a view, which in the end we are convinced, will prevail everywhere. It is only by denying altogether the existence of bituminous shale, that the present substance can with any consistency be entitled to the name of coal. Specimens may be seen in the collection of the Canadian Institute.

E. J. C.

ETHNOLOGY AND ARCHÆOLOGY.

CRANIA OF THE ANCIENT BRITONS.

Mr. Joseph Barnard Davis submitted to the British Association at the Glasgow meeting, a series of remarks and deductions relative to the forms of the Crania of the Ancient Britons chiefly founded upon his observations of a skull derived from the

Green-Gate-Hill Barrow, near Pickering. The following abstract of this communication is made from a copy transmitted by Mr. Davis to the Editor, and some portions of it will not be without value in relation to our own Canadian ethnological investigations and deductions. An observant eye, he remarks, is able to discriminate between natives of the different provinces of the same country, therefore a more comprehensive investigation of the bones of the face and head will lead to reliable conclusions respecting their specific forms. By extended observation, by keeping close to the teachings of the physical phenomena, and by regarding the information to be derived from history, philology and antiquities, more as illustrative and accessory, we may hope to obtain more definite and conclusive knowledge. In explanation of the uncertainty in which the subject is at present involved, he remarks:—1. *Data have been inadequate*, and from this scarcity of authentic data, observations have deen disconnected and immature. 2. *Study has been too much separated from that of human skulls in general.* Taken up more as an antiquarian than anatomical or ethnological inquiry. 3. *Little attention has been paid to discrimination of sexes and ages.* Some archæologists of great learning have entirely passed these over, yet the cranium undergoes important modifications in the course of development and growth, not ceasing even in old age. These changes render it necessary to select examples from the middle and mature season of life. Attention to sex is even of greater moment, as, if disregarded, errors may be induced extending to an entire class. The skulls of women seldom exhibit the normal and characteristic ethnic features markedly, and should be employed sparingly. 4. A prolific source of error consists in *overlooking the great diversities of form which present themselves regularly in every family* of the European races, and assuming that we shall find the cranial character more stereotyped as we ascend to primitive times. This assumption has probably led men of great distinction, upon slender evidence for the difference of antiquity of certain skulls, to refer them to a succession of races. 5. *More definite views that prevail on primæval antiquities have dissipated certain preconceptions* concerning cromlechs and kistvaens, and the rites to which they were destined; have proved that cremation and inhumation were practised contemporaneously from the earliest periods; and that the doctrine of the ages of Stone, Bronze and Iron, if not received too exactly and employed too readily in solving difficult problems, is in the main true. Probably until these advances had been made in archæology, the study of ancient crania could not have been profitably undertaken.

From these impediments it must not be inferred there are no fixed principles in the investigation. For,—1. Although it must be admitted there is considerable diversity of form amongst the crania of even one people, *extensive observation enables us to perceive the general characteristic marks which appertain to them.* 2. Whether the origin of the human race is regarded as one of the arcana of nature enshrouded in primæval obscurity, wholly impenetrable, or not, we are constrained to admit that *marked dissimiliarities have existed from the most remote periods.* 3. Another, equally essential, is *the law of permanence of ethnic forms;* that the characters impressed upon races are not transmutable, but constant. This law has been the subject of much controversy, but the facts adduced against it appear too dubious, unimportant, and few, to shake its stability; a stability uniform with that observed in all the other divisions of nature, and not to be successfully assailed by the hypothesis of development.

The best course to be pursued in the study of the ancient British skull is to determine the *normal form*, and then to ascertain the usual deviations from it. This simple method, which has been employed in the elucidation of other natural objects, will reduce the subject to as great order as it admits of, and render description and delineation easy to be understood. A knowledge of the general character of the British skull is not to be obtained from the examination of those belonging to one tribe only, but from a comparative investigation of crania derived from many. It is believed by Mr. Davis that a skull derived from the Green-Gate-Hill Barrow, exhibits the true *typical form* of the ancient British cranium. Its most marked distinctive features are, the shortness of the face, which is. at the same time, rugged with elevations and depressions, the indications of wild passions operating on the muscles of expression; zygomatic arches not unusually expanded; the nose short, projecting at an angle too great to be graceful; immediately above its root rises an abrupt prominence occasioned by the large frontal sinuses, which passes on the sides into the elevated superciliary ridges, and produces a deep depression between the nose and forehead, giving to the profile a savage character; the osseous case for the brain upon the whole not large, rather than small; the occipito-frontal diameter somewhat contracted, and parietal diameter good. It ranges with the *orthognathic* crania, or those having upright jaws, and inclines to the *brachy-cephalic* division. It presents the uncivilized character, but from the mass of the brain it has evidently belonged to a savage possessed of power, and fitted to profit by contact with men of other races.

Having thus enumerated the chief peculiarities of the *typical* British cranium, Dr. Davis remarks; we may advert to its leading *aberrant forms*, which admit of being arranged in a simple intelligible method. They will be easily understood as the *abbreviated*, or strictly *brachy-cephalic*; the *elongated*, or *dolicho-cephalic*; the *elevated*, or, to continue the terms, the *acro-cephalic*; and the *expanded* or *platy-cephalic*.

It must be added, however, such a system as that adopted by Mr. Davis here, of classing under the convenient title of "*aberrant forms*" cranial peculiarities of the widest possible diversity, seems irreconcileable with the law of permanence of ethnic forms. Unless indeed guarded to an extent not at all apparent in the above remarks, it would put an end to all ethnical deductions from cranial or osteological evidence. The grounds, however, on which so comprehensive a statement is based may be looked for in the forthcoming "*Crania Britannica*" of the author. Meanwhile he thus partially alludes to some of them:—

Notwithstanding these aberrant forms, the whole series bears the impress of so many similar features, as to shew that it constitutes one natural group. The dolicho-cephalic has been supposed to indicate an "Allophylian" or "pre-Celtic" race, but it may probably be regarded as more properly a family peculiarity in some cases, and accidental in others, in which it has been met with in the same Barrow, and in a position proving the interment to be equally ancient, with a calvarium of the normal form. Stress has been laid upon the circumstance that it has occurred in *Chambered Barrows*, resembling the famous one of New Grange. The best informed antiquaries accord to these Barrows an extremely early date, but, that they have altogether preceded simpler and ruder sepulchral cairns, and were erected by a distinct antecedent race, appear to stand in need of much confirmatory evidence before they can be admitted with tolerable confidence.

D. W

CHEMISTRY.

Soft Sulphur.—Baudrimont has found that fresh soft sulphur left for five or six days in contact with oil of turpentine in a closed tube, becomes opaque and covered with small transparent brilliant crystals, which are also deposited on the sides of the tube They are modifications of the symmetrical octohedron. This arises probably from the greater solubility of soft sulphur in oil of turpentine —*Comptes Rendus, Ap.* 28.

Carbonic Oxide.—Grimm and Ramdohr, have found that the Carbonic Oxide gas, prepared by Fownes' process (heating 1 part ferrocyanide of potassium with 9 parts concentrated sulphuric acid,) is not quite pure, containing a small quantity of carbonic as well as of sulphurous acid. It may be perfectly purified by solution of potassa.—*Ann. d. Ch. u. Ph*, *Ap.*, 1856

Bone Earth.—Wöhler has found that bone-dust if left some time in contact with water gives up a certain proportion of the phosphates of lime and magnesia. The same result is obtained if the water be perfectly freed from carbonic acid by long boiling. The quantity dissolved seems to increase, as the organic matter putrifies This fact is of considerable importance in reference to agriculture.—*Ann. d. Ch u. Ph. Ap.* 1856.

Pure Silver.—Wicke dissolves the alloy of copper and silver in nitric acid, precipitates with hot solution of carbonate of soda, boils the precipitate with a solution of grape sugar by which the copper is obtained in the form of suboxide and the silver as metal. The precipitate is treated with a hot solution of carbonate of ammonia, which dissolves the oxide of copper but none of the silver.—*Ann. d. Ch. u. Ph. Ap*, 1856.

Test for Iodine.—Liebig recommends the addition of a small quantity of an alkalic iodate, followed by sulphuric or muriatic acid to a solution containing so small a quantity of iodide that no coloration is produced by starch and nitric acid; in this case a much deeper colour is produced. Neither iodic acid nor iodide of potassium produces any colour with muriatic acid and starch paste, The mother liquors of some mineral springs produce the colour without the addition of the iodate; they must contain some substance which acts in a similar manner, possibly nitrates.—*Ann. d. Ch. u. Ph Ap.*, 1856.

Determination of Chlorine.—Levol has described a method of determining chlorine by means of a normal solution of nitrate of silver, in which he renders the completion of the precipitation perceptible by an addition of phosphate of soda, the presence of an excess of silver being indicated by the yellow tint of the precipitate. This colour being very faint, Mohr recommends the use of chromate of potash, the red colour of the chromate of silver becomes perceptible when a very minute excess of the silver solution has been employed. The chromate and not the bichromate should be used and the solution must not be acid. Mohr has employed the process in the examination of urine, well water, mineral waters, saltpetre, potashes. soda, and chlorate of potash, and always with concordant results.—*Ann. d. Ch. u. Ph. Ap.*. 97.

Silvering.—Liebig has given valuable directions for silvering glass mirrors in the cold, the silvering is effected by a solution of ammoniacal nitrate of silver. excess of caustic potassa and milksugar.—*Ann. d. Ch. u. Ph.. April,* 1856, *Ch. Gaz.* 327.

Furfurine —Svanberg and Bergstrand have examined the sulphate, phosphates and tartrate. The formula they give to the alkaloid is $C^{30} H^{12} O^{6} N^{2}$.—*Ch. Gaz.* 324.

New Alcohols.—Cahours and Hoffmann have discovered a new alcohol belonging to a new series which they term the Acrylic series. By distilling glycerine Redtenbacher obtained acroleine which with oxide of silver yields acrylic acid, standing therefore in the relation of aldehyde to acetic acid, the formulæ being $C^{6} H^{4} O^{2}$ and $C^{6} H^{4} O^{4}$. Berthelot and DeLuca by acting on glycerine with iodide of phosphorus obtained iodide of propylene (acryle) $C^{6} H^{5} J$, an analogue of the chloride and bromide already known. The researches of Will and Wertheim shewed a connection between acroleine compounds and the oils of mustard and garlic, the latter being $C^{6} H^{5} S$, and the former $C^{6} H^{5} S, NS^{2}$, this same compound has been obtained by Berthelot and De Luca, by the action of iodide of propylene on sulphocyanide of potassium. Cahours and Hoffmann have now succeeded in obtaining the alcohol of this series, $C^{6} H^{6} O^{2}$.

By acting on oxalate of silver with iodide of acryl the oxalate of acryl is obtained, this with ammonia gives oxamide and the alcohol, the latter with potassium gives hydrogen and the potassium-acrylic-alcohol, this with the iodide gives the ether, or with ethylic iodide the double ether; if the alcohol be distilled with chloride, bromide or iodide of phosphorus, the chloride, bromide or iodide is obtained. A coupled sulphuric acid is also easily formed, also a compound corresponding to xanthic acid. The following ethers have been prepared: oxamate, carbonate, benzoate, acetate and cyanate. This latter with ammonia gives acrylic urea, corresponding to the long known sulphur-urea term of this series. viz: thiosinnamine. With aniline a similar compound is generated. With water or with solution of potassa, the cyanate gives diacrylic urea or sinapoline, in the latter case various volatile bases are also formed, viz: methylamine, propylamine and acrylamine.

This new alcohol will therefore be the third term in a series represented by the formula $C^{n} H^{n} O^{2}$, while the ordinary alcohols are $C^{n} H^{n+2} O^{2}$.—*Ch. Gaz* 324.

Berthelot and De Luca in pursuing their investigations above referred to, have arrived at similar results, but do not appear to have obtained the alcohol. By the action of sodium on the iodide they obtained acryl or allyl as they term it, employing the old name originally proposed by Will and Wertheim.—*Ch. Gaz.* 325.

Chlorides and Bromides of Organic Radicals.—Béchamp has obtained the chlorides of cinnamyle, benzoyle, valeryle, butyryle, propionyle, and acetyle, and the bromides of valeryle, butyryle and acetyle, almost in the quantity indicated by theory, by distilling the monohydrated acids with the protochloride or protobromide of phosphorus, in the proportions corresponding to the following equation $2\ RO, HO+P\ Cl^{3} = Cl\ H+PO^{3}, HO+2\ R\ Cl$

The mixture is gently heated as long as hydrochloric acid is evolved, the volatile chloride distilled off from the mixture, or if it separates as a distinct layer, it is decanted and rectified by itself. This plan is better as the phosphorous acid is apt to evolve phosphuretted hydrogen towards the end of the distillation. The compounds whose boiling points differ most from that of the chloride or bromide of phosphorus, are most readily obtained.—*Ch. Gaz.* 325.

Anisoic Acid.—By the action of weak nitric acid upon oil of anise, Limpricht has obtained a compound to which he gives the above name, and which seems to be the first product of oxidation, preceding anisaldehyde. Anisoine $C^{20} H^{12} O^{2} + 6 HO + 4 O = C^{20} H^{18} O^{12}$. He has examined several of the salts, the silver compound is $C^{20} H^{17} O^{11}$, Ag O.—*Ch. Gaz.* 325.

Anilotic Acid.— Major has examined the acid obtained by Piria by the action of nitric acid upon salicine, to which he gave the above name, and states it to be identical with nitrosalicylic. Piria denies this, and recommends for its formation the following process : Into a stoppered bottle, 1 part of powdered salicine and 6 to 8 parts of nitric acid of 20° B are put, the bottle is closed and placed in a cool place, hyponitrous acid is formed, the fluid becomes green, and after some time crystals of anilotic acid separate. If the process be conducted in an open vessel, the liquid becomes yellow, and helicine is formed. The properties of the acid are described.—*Ch. Gaz.*, 325.

Arachic Acid.—Scheven and Gössmann have described the salts, ether, amide and glyceride of the above acid. Its formula is $C^{40}H^{40}O^{4}$; the acid is obtained from ground nut oil.—*Ch. Gaz.*, 326.

Ethylamine.—Emil Meyer has described various salts aud double salts of this base, with phosphoric, sulphuric and molybdic acids, &c., &c.—*Ch. Gaz.* 327.

Acids in the Animal Organism.—Bertagnini finds that camphoric acid passes unchanged into the urine, the anhydrous acid becomes hydrated, anisic acid passes unchanged, salicylic acid rapidly passes into the urine as indicated by the iron test, but a portion becomes converted into a new compound which he calls salicyluric acid, having taken up the elements of glycocine and lost two equivalents of water. The acid can be separated by evaporating the urine, separating from the salts, acidulating with hydrochloric acid, shaking with ether, evaporating, and recrystallizing. The salicylic acid is removed by heating to 284—302 F in a current of air,—the residue is decolorized and crystallized. The formula is $C^{18}H^{9}NO^{8}$.—*Ch. Gaz.*, 325.

Saponification.—Pelouze finds that fats can be readily saponified by the anhydrous oxides or their hydrates in a solid form, if the mixture be heated to 482° F. With suet the soap formed yields from 95 to 96 per cent. of the suet operated on. During the reaction a white smoke is evolved with an odour of burnt sugar, that of acetone is also perceptible. 10 parts of anhydrous lime are sufficient for 100 parts of suet, with 12 or 14 the reaction takes place with much greater facility; but on operating with large quantities it is difficult to keep within bounds so as to prevent decomposition.

Slaked lime in the proportion of 10 to 12 per cent. rapidly saponifies fats at a temperature between 410° 447° F. Two pounds of suet with 120 grammes of slaked lime were saponified in one hour; if the temperature be raised rapidly to 482°, the process may be completed in a few minutes.

This fact promises to be of very great importance to the manufacturers of the so-called stearine candles.

H. C.

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

Latitude—43 deg. 39.4 min. North. Longitude—79 deg. 21 min. West. Elevation above Lake Ontario, 108 feet.

Day.	Barom. at temp. of 32°.				Temp of the Air.				Mean Temp +or— of the Av'age.	Tens. of Vapour.				Humidity of Air.				Direction of Wind.			Mean Direction.	Velocity of Wind.				Rain in Inches.	Snow in Inches.
	6 A.M.	2 P.M.	10 P.M.	MEAN	6 A.M	2 P.M	10 P.M	ME'N		6 A.M	2 P.M	10 P.M	M'N	6 A.M	2 P.M	10 P.M	M'N	6 A.M.	2 P.M.	10 P.M.		6 A.M	2 P.M	10 P.M	ME'N		
					°	°	°	°	°												°						
1	29.858	29.723	29.556	29.6945	46.7	46.2	45.2	46.10	— 0.32	.193	.228	.279	.236	.62	.74	.94	.77	E N E	E	E	E 4 N	24.8	24.2	16.0	20.89	0.790	...
2	.373	.357	.438	.3907	40.6	46.1	45.3	44.08	— 2.63	.238	.286	.265	.262	.95	.93	.89	.92	E	E b N	E N E	E 23 N	17.8	10.6	7.2	10.25	.195	...
3	.472	.541	.599	.5468	44.5	50.8	43.8	46.30	— 0.75	.226	.233	.226	.216	.78	.64	.80	.70	N N E	S S W	N b W	N 10 W	10.4	11.5	12.4	11.91	...	...
4	.698	.661	—	—	39.2	51.2	—	—	—	.131	.151	—	—	.54	.40	—	—	N W b N	N N W	N	N 22 W	11.8	22.2	12.9	15.62	...	...
5	.810	.898	.969	.8922	41.8	49.2	40.0	44.27	— 3.42	.164	.199	.164	.179	.63	.57	.67	.62	N b W	S b E	E b N	E 9 N	14.1	11.6	3.6	8.77	...	...
6	.950	.815	.697	.8138	44.6	49.8	49.9	48.08	+ 0.05	.126	.150	.225	.175	.48	.42	.64	.53	E b N	E	E N E	E 11 N	9.0	21.6	8.9	12.47	...	...
7	.639	.569	.514	.5705	48.2	56.4	46.5	50.00	+ 1.58	.186	.198	.190	.193	.56	.43	.61	.55	E b N	E	Calm.	E 9 N	10.2	24.8	0.0	10.47	...	...
8	.491	.524	.520	.5133	44.9	45.6	45.4	45.10	— 3.68	.222	.257	.261	.249	.75	.85	.87	.84	E b N	E b N	N E	E 24 N	12.8	14.4	6.5	11.01	.330	...
9	.520	.546	.566	.5442	42.0	46.5	41.3	43.12	— 6.05	.231	.264	.230	.239	.87	.84	.89	.86	E N E	E N E	E	E 22 N	10.5	7.4	3.0	5.28	.095	...
10	.483	.509	.489	.4982	44.3	57.7	57.1	54.47	+ 4.97	.262	.369	.229	.264	.91	.66	.50	.64	N W b N	S S W	N b W	N 29 W	3.2	8.8	8.3	9.45	...	...
11	.499	.455	—	—	55.6	67.5	—	—	—	.361	.356	—	—	.83	.54	—	—	N N W	S W b S	N W b N	W 34 N	11.4	7.2	3.5	5.99	...	...
12	.486	.661	.716	.6262	55.5	45.8	46.8	49.83	— 0.33	.251	.189	.254	.225	.60	.62	.74	.64	N W b W	N b W	N	N 11 W	9.6	14.5	11.4	14.21	.055	...
13	.776	.838	.838	.8298	44.8	47.4	43.4	45.28	— 5.28	.183	.227	.227	.219	.70	.71	.82	.74	N	E	E N E	E 16 N	5.5	9.2	4.7	6.45	...	...
14	.801	.697	.650	.7127	46.0	58.9	51.7	52.73	+ 1.85	.253	.347	.335	.317	.82	.71	.89	.81	E N E	E b S	S S E	E 14 S	6.0	8.9	1.2	4.67	.235	...
15	.599	.488	.533	.5380	51.7	62.1	60.7	58.62	+ 7.33	.345	.383	.444	.391	.91	.70	.86	.81	Calm.	S W b S	N W b N	W 30 S	0.0	16.1	10.5	9.14	.125	...
16	.709	.677	.641	.6700	46.7	57.1	46.0	50.58	— 1.00	.307	.335	.209	.282	.97	.73	.69	.77	N b W	S b W	N	N 11 W	13.6	4.0	13.8	7.25	...	...
17	.608	.494	.369	.4865	45.6	58.1	55.6	54.25	+ 2.27	.206	.284	.392	.302	.68	.60	.90	.72	N N E	E b N	E N E	E 17 N	6.1	10.2	10.5	8.88	2.135	...
18	.364	.433	—	—	56.7	57.6	—	—	—	.423	.417	—	—	.94	.90	—	—	N E b N	E b S	W S W	N 32 W	4.2	0.4	0.6	1.35	.025	...
19	.404	.296	.276	.3210	52.1	61.8	60.0	57.85	+ 5.23	.372	.437	.276	.361	.97	.81	.54	.77	W b N	S	W N W	W 20 S	2.0	14.6	10.3	9.92	...	...
20	.388	.480	.595	.5012	55.8	64.3	49.9	56.50	+ 3.48	.327	.217	.149	.227	.75	.42	.41	.50	N N W	N N W	N b W	N 19 W	15.4	20.5	11.2	13.84	...	...
21	.736	.759	.778	.7613	45.6	51.3	48.5	49.58	— 3.73	.152	.223	.223	.208	.51	.60	.66	.60	N	S b W	N b W	N 28 W	8.4	9.0	10.1	7.70	...	...
22	.856	.775	.674	.7603	46.0	64.6	50.0	53.88	+ 0.18	.209	.310	.240	.251	.68	.58	.68	.64	Calm.	S S E	S S W	S 17 W	0.0	4.8	2.0	3.24	...	...
23	.647	.580	.652	.6100	56.0	74.3	61.4	63.72	+ 9.75	.304	.394	.504	.398	.69	.48	.95	.71	S W b W	S W b S	S W b W	S 41 W	1.5	15.2	10.0	7.23	.110	...
24	.479	.417	—	—	60.7	80.1	—	—	—	.399	.443	—	—	.77	.44	—	—	S W b W	W N W	N N W	N 45 W	1.2	21.0	13.4	14.98	...	...
25	.581	.585	—	—	45.0	54.2	—	—	—	.162	.187	—	—	.55	.45	—	—	W	N N W	N b W	N 32 W	17.8	25.0	10.7	18.46	...	...
26	.694	.624	.539	.6132	51.0	69.3	53.5	57.62	+ 2.63	.267	.256	.345	.293	.73	.36	.86	.66	N N W	N W b N	Calm.	N 28 W	14.7	10.5	0.0	6.65	...	...
27	.436	.307	.186	.2952	49.9	57.4	51.0	53.10	— 2.18	.279	.363	.344	.322	.79	.79	.94	.82	Calm.	Calm.	Calm.	E 25 S	0.0	0.0	0.0	1.48	.355	...
28	.125	.201	.342	.2292	54.6	60.1	47.0	53.48	— 2.17	.383	.340	.233	.306	.91	.66	.74	.75	W b N	N N W	Calm.	N 32 W	2.9	24.4	0.0	12.95	Inap	...
29	.320	.354	.446	.3820	45.2	43.4	39.9	42.42	— 13.53	.228	.256	.157	.215	.76	.92	.64	.79	N E	N N E	N W	N 1 W	1.6	10.9	7.6	9.87	.030	...
30	.530	.593	.702	.6198	40.2	45.2	37.3	41.02	— 15.23	.216	.136	.194	.167	.88	.45	.87	.67	N W b N	N N W	W b N	N 41 W	10.5	20.4	6.8	13.22	...	Inp
31	.786	.697	.692	.7470	39.1	62.3	55.5	51.67	— 4.88	.160	.224	.268	.225	.67	.41	.62	.60	W N W	W	W	W 24 S	11.2	17.3	7.1	10.42	.100	...
M	29.5960	29.5770	29.5760	29.5822	46.82	54.95	48.95	50.52	— 0.96	.242	.264	.263	.259	.75	.64	.75	.71	N 14 E	N 8 W	N 1 W	N 4 E	8.55	13.59	7.23	9.81	4.580	Inp

Highest Barometer .... 29.969 at 10 p. m., on 5th } Monthly range=
Lowest Barometer .... 29.125 at 6 a. m., on 28th } 0.844 inches.

Highest registered temperature......... 82°2 at p. m., on 24th } Monthly range=
Lowest registered temperature......... 31°2 at a. m., on 4th } 51°0

Mean maximum Thermometer......... 59°56 } Mean daily range = 18°93
Mean minimum Thermometer......... 40°63 }

Greatest daily range .... 44°2 from p. m. of 24th to a. m. of 25th.
Least daily range.......................... 7°0 from p. m. of 8th to a. m. of 9th.

Warmest day......... 23rd ... Mean temperature......... 63°72 } Difference = 22°70.
Coldest day........... 30th ... Mean temperature......... 41°02 }

Greatest intensity of Solar Radiation ... 96°8 on p. m. of 24th } Monthly range=
Lowest point of Terrestrial Radiation ... 21°5 on a. m. of 30th } 75°3

No Auroral Light observed this month; possible to see aurora on 16 nights; impossible to see aurora on 15 nights.

Snowing on 30th, time and quantity inappreciable. Raining on 14 days,—depth 4.580 inches—raining 89.4 hours.

Mean of cloudiness =0.59; most cloudy hour observed, 4 p. m., mean =0.61; least cloudy hour observed, 8 a. m., mean, =0.55.

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

North.	West.	South.	East.
3815.24	2096.21	857.29	2318.37

Mean direction of the wind, N 4° E.

Mean velocity of the wind......... 9.81 miles per hour.

Maximum velocity .... 33.7 miles per hour, from 11 a. m. to noon on 25th.

Most windy day........................ 1st...Mean velocity 20.89 miles per hour.

Least windy day ....18th...Mean velocity 1.35 ditto.

Most windy hour ... 1 p. m. ....Mean velocity 13.65 ditto.

Least windy hour ...1 a. m. ....Mean velocity 6.19 ditto.

Mean diurnal variation = 7.46 miles.

4th—Wild Pigeons and Humming Birds first observed.

5th and 6th—Hoar frost on boards at 5 and 6 a. m.

10th—Large Meteor in N. W. at 9.18 p. m., time of flight about 15 seconds.

15th—Wild Strawberries in bloom.

" —Thunderstorm from 6.30 to 8.30 p. m.

" —Very perfect Rainbow at 7.10 p. m.

16th—Large Halo round the Moon from 10 p. m.

19th—Very dense Fog 5 to 8 a. m.

23rd—Thunderstorm 6.30 to 10.10 p. m.

30th—Slight particles of Snow and hail falling during the day.

31st—Hoar frost on boards, and thin Ice on water 6 to 8 a. m.

COMPARATIVE TABLE FOR MAY.

Year.	Temperature.					Rain.		Snow.		Wind.	
	Mean.	Diff. from Aver.	Max. obs'd.	Min. obs'd.	Range.	Days.	Inch's.	Days.	Inch's.	Mean Direc'n.	Mean Force or Velocity.
	°	°	°	°	°						
1840	53.8	+2.4	74.5	30.8	43.7	9	4.150	...	not	...	...
1841	50.5	—0.9	76.2	26.6	49.6	11	2.350	1	Reg.	...	0.35 lbs.
1842	49.1	—2.3	74.3	30.0	44.3	7	1.275	...		...	0.53 "
1843	49.1	—2.3	79.6	28.9	50.7	5	1.570	...	...	...	0.52 "
1844	53.6	+2.2	77.7	29.0	48.7	14	5.670	...	...	...	0.30 "
1845	49.6	—1.8	76.6	29.4	47.2	8	2.300	...	...	...	0.55 "
1846	55.5	+4.1	78.1	34.3	43.8	9	4.375	...	...	...	0.46 "
1847	54.4	+3.0	72.5	27.8	44.7	12	2.040	...	...	...	0.29 "
1848	54.1	+2.7	78.5	31.9	46.6	13	2.520	...	...	N 39° W	4.93 miles
1849	48.0	—3.4	72.5	32.7	39.8	16	5.115	...	...	E 39° N	5.33 "
1850	47.6	—3.8	76.3	31.1	45.2	7	0.545	1	Inapp	W 26° N	6.32 "
1851	51.3	—0.1	73.2	28.7	44.5	12	2.950	1	0.5	N 32° W	6.34 "
1852	51.4	0.0	73.3	34.5	38.8	7	1.125	1	Inapp	W 8° S	4.00 "
1853	50.9	—0.5	78.4	38.4	40.0	17	4.420	1	Inapp	N 20° W	5.14 "
1854	52.2	+0.8	69.0	27.6	41.4	11	4.630	...	...	E 24° S	5.38 "
1855	53.1	+1.7	74.8	33.9	40.9	6	2.565	2	0.9	N 1° W	5.93 "
1856	50.5	—0.9	80.1	35.5	44.6	14	4.580	1	Inapp	N 4° E	9.81 "
Mean	51.45	...	75.62	31.24	44.38	10.5	3.069	0.5	0.1	...	5.91 miles

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

Latitude—43 deg. 39.4 min. North. Longitude—70 deg. 21 min. West. Elevation above Lake Ontario, 108 feet

Day.	Barom. at temp. of 32°.				Temp. of the Air.				Mean Temp +or— of the Av'age.	Tens. of Vapour.				Humidity of Air.				Direction of Wind.			Resultant Direction	Velocity of Wind.					Rain in inches.
	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M	2 P.M	10PM	ME'N		6 A.M	2 P.M.	10 P.M.	M'N	6 A.M	2 P.M	10 P.M.	M'N	6 A. M.	2 P. M.	10 P.M.		6 A.M	2 P.M	10 P.M.	Result'.	M'N	
					°	°	°	°	°												°						
1	29.661	29.639	—	—	48.3	65.3	—	—	—	.507	.392	—	—	.92	.64	—	—	E b s	s s E	w b N	N 45 W	3.6	7.4	0.5	1.75	5.39	0.035
2	.719	.644	29.607	29.6507	51.7	54.1	56.4	54.80	— 2.47	.325	.347	.415	.364	86	85	.93	.86	Calm	s E b E	s w b s	s 22 E	0.0	5.6	0.4	0.83	3.27	.315
3	.648	.577	.588	.5987	53.5	66.2	58.5	61.02	+ 3.47	.376	.524	.434	.470	93	84	91	89	s b w	s E	N b w	E 13 s	3.8	6.0	1.8	4.08	5.29	.015
4	.517	.443	—	—	52.0	58.3	—	—	—	.370	.448	—	—	94	88	—	—	E b N	N b E	E	E 8 s	6.4	5.4	2.5	4.08	4.79	.160
5	.688	.749	.753	.7313	54.6	60.0	56.4	57.33	— 0.82	.344	.344	.384	.354	82	68	86	78	NE b N	s b E	E b N	E 6 s	0.4	6.0	7.4	4.76	5.59	...
6	.733	.724	.662	.6990	53.1	60.5	56.7	57.17	— 1.28	.380	.404	.386	.396	96	78	86	87	NE b N	E b s	E N E	E 14 N	7.0	10.8	2.6	6.84	6.97	...
7	.590	.534	.451	.5130	49.5	54.9	56.4	53.97	— 4.78	.313	.380	.427	.372	90	90	96	90	NE b E	s E b E	W W N	E 26 N	1.2	1.1	8.4	2.97	5.04	.445
8	.390	.364	—	—	54.6	57.4	—	—	—	.396	.404	—	—	76	63	—	—	E b s	E s E	s w b s	E 31 s	4.0	8.3	2.0	0.66	3.81	.055
9	.391	.424	.465	.4332	55.3	62.1	55.4	58.38	— 1.10	.361	.453	.395	.410	84	83	92	85	W N W	s b W	N E	s 38 W	4.1	5.2	3.8	2.18	3.45	Inap
10	.517	.496	.483	.5015	56.0	71.1	54.6	61.13	+ 1.35	.405	.505	.383	.420	92	69	91	81	Calm	s s E	E b N	s 19 E	0.0	5.6	1.0	2.26	2.98	...
11	.553	.504	.488	.5053	59.2	67.8	58.5	61.57	+ 1.58	.415	.453	.412	.425	84	69	86	80	Calm	s E	N E b E	E 24 s	0.0	9.5	1.2	3.20	3.58	...
12	.458	.592	.460	.4312	59.2	65.0	54.9	59.08	— 1.18	.415	.452	.394	.419	84	75	93	86	E b N	N W	s s W	N 10 E	0.2	15.2	0.6	0.59	4.76	.120
13	.385	.323	.342	.3492	54.6	66.0	56.7	59.10	— 1.48	.374	.473	.349	.383	90	76	76	78	E s E	s w b w	w b s	w 26 s	4.6	8.0	5.8	2.73	5.95	.090
14	.348	.394	.454	.4007	55.3	58.2	52.0	55.18	— 5.65	.394	.384	.313	.357	92	82	82	84	Calm	w b s	w b s	w 25 s	0.0	7.0	5.0	6.68	7.23	.025
15	.443	.482	—	—	53.9	60.0	—	—	—	.311	.322	—	—	86	81	—	—	W N W	w b s	W	W 9 s	7.6	7.5	1.0	5.51	6.22	...
16	.631	.665	.675	.6605	53.5	67.5	52.5	58.15	— 3.20	.330	.355	.335	.348	82	54	86	74	Calm	s	Calm	s s W	0.0	6.0	0.0	3.66	3.69	...
17	.683	.626	.535	.6060	54.8	65.5	62.1	60.55	— 1.10	.371	.389	.310	.352	89	63	56	68	Calm	E	E N E	E 1 N	0.0	7.7	7.8	5.62	5.97	...
18	.514	.513	.541	.5235	55.3	64.4	57.6	60.43	— 1.52	.346	.482	.436	.430	81	81	94	83	N E	E	Calm	E 12 s	6.8	10.8	0.0	3.06	4.50	...
19	.577	.559	.551	.5645	59.9	75.0	59.2	65.35	+ 3.22	.452	.592	.425	.487	89	70	87	80	w b N	s	s w b s	s 27 w	1.2	7.5	0.2	5.64	6.10	...
20	.601	.570	.625	.5978	63.2	79.1	72.1	71.13	+ 8.68	.490	.586	.625	.566	87	61	82	78	s w	s s w	w	s 36 w	7.4	14.5	1.6	6.28	6.60	...
21	.731	.676	.639	.6770	68.9	81.8	71.4	74.57	+11.90	.561	.628	.527	.575	82	60	72	70	s b w	s b w	s w b w	s 34 w	0.4	9.9	3.5	4.43	4.75	...
22	.669	.643	—	—	70.7	78.6	—	—	—	.626	.767	—	—	80	73	—	—	w s w	s E	N b w	N 31 w	2.4	3.6	8.5	4.17	7.27	.335
23	.778	.765	.715	.7502	61.7	62.7	53.8	59.42	— 3.73	.490	.386	.311	.364	91	69	76	75	E N E	s E b s	Calm	E 29 s	8.9	3.4	0.0	2.93	3.01	...
24	.688	.600	.439	.5690	57.3	65.0	57.8	60.45	— 2.90	.352	.342	.431	.370	77	56	92	74	Calm	E	w N w	E 6 s	0.0	9.5	4.0	3.71	5.52	.310
25	.486	.489	.513	.4962	61.7	73.9	65.0	66.92	+ 3.37	.509	.672	.434	.544	95	83	72	84	s s w	s w b s	N b E	w 40 s	5.0	6.4	3.8	2.08	3.85	...
26	.520	.448	.505	.4883	64.3	75.5	67.5	69.48	+ 5.60	.461	.627	.481	.534	79	73	74	76	Calm	s s E	N w b w	N 43 w	0.0	0.4	6.6	2.85	4.27	..
27	.633	.654	.591	.6233	60.7	70.5	58.9	64.42	+ 0.35	.326	.362	.376	.360	63	49	77	62	N b w	s w b s	Calm	s 27 E	9.0	5.8	0.0	0.59	2.74	...
28	.508	.328	.247	.3507	62.7	81.8	73.3	73.08	+ 8.80	.421	.671	.667	.582	76	64	83	73	N E b N	s wb s	s w b w	s 35 w	0.9	13.8	5.0	4.59	4.85	...
89	.230	.207	—	—	72.5	74.3	—	—	—	.622	.603	—	—	78	45	—	—	Calm	s w	s w b w	w 41 s	0.0	20.8	3.5	5.24	5.55	1.295
30	.230	.346	.696	.4442	67.8	77.7	56.9	67.82	+ 3.23	.608	.483	.370	.469	92	52	82	71	s w	w N w	N w b w	w 25 N	5.4	22.4	5.9	14.60	16.03	...
M	29.5654	29.5416	29.5428	29.5484	58.07	67.76	59.36	62.11	+ 1.08	.409	.471	.418	.432	.86	.71	.84	.79	....	....	....	....	3.01	8.37	3.15	... ...	5 30	3.200

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR JUNE.

Highest Barometer .... 29.798 at 8 a. m. on 23rd } Monthly range=
Lowest Barometer .... 29.207 at 2 p m. on 29th } 0.591 inches.

Highest registered temperature .... 89°2 at p. m. on 29th } Monthly range=
Lowest registered temperature .... 42°0 at a. m. on 1st } 47°2

Mean maximum Thermometer......... 71°59 } Mean daily range = 19°20
Mean minimum Thermometer......... 52°39 }

Greatest daily range........................ 28°8 from p. m. of 30th to a. m. 1st July
Least daily range .... 10°4 from p. m. of 8th to a. m. of 9th.

Warmest day............ 21st ... Mean temperature......... 74°57 } Difference= 20°60.
Coldest day............... 7th ... Mean temperature......... 53°97 }

Greatest intensity of Solar Radiation.. 104°8 on p. m. of 29th } Monthly range=
Lowest point of Terrestrial Radiation 35°0 on a. m. of 1st } 69°8

Aurora observed on 1 night, viz.. on the 10th; possible to see Aurora on 18 nights; impossible to see Aurora on 12 nights.

Raining on 13 days; depth, 3.200 inches; duration of fall, 27.9 hours.

Mean of cloudiness=0.47; most cloudy hour observed, 2 p. m., mean=0.58; least cloudy hour observed, 10 p. m., mean=0.35.

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

North.	South.	East.	West.
732.70	1340.86	1250.04	1477.80

Resultant direction of the wind, S 21° W; Resultant Velocity, 0.90 miles per hour.

Mean velocity of the wind............ 5.30 miles per hour.
Maximum velocity .... 26.0 miles per hour, from 3 to 4 p. m. on 30th.

Most windy day......................... 30th...Mean velocity 16.03 miles per hour.
Least windy day......................... 27th...Mean velocity 2.74 ditto

Most windy hour................ 1 to 2 p. m...Mean velocity 8.52 ditto } Difference
Least windy hour............... 1 to 2 a. m...Mean velocity 2.74 ditto } 5.78 miles.

This month exhibits no striking examples of abrupt or extensive change, either of the Barometer or of Temperature.

In the Comparative Table, the only deviations to be noticed of the Monthly Means from the Means derived from the aggregate of past years, are shown by the Minimum Temperature, which is the highest on record, save that of 1850. the Range, which is more than 9° less than the Average; and the Mean Velocity of the Wind.

The columns Resultant Direction and Resultant Velocity shews that the total displacement of air produced in the month is equivalent to that which would have been produced by a wind blowing constantly from S 21° W, with a uniform Velocity of 0.9 miles per hour.

The total displacement in the months of June since 1848, inclusive, is equal to that of a constant wind blowing from S 84° W, with a velocity of 0.46 miles.

On June 1st, at 30 min. past noon, a violent Squall occurred, accompanied by violent thunder, lightning and hail. The stones were of an oblate spheroidal form and unusually large, the greater axis amounting in many cases, to ⅘ of an inch. From their hardness, they appeared to have been formed at an extremely low temperature.

COMPARATIVE TABLE FOR JUNE.

YEAR.	TEMPERATURE.					RAIN.		WIND.		
	Mean.	Difference from Average.	Maximum observed.	Minimum observed.	Range.	No. of d'ys	Inches.	Resultant. Direction.	Resultant. Velocity	Mean Velocity.
1840	59°.8	−1.6	78°.5	37°.1	41.4	11	4.860	—	—	—
1841	65.6	+4.2	92.8	45.7	47.1	9	1.560	—	—	0.36 lbs.
1842	55.6	−5.8	73.9	28.0	45.9	15	5.755	—	—	0.31 "
1843	58.4	−3.0	81.3	28.5	52.8	12	4.595	—	—	0.27 "
1844	59.9	−1.5	82.8	33.1	49.7	9	3.535	—	—	0.19 "
1845	61.0	−0.4	83.6	40.9	42.7	11	3.715	—	—	0.27 "
1846	63.3	+1 9	83.3	41.5	41.8	10	1.920	—	—	0.32 "
1847	58 4	−3.0	78.3	36.7	41.6	14	2.625	—	—	0.30 "
1848	62.9	+1.5	92.5	38.3	54.2	8	1.810	W 29° N	1.90	4.51 miles.
1849	63.2	+1.8	84 9	45.2	39.7	7	2.020	E 19 S	0.49	3.32 "
1850	64.3	+2.9	83.2	49.0	34.2	10	3.345	W 30 S	0.38	4.54 "
1851	59.2	−2.2	79.2	41.2	38.0	11	2.695	S 2 W	1.[illegible]	4 42 "
1852	60.8	−0.6	86.1	43.6	42.5	10	3.160	W 14 S	1.49	4 09 "
1853	65.5	+4.1	86.3	43.3	43.0	9	1.550	N 14 W	0.27	[illegible] "
1854	64.1	+2.7	88.7	47.4	41.3	9	1.460	N 21 E	0.80	[illegible] "
1855	59.9	−1.5	90.7	40.6	50.1	17	4.070	W 21 N	1.32	5.70 "
1856	62.1	+0.7	82.6	48.3	34.3	13	3.200	S 21 W	0.90	5.30 "
Mean	61.41	...	84.04	40.49	43.55	1.09	3.051	—	—	4.41 miles.

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

Latitude—43 deg. 39.4 min. North. Longitude—79 deg. 21 min. West. Elevation above Lake Ontario, 108 feet.

Day.	Barom. at temp. of 32°.				Temp. of the Air.				Mean Temp. + or — of the Av'age.	Tens. of Vapour.				Humidity of Air.				Direction of Wind.			Resultant Direction.	Direction of Wind.					Rain in inches.
	6 A.M.	2 P.M.	10 P.M.	Mean.	6 A.M	2 P.M	10AM	ME'N		6 A.M	2 P.M	10 P.M.	M'N	6 A.M	2 P.M.	10 P.M.	M'N	6 A. M.	2 P. M.	10 P.M.		6 A.M	2 P.M.	10 P.M.	Result'.	M'E'N	
1	29.838	29.817	29.809	29.8178	°57.1	°61.6	°55.1	°60.03	° — 4.73	.346	.377	.344	.354	.76	.61	.81	.70	N N W	S S W	Calm	° S 64 E	4.8	7.6	0.0	0.16	3.91	...
2	739	677	588	.6603	56.4	66.7	54.9	60.18	— 4.82	306	341	370	342	68	53	88	68	Calm	E S E	Calm	S 85 E	0.0	[illegible]	0.0	1.72	2.39	...
3	486	385	419	.4212	64.0	85.1	69.6	73.52	+ 8.37	446	599	470	505	77	51	68	65	W S W	W	W N W	N 72 W	4.2	13.0	1.0	3.57	5.70	...
4	445	528	556	.5152	62.1	67.5	60.3	63.80	— 1 50	394	473	330	394	73	72	64	68	N b E	S	Calm	S 16 E	9.7	9.0	0.0	0.60	3.05	...
5	545	432	391	.4155	56.7	75.6	65.1	66.82	+ 1.45	359	481	508	439	80	56	81	69	Calm	W S W	W b S	S 69 W	0.0	10.2	4.3	6.26	7.83	0 375
6	450	502	—	—	58.9	70.1	—	—	—	381	323	—	—	78	45	—	—	W N W	N b W	N N W	N 18 W	10.8	14.4	8.0	10.63	11 37	...
7	636	656	651	.6413	56.4	65.0	51.4	58.78	— 6.92	301	318	332	318	67	53	88	67	N	S E b E	E	N 76 E	9.7	9.2	3.6	4.76	6.15	...
8	648	640	632	.6415	59.2	67.1	61.7	63.73	— 2.05	311	391	432	394	63	60	81	68	N E	E S E	E b N	N 82 E	9.6	7 0	3.6	7.66	8.10	...
9	662	661	604	.6595	63.2	68.2	59.2	63.83	— 2.15	454	471	426	456	80	71	87	79	E N E	E S E	Calm	N 86 E	8.4	8.2	0.0	3.85	4.54	...
10	658	652	579	.6310	63.2	74.3	62.3	67.33	+ 1.25	483	575	482	511	86	70	88	79	Calm	S	E S E	S 20 E	0.0	6.4	0.2	1.22	1.81	...
11	557	478	368	.4583	65.0	75.4	68.9	70.57	+ 4.38	482	601	515	538	80	71	75	74	Calm	E S E	E	S 83 E	0.0	7.6	5.2	3.81	4.04	...
12	297	241	301	.2842	68.9	74.8	68.4	68.93	+ 2.63	538	599	587	560	78	72	88	82	E	E b S	Calm	S 82 E	4.0	9.0	0.0	2.62	3.14	Inap
13	431	495	—	—	67 5	80.4	—	—	—	545	560	—	—	83	56	—	—	N W	S	S W b W	S 31 W	8.0	8.2	1.5	2.54	3.67	...
14	592	531	483	.5277	67.3	82.2	71.8	73.73	+ 7.82	561	639	696	631	87	60	92	79	Calm	S b W	N W	S 33 W	0.0	11.6	1.0	3.42	4.05	0.405
15	544	616	592	.5860	71.5	83.6	66.4	73.52	+ 7.03	648	474	495	516	86	43	78	67	S W b W	N W b N	W b S	N 29 W	2.0	16.8	2.0	5.21	5.52	...
16	695	623	605	.6305	65.3	85.4	77.4	76.50	+ 9.92	506	614	633	589	84	51	69	67	N W b W	S	W S W	S 23 W	0.6	11.3	2.8	5.11	5.52	
17	569	458	406	.4708	74.7	92.0	76.2	81.77	+15.08	663	714	731	691	80	49	84	68	Calm	S S W	S W	S 51 W	0.0	11.0	9.0	7.40	8.38	...
18	469	407	500	.4477	70.8	79.5	64.6	71.60	+ 4.92	440	406	355	423	59	42	60	57	W S W	W b N	N W b W	N 84 W	5.0	20.0	21.0	13.85	15.80	...
19	521	555	640	.5793	61.4	74.3	61.0	65.90	— 0.88	390	544	329	415	73	67	62	66	N W b W	N W b N	N W b W	N 26 W	9.6	20.2	8.8	14.56	14.85	...
20	717	731	—	—	60.7	74.3	—	—	—	378	348	—	—	72	42	—	—	N N W	N	N W	N 12 W	10.4	14.2	8.8	9.26	10.03	...
21	814	787	809	.8050	60.2	70.9	61.2	66.07	— 0.70	361	412	426	412	71	56	81	66	W	S W b S	W b S	S 56 W	0.2	2.2	2.5	2.71	3.52	0 075
22	835	796	783	.8010	58.5	81.1	67.3	69.90	+ 3.03	381	363	442	395	79	35	68	58	Calm	S S W	W S W	S 45 W	0.0	9.2	4.0	3.75	4.41	...
23	812	761	763	.7775	63 5	76.8	71.8	71.38	+ 4.50	463	627	547	542	81	70	72	72	Calm	S S W	N E	S 10 W	0.0	6.2	6.0	0.92	3.56	0 115
24	815	753	713	.7592	66.5	85.9	70.7	75.82	+ 8.95	545	474	508	529	86	40	70	64	N W	S	N W b W	S 37 W	0.2	8.4	2.0	3.71	4.28	...
25	717	641	628	.6622	67.3	87.6	72.2	76.78	+ 9.82	547	588	538	548	84	47	70	65	Calm	S W b S	S W b S	S 50 W	0.0	17.6	7.0	4.42	5.37	...
26	653	598	610	.6168	69.8	89.4	77.5	79.80	+12.83	570	487	549	537	81	36	60	57	Calm	S	W S W	S 50 W	0.0	8.8	4.0	2.77	4.11	...
27	671	624	—	—	71.1	85.1	—	—	—	576	626	—	—	78	53	—	—	W b N	S	W b S	S 56 W	7.0	5.2	4.0	5 30	6.00	0.085
28	637	614	598	.6145	68.6	83.6	73.1	74.70	+ 7.73	610	595	592	607	90	53	74	74	W N W	S W	W	S 51 W	3.7	6.4	5.8	3.48	3.83	0 050
29	529	413	390	.4317	69.8	75.7	66.8	70.97	+ 4 02	625	711	594	641	89	83	93	87	S W	S S W	S E b E	S 11 W	6.0	9.6	0.2	3.76	4.14	0.015
30	401	468	522	.4707	66.1	82.6	70.4	73.27	+ 6.32	579	470	402	487	93	43	55	63	S b E	N W b N	W b S	N 48 W	0.2	18.5	6.2	7.58	7.92	...
31	592	590	611	.6035	61.8	76.5	64.7	67.97	+ 1.02	432	416	456	440	81	47	76	68	N N W	S b E	E S E	S 44 E	1.8	10.0	5.6	2.01	4.03	...
M	29.6188	29.5844	29.5761	29 591	64.27	77.46	66.30	69.90	+3.66	.472	.510	.485	.489	.79	.56	.76	.69	....	....	....	....	3.74	10.10	4.13	......	5.84	1.120

Highest Barometer . . . . 29.844 at 8 a. m. on 22nd } Monthly range=
Lowest Barometer . . . . 29.241 at 2 p. m. on 12th } 0.603 inches.
Highest registered temperature . . . . 96°6 at p. m. on 17th } Monthly range=
Lowest registered temperature . . . . 49°5 at a. m. on 5th } 47°1
Mean maximum temperature . . 80°36 } Mean daily range = 21°32
Mean minimum temperature . . 59°04 }
Greatest daily range . . . . . . 28°7 from p. m. of 30th to a. m. of 31st.
Least daily range . . . . 13°4 from p. m. of 12th to a. m. of 13th.
Warmest day . . 17th ... Mean Temperature . . . 81°77 } Difference=21°74.
Coldest day . . . 1st ... Mean Temperature . . . 60°03 }
Greatest intensity of Solar Radiation . . 110°2 on p. m. of 17th } Monthly range=
Lowest point of Terrestrial Radiation . 39°5 on a. m. of 5th } 70°7
Aurora observed on 4 nights, viz.: on the 7th, 9th, 10th and 12th; possible to see Aurora on 26 nights; impossible to see Aurora on 5 nights.
Raining on 8 days; depth, 1.120 inches; duration of fall, 9.8 hours.
Mean of cloudiness=0.39; most cloudy hour observed, 4 p. m., mean=0.49: least cloudy hour observed, 10 p., mean=0.24.

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

North.	South.	East.	West.
1577.03	1355.01	727824	1876.13

Resultant direction of the wind, N 79° W; Resultant Velocity, 1.57 miles per hour.
Mean velocity of the wind . . . . 5.84 miles per hour.
Maximum velocity . . . . 28.4 miles per hour, from 5 to 6 p. m. on 18th
Most windy day . . . . 18th—Mean velocity, 15.86 miles per hour.
Least windy day . . . . . . 10th—Mean velocity, 1.81 do
Most windy hour . . . 12 to 1 p. m—Mean velocity, 10.17 do } Difference
Least windy hour . . . 5 to 6 a. m.—Mean velocity, 3.17 do } 7.00 miles.

The Mean Temperature of the month, exceeded only in 1854, was 3° above the average of 17 years; the rain that fell was scarcely one-third of the amount that usually falls during the month of July: and the Mean Velocity of the wind which exceeded the average by 1.31 miles is the highest on record, save that of last year. July 1856, therefore, may be characterized as a hot, dry, and windy month.

The total displacement of air during the month, as shewn by the columns of *Resultant Direction* and *Resultant Velocity* of the wind, was equal to that produced by a wind blowing constantly from N 79° W, with a uniform velocity of 1.57 miles per hour.

The total displacement in the months of July since 1848 inclusive, was equal to that of a westerly wind, having a uniform velocity of 0.31 miles.

COMPARATIVE TABLE FOR JULY.

YEAR.	TEMPERATURE.					RAIN.		WIND.		
	Mean.	Difference from Average.	Maximum observed.	Minimum observed.	Range.	No. of dy's.	Inches.	Resultant. Direction.	Resultant. Velocity	Mean Velocity.
	°	°	°	°	°			°		
1840	65.8	—1.2	79.4	48.2	31.2	6	5.270	—	--	—
1841	65.0	—2.0	86.3	43.2	43.1	10	8.150	—	--	0.27 lbs.
1842	64.7	—2.3	90.5	42.0	48.5	4	3.050	—	—	0.33 "
1843	64.5	—2.5	86.1	40.2	45.9	8	4.605	—	—	0.44 "
1844	66.0	—1.0	86.1	40.5	45.6	12	2.815	—	-	0.19 "
1845	66.2	—0.8	94.6	45.6	49.0	7	2.195	—	—	0.30 "
1846	68.0	+1.0	94.0	44.9	49.1	9	2.895	—	—	0.29 "
1847	68.0	+1.0	87.5	43.8	43.7	8	3.355	—	--	0.19 "
1848	65.5	—1.5	82.7	46.7	36.0	10	1.890	N 14 W	0.18	4.94 miles
1849	68.4	+1.4	89.1	51.0	38.1	4	3.415	S 5 W	0.76	3.52 "
1850	68.9	+1.9	84.9	52.8	32.1	12	5.270	N 81 E	0.59	4.56 "
1851	65.0	—2.0	82.7	52.1	30.6	12	3.625	N 60 W	0.88	4.13 "
1852	66.8	—0.2	90.1	49.5	40.6	8	4.025	N 43 W	0.93	3.33 "
1853	65.6	—1.4	85.4	49.4	36.0	10	0.915	S 76 E	0.31	3.70 "
1854	72.5	+5.5	93.6	53.0	40.6	9	4.805	S 58 W	0.34	4.26 "
1855	67.9	+0.9	88.4	53.1	35.3	13	3.245	S 10 W	0.73	6.47 "
1856	69.9	+2.9	92.0	51.4	30.6	8	1.729	N 79 W	1.57	5.84 "
Mean	66.98	...	87.85	47.49	40.35	8.8	3.567	—	—	4.53

MONTHLY METEOROLOGICAL REGISTER, KINGSTON, CANADA WEST, FEBRUARY, 1856.

BY MR. DONALD M'LENNAN.

Latitude, 44 *deg.* 13.30 *min. North; Longitude,* 76 *deg.* 31.51 *min. West. Height above Sea,* 280 *feet.*

Day.	Barometer at 32°		Thermom.		Thermom. during 24 hours.		Tension of Vapor.		Humidity.		Clouds.		Direction of Wind.		Pressure in lbs avoirdupois.		Rain in inches.	Snow in inches.	Remarks.
	9 A. M.	3 P. M.	9 A. M.	3 P. M.	Max.	Min.	9 A. M.	3 P. M.	9 A. M.	3 P. M.	9 A. M.	3 P. M.	9 A. M.	3 P. M.	9 A. M.	3 P. M.			
1	29.350	29.126	16.5	27.2	23	11	.095	.157	.879	.802	10	10	S E	S	.25	2.0	...	...	Stormy and snowy.
2	29.324	29.286	4	7	19	13	.074	.049	1.000	.627	2	0	W by N	W S W	1.5	1.5	...	...	
3	29.373	29.355	-2	5	4	-5	.055	.050	.633	.540	1	1	W N W	W S W	1.25	1.25	...	...	Clouds. Ci. str.
4	29.413	29.400	2	10.5	9.5	-2	.042	.072	.629	.785	5	5	W	W S W	1.	1.25	...	...	
5	29.713	29.788	10	15	15	9	.065	.069	.730	.644	5	10	W S W	W S W	1.	.5	...	...	A solar halo (morning.)
6	30.086	30.039	14	16	16	11	.088	.092	.852	.856	10	10	W S W	S W	.5	1.	...	...	
7	29.519	29.366	21	31	31	14	.098	.158	.736	.817	10	10	S S E	S S W	1.25	1.25	...	...	Flurries of snow. Slight thaw.
8	29.690	29.661	4	12	31	2	.055	.088	.633	.827	1	2	W N W	W N W	.25	.5	...	...	Clouds. Ci. cu. and str. Mild.
9	29.566	29.567	11	13	12.5	2.5	.065	.087	.730	.847	10	7	W N W	W S W	.0	.5	...	...	Gloomy and cold.
10	29.670	29.628	16	21	21	10.5	.072	.084	.643	.625	10	6	S	S	.25	1.	...	...	Mild.
11	29.469	29.290	30	32	34	21	.129	.170	.669	.848	8	10	S W by S	S S W	1.	.75	...	...	Snow. Slight thaw. Rain.
12	28.960	29.121	21	7	33.5	5.5	.084	.056	.625	.630	10	7	W N W	W S W	1.	1.25	...	...	Clouds. Ci. & cu, Very stormy.
13	29.804	29.784	-13	-2	.5	-18.5	.117	.091	.941	.912	0	0	N W	W S W	.75	1.25	...	...	Cold.
14	29.810	29.695	-5	11	10	-8.5	.045	.067	1.000	.731	0	9	W S W	W S W	.5	.5	...	...	Pleasant.
15	29.410	29.204	7	17	17	2	.068	.084	.678	.730	10	10	S by W	S	1.25	1.25	...	...	Flurries of snow.
16	28.947	28.880	24.5	31.5	32.5	16.5	.085	.135	.616	.699	9	10	W S W	N N W	.0	.0	...	1.	Clouds. Str. ci. and str. cu.
17	29.435	29.491	10	13	12	10	.084	.064	.872	.637	7	7	W	W N W	1.5	2.25	...	1.5	Blowing: cold,
18	29.374	29 779	-3	8	12.5	-6	.048	.059	.520	.638	1	5	W S W	W S W	1.	1.25	...	...	Pleasant.
19	29.826	29.725	5.5	16.5	16.5	-1	.064	.071	.641	.680	0	1.5	W by S	S W by W	1.	1.	...	...	Do.
20	29.430	29.424	25	30	30	15.5	.132	.145	.888	.783	9	7	S W by W	W by S	1.	.87	...	...	Clouds. Cu. and str. cu.
21	29.394	29.338	30.5	30.5	32	28.5	.139	.108	.460	.775	6	1	W by S	S W by W	.75	1.2	...	...	Pleasant: a thaw.
22	29.460	29.450	17	31.5	32	11.2	.084	.106	.730	.731	0	7	S W by W	S E	.8	.3	...	...	Do.
23	29.205	29.088	23.5	34.5	35	20	.078	.073	.735	.682	9	8	N N W	S	.3	.2	...	...	A slight thaw.
24	29.430	29.440	19	22.5	33	18	.107	.075	.685	.727	3	1	N N W	S W by W	.0	.5	...	...	Pleasant.
25	29.381	29.338	13	24 5	24	6.5	.085	.096	.886	.686	8	4	N W by W	W by S	.5	.25	...	...	Clouds. Cu. and ci. and ci. cu.
26	29.615	29.573	11	26	26	5.5	.087	.118	.939	.731	0	0	W	S W	.1	.0	...	...	Pleasant.
27	29.686	29.607	10.5	26	26	5	.077	.072	.783	.783	4	4	W N W	E S E	.2	.2	...	...	Cloudy.
28	29.698	29.680	13	21	26	10	.073	.115	.734	.875	1	4	N W	S S W	.2	.2	...	...	Pleasant.
29	29.737	29.763	18	31	30	12	.088	.137	.728	.820	9	8	S	W S W	.0	.5	...	...	Clouds. Ci. cu.
M	29.510	29.479	12.2	19.59	22.3	7.2	.082	.094	.744	.740	5.4	5.6			.66	.84	...	2.5	

MONTHLY METEOROLOGICAL REGISTER, KINGSTON, CANADA WES', MARCH, 1856.

BY MESSRS. DUNCAN M'MILLAN AND GEORGE S. ROSE.

Latitude, 44° 13' 30'', *North*. *Longitude*, 76° 31' 51'', *West*. *Height above Sea*, 280 *Feet*.

Day.	Barometer at 32° 9 A.M.	Barometer at 32° 3 P.M.	Thermom. 9 A.M.	Thermom. 3 P.M.	Thermom. during 24h. Max.	Thermom. during 24h. Min.	Tension of Vapor. 9 A.M.	Tension of Vapor. 3 P.M.	Humidity. 9 A.M.	Humidity. 3 P.M.	Clouds. 9 A.M.	Clouds. 3 P.M.	Direction of Wind. 9 A.M.	Direction of Wind. 3 P.M.	Pressure in lbs avoirdup 9 A.M.	Pressure in lbs avoirdup 3 P.M.	Rain in inches.	Snow in inches.	REMARKS.
1	29.839	29.788	22.5	24.5	29.	18.5	.073	.052	.734	1.000	10	7	N N W	E S E	.2	.2	...	...	
2	28.931	28.971	18.5	28.	25.	16.	.104	.090	.812	.626	10	9	N E by N	W N W	1	.8	...	6	Flurries of snow.
3	29.505	29.593	15.	23.	23.	15.	.094	.090	.868	.626	2	5	W N W	W S W	1	1.	...	...	Mild.
4	29.559	29.185	19.	28.5	30.	18.	.077	.129	.648	.725	10	6	S E	S E	3	6.	...	...	Boisterous—snowing.
5	29.621	29.572	16.5	23.5	26.	11.5	.097	.126	.855	.840	3	4	W	W S W	1.7	.2	...	...	Solar halo.
6	29.217	29.317	23.	25.	26.	18.	.125	.132	.840	.848	7	9	N W by W	W N W	1.	1.	...	...	Pleasant.
7	29.622	29.479	8.	20.	24.	3 5	.055	.068	.663	.640	8	7	W N W	S	0.	1.5	...	...	Raw—cold.
8	29.597	29.583	6.5	5.5	22.	4.	.045	.064	.495	.637	5	1.	W S W	W S W	1.	1.3	...	4	Aurora bright, visible at 1 a.m.
9	29.771	29.738	—5.5	2.7	1.5	—12.5	.050	.064	.635	.637	0	.5	W N W	S W	.7	.8	...	...	Cold.
10	29.709	29.581	—4.2	8.5	7.5	—12.5	.056	.050	.586	.635	0	2	W	W S W	.8	2.	...	...	Cold.
11	29.402	29.228	12.5	19.	19.2	3.	.049	.077	.544	.783	2	4	W S W	W S W	2.	1.2	...	...	Raw—cold—windy.
12	29.370	29.375	7.5	18.7	19.	4.25	.047	.056	.496	.543	0	4	W	W S W	.8	1.2	...	...	
13	29.716	29.720	11.5	24.5	23.5	5.5	.080	.130	.782	.495	0	0	W	W	.2	.4	...	...	Lunar halo, 9 p.m.
14	29.778	29.764	18.	27.5	27.7	3.	.103	.150	.685	.589	5	1	W	S W	0	0	...	...	Pleasant: thaw.
15	29.784	29.668	28.5	29.5	33.	18.	.113	.130	.657	.780	8	7	W S W	W S W	1.	1	...	2	Gloomy.
16	29.725	29.638	27 7	29.	32.	19.5	.120	.164	.740	.915	7	6	S W	W S W	.8	0	...	1	Gloomy; thaw.
17	29.808	29.789	23.5	32,5	34.	18.5	.091	.153	.634	.756	6	9	W S W	W N W	.2	.5	...	...	Do do.
18	29.968	29.858	20.	31.	34.	12.5	.110	.147	.848	.762	0	1	W S W	W S W	.4	.4	...	...	Pleasant—thaw.
19	29 575	29.414	24.5	33.	34.	17.	.129	.161	.868	.780	7	10	N W	E	.2	0	...	1.5	Snow—inclined to rain.
20	29.454	26.426	30.5	34.	39.	25.5	.147	.178	.762	.834	8	1	S	N E	0.	0	...	3.5	Pleasant—thaw.
21	29.419	29.494	25.5	36.5	37.	22.	.125	.213	.779	.929	8	2	S	S E	0.	0	...	...	Do.
22	29.591	29.583	25.5	34.	38.	15.	.141	.178	.906	.834	4	2	S E	S W	.2	0	...	...	Do.
23	29.622	29.554	27.5	33.5	36.	19.5	.137	.164	.817	.793	10	8	S S W	S W	0	0	...	...	Gloomy; thaw.
24	29.336	29.278	33.	34.	36.	23.	.169	.178	.821	.834	8	8	E	E N E	0	0	...	...	Snow—inclined to rain.
25	29.522	29.514	34.	37.	40.	30.2	.178	.199	.834	.839	5	5	N	S W	0	0	...	...	Thaw.
26	29.461	29.370	32.5	33.5	37.8	28.	177	.164	.891	.793	5	4	W	W	.2	1.7	...	...	Do.
27	29.342	29.283	25.	29.	36.	22.5	.110	.137	.701	.766	1.5	8	W	N W	.4	.8	...	...	Cold wind.
28	29.418	29.387	15.	22.	28	12.	.092	.119	.856	.855	8	6	N W	W	1.2	1.8	...	...	Cold and windy.
29	29.564	29.553	21.	27.	28.	17.	.071	.146	.506	.880	5	9	N W	N W by N	1.3	.5	...	...	
30	29.754	29.706	16.5	25.	27.7	11.	.074	.107	.652	.685	0	1.5	N W	S W	.5	.8	...	...	Raw cold.
31	30.035	30.035	15.8	25.	25.	8.	.073	.135	.680	.867	0	0	N	S W by W	.7	.0	...	...	Pleasant.
M	29.582	29.561	19.5	26.1	28.3	13.37	.100	.127	.729	.759	4.9	4.7			.66	.8	...	18	

L*

MONTHLY METEOROLOGICAL REGISTER, KINGSTON, CANADA WEST, APRIL, 1856.

BY MESSRS. HUGH J. BORTHWICK AND ALEXANDER M'LENNAN.

Latitude, 44 *deg.* 13.30 *min. North; Longitude,* 76 *deg.* 31.51 *min. West. Height above Sea,* 280 *feet.*

Day.	Barometer at 32°		Thermom.		Thermom. during 24 hours.		Tension of Vapor.		Humidity.		Clouds.		Direction of Wind.		Pressure in lbs avoirdupois.		Rain in inches.	Snow in inches.	REMARKS.
	9 A. M.	3 P. M.	9 A. M.	3 P. M.	Max.	Min.	9 A. M.	3 P. M.	9 A. M.	3 P. M.	9 A. M.	3 P. M.	9 A. M.	3 P. M.	9 A. M.	3 P. M.			
1	30.180	30.055	20.0	30.0	32.5	10.0	.110	.152	.848	.824	0.	9.	S W	S	.0	.0	...	...	Pleasant
2	29.731	29.545	33.0	42.5	43.8	20.0	.173	.259	.841	.795	4.	10.	S S E	S S E	1.3	1.2	...	...	Warm and cloudy.
3	29.320	29.319	41.0	40.0	44.3	35.0	.226	.218	.827	.225	10.	10.	S S E	S S E	1.3	1.0	...	...	Rainy and disagreeable.
4	29.415	29.420	34.0	37.0	40.0	32.3	.186	.191	.874	.802	10.	10.	S S W	S W	1.5	1.8	...	...	Do. do.
5	29.628	29.643	34.2	34.0	38.4	29.5	.181	.195	.847	.913	9.	9.	W N W	N W	.3	.2	...	...	Pleasant.
6	29.682	29.643	37.0	38.5	38.0	30.2	.212	.205	.889	.833	0.	0.	S S W	S S W	.2	.0	...	...	Do.
7	29.109	29.716	34.3	39.7	38.5	29.0	.174	.196	.852	.769	10.	1.	S S W	S S W	.0	.0	...	...	Do.
8	29.966	29.948	35.0	45.0	44.2	28.3	.118	.242	.800	.827	2.	0.	S S W	S S W	.0	.0	...	...	Do.
9	29.808	29.519	43.0	50.0	45.5	32.0	.242	.315	.827	.842	4.	9.	W S W	S	.0	1.8	...	...	Do.
10	29.987	29.928	32.7	41.5	46.0	31.3	.157	.209	.802	.730	0.	0.	N N W	W	.5	.5	...	...	Do.
11	29.861	29.699	34.0	41.0	47.0	27.5	.170	.217	.795	.796	7.	6.	S S W	S	.3	.3	...	...	Do. [in the Bay.
12	29.201	29.189	39.0	44.0	41.0	34.5	.224	.272	.879	.893	10.	10.	W N W	N	.3	.3	.38	...	Rainy. Breaking up of the ice
13	29.937	29.900	21.5	30.0	40.5	21.0	.050	.125	.635	.674	0.	0.	N N E	S S W	1.3	1.8	...	...	Cold and windy.
14	29.784	29.611	32.0	37.0	40.5	28.0	.153	.181	.768	.736	10.	10.	S S W	S	1.3	.8	...	...	Warm and cloudy.
15	29.629	29.559	41.0	49.0	50.3	28.7	.209	.324	.767	.898	6.	10.	N N E	N N E	.0	.0	...	...	Do.
16	29.651	29.590	42.0	49.0	51.3	36.5	.243	.300	.858	.837	10.	8.	E	S S E	.0	.0	...	...	Do. [left Kingston wharf
17	29.566	29.443	44.0	43.0	54.5	36.5	.261	.262	.855	.892	10.	10.	Calm.	Calm.	.0	.0	.11	...	Foggy. Stmr. "St. Lawrence"
18	29.407	29.428	39.0	45.0	54.2	31.5	.205	.253	.804	.802	8.	3.	S S E	S S W	.3	.3	...	...	Pleasant.
19	29.712	29.672	42.0	47.0	53.2	32.0	.225	.261	.797	.716	4.	3.	N N W	Calm	.0	.0	...	...	Do.
20	29.830	29.762	32.0	44.0	50.5	30.0	.153	.184	.768	.606	4.	8.	N	N N E	2.3	1.75	...	...	Cold and windy.
21	29.674	29.500	34.0	51.0	50.5	32.5	.141	.238	.660	.615	10.	8.	N N E	N E	2.	1.	...	...	Do [this A.M. for Toronto.
22	29.269	29.257	42.0	47.5	51.0	35.0	.225	.291	.797	.866	10.	7.	E N E	S S E	1.	.0	...	...	Pleasant. Stmr. "Kingston" left
23	29.488	29.466	42.5	51.0	53.0	34.0	.213	.293	.858	.760	3	0.	S	S S W	.0	.0	...	...	Calm and pleasant.
24	29.560	29.487	51.0	59.0	62.0	34.0	.337	.402	.871	.796	3.	3.	S S W	S S W	.0	.0	...	...	Calm and warm.
25	29.830	29.833	57.0	59.7	65.5	42.5	.434	.454	.867	.695	5.	.5	N N E	N E	.25	.0	...	...	Delightful.
26	29.970	29.864	58.5	64.0	62.2	42.5	.425	.496	.687	.726	1.	1.	N E	N	.125	.125	...	...	Warm and sultry.
27	29.758	29.658	55.0	64.5	66.5	40.5	.372	.515	.843	.708	0.	0.	S	Calm.	.75	.0	...	...	Very hot for the season.
28	29.580	29.490	55.0	61.5	68.5	48.5	.387	.408	.844	.619	6.	2.	W S W	W S W	.75	.0	...	...	
29	29.639	29.639	49.0	51.0	52.0	41.0	.251	.272	.696	.700	3.	0.	Calm.	Calm.	.0	3.	...	...	
30	29.890	29.938	47.5	55.0	63.0	43.0	.647	.222	.647	.537	9.	9.	N N E	E	.5	1 5	...	...	
M	29.688	29.624	39.94	42.31	49.781	32.576	.221	.271	.803	.747	5.6	5.21			.512	.516	.016	...	

MONTHLY METEOROLOGICAL REGISTER, KINGSTON, CANADA WEST, MAY, 1856.

By Messrs. Hugh J. Bostwick, and Alexander McLennan.

Latitude, 44 *deg.* 13.30 *min. North.* *Longitude,* 76 *deg.* 31.51 *min. West.* *Height above Sea,* 280 *Feet.*

Days.	Barometer at 32° 9 A.M.	Barometer at 32° 3 P.M.	Thermom. 9 A.M.	Thermom. 3 P.M.	Thermom. During 24 h. Max.	Thermom. During 24 h. Min.	Tension of Vapour. 9 A.M.	Tension of Vapour. 3 P.M.	Humidity. 9 A.M.	Humidity. 3 P.M.	Clouds. 9 A.M.	Clouds. 3 P.M.	Direction of Wind. 9 A.M.	Direction of Wind. 3 P.M.	Pressure in lbs. avoirdupois. 9 A.M.	Pressure in lbs. avoirdupois. 3 P.M.	Rain in inches.	Snow in inches.	REMARKS.
1	30.383	....	48.25	....	....	....	.349	....	1.000	....	9.	....	E N E	....	1.5	....	0	...	
2	29.459	29.692	46.00	46.00	62.0	42.0	.278	.278	.825	.852	10.	10.	N N E	N E	1.5	1.5	.65	...	
3	29.529	29.559	42.00	51.00	61.0	37.5	167	.192	.588	.498	.01	0	N N E	N N E	1.5	0	.125	...	
4	29.659	29.649	40.00	45.00	53.0	33.5	.227	.272	.858	.863	9.	8.	N W	N W	1.5	1.	0	...	
5	29.896	29.927	42.50	49.00	53.0	33.0	.253	.336	.928	.930	7.	6.	N N E	N N E	0	0	0	...	
6	30.375	29.103	48.00	55.00	56.0	36.0	.302	.394	.865	.888	0	10.	E N E	S W	0	0	0	...	
7	29.743	29.646	51.25	67.00	63.0	43.0	.337	.594	.871	.897	1.	0	S W	E	0	0	0	...	
8	29.840	29.723	52.25	52.00	64.0	44.5	.373	.349	.934	.873	5.	10	E N E	O	0	0	0	...	
9	29.590	29.595	46.00	46.00	54.0	42.5	.303	.262	.931	.803	10.	0	S W	E	0	0	.40	...	
10	29.575	29.494	50.00	64.00	61.0	41.0	.349	.525	.932	.946	8.	10.	N N E	N E	0	1.5	0	...	
11	29.548	29.431	53.00	50.00	66.0	40.0	.337	.373	.815	1.000	0	6.	N E	S W.	0	0	0	...	
12	29.443	29.640	53.50	52.00	61.0	42.5	.373	.304	.903	.761	0	10.	S W	S W	0	0	0	...	
13	29.892	29.939	46.50	49.00	54.0	43.0	.282	.312	.864	.867	10.	5.	N	S W	0	0	0	...	
14	29.886	29.760	54.00	68.25	71.0	41.5	.373	.646	.875	.949	3.	0.	S S W	S	0	0	0	...	
15	29.666	29.382	54.00	60.00	72.0	47.0	.400	.467	.934	.893	10.	10.	S	S W	0	0	0	...	
16	29.694	29.682	56.00	55.00	64.0	49.0	.420	.418	.927	.944	9	10.	W N W	S W	0	.5	.44	...	
17	29.679	29.481	55.00	66.00	68.0	45.0	.394	.605	.888	.949	7.	10.	N E	E N E	0	0	0	...	
18	29.557	29.431	55.00	58.50	68.0	54.0	.351	.437	.793	.893	10.	10.	S S E	S E	1.5	.5	1.7	...	
19	29.403	29.344	51.50	57.00	65.0	48.0	.337	.376	.871	.796	10.	2.	E N E	S S E	.75	.5	.17	...	
20	29.355	29.449	55.00	63.00	64.5	44.0	.351	.345	.793	.597	10.	.5	N W	N W	.75	.75	.14	...	
21	29.708	29.737	47.00	49.00	65.0	38.5	.217	.270	.647	.749	0	.5	N N E	S W	.75	.75	0	...	
22	29.858	29.814	53.00	54.00	58.5	38.5	.274	.246	.662	.576	10.	.5	S	S W	0	.75	0	...	
23	29.676	29.582	54.00	60.50	64.0	39.0	.296	.371	.687	.710	0	.5	S S W	S W	0	.5	0	...	
24	29.433	29.351	53.00	63.00	65.25	39.0	.337	.423	.815	.731	10.	.1	S S W	S W	.75	.75	0	...	
25	29.519	29.550	40.00	45.00	74.5	38.0	.210	.202	.793	.643	10.	9.	W	N N W	1.25	.2	0	...	
26	29.588	29.577	56.00	61.50	68.5	40.5	.271	.342	.593	.632	1.	.5	N	N E	1.5	.5	0	...	
27	29.477	29.336	52.00	40.00	67.25	40.0	.304	.361	.761	.584	5.	10.	S S W	S S W	0	0	0	...	
28	29.529	29.112	55.00	60.00	68.5	41.0	.394	.361	.888	.680	10.	9.	S W	W N W	0	.25	.12	...	
29	29.401	29.367	44.00	46.00	62.0	38.0	.207	.218	.682	669	4.	10.	N N W	S S E	1.	.1	.5	...	
30	29.497	29.523	41.50	44.00	50.0	34.0	.186	.177	.677	.582	10.	8.	N W	N W	.75	.75	0	...	
31	29.741	29.672	42.00	51.00	53.5	34.0	.192	.255	.679	.661	10.	1.	W N W	S W	.25	.5	0	...	
M	29.666	29.524	49.58	54.25	62.58	40.91	.304	.357	.776	.780	6.06	5.01			.492	.500	.134	...	

REMARKS ON THE KINGSTON METEOROLOGICAL REGISTER FOR APRIL.

Highest Barometer .... 30.180 at 9 A. M. on 1st.
Lowest Barometer .... 29.109 at 9 A. M. on 7th.
Monthly Range .... 1.071 inches.
Highest registered temperature.. 68°5 on 28th
Lowest registered temperature .... 10° on 1st.
Mean maximum thermometer .... 49°781
Mean minimum thermometer .... 32°576
Mean daily range .... 17°205
Warmest day, 26th, mean temperature.. 58°5
Coldest day, 1st, mean temperature 21°2: difference .... 37°3
Raining on 4 days: depth, .49 inches. Most windy day, 20th.

REMARKS ON THE KINGSTON METEOROLOGICAL REGISTER FOR MAY.

Highest Barometer .... 30.383 on 1st.
Lowest Barometer .... 29.103 on 6th.
Monthly Range.. 1.280 inches.
Highest registered temperature.. 74°5 on 25th.
Lowest registered temperature .... 33°5 on 30th.
Monthly Range.. 41°.
Mean maximum thermometer.. 62°58
Mean minimum thermometer.. 42°91
Mean daily range .... 21°67
Warmest day, 18th, mean temperature.. 61°
Coldest day, 30th, mean temperature 42°; difference.. 19°
Raining on 9 days: depth, 4.04 inches. Wind maximum velocity, 27.09 miles per hour. Most windy day, 25th.

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

(NINE MILES WEST OF MONTREAL.)

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

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

Day.	Barom. corrected and reduced to 32° Fahr.			Temp. of the Air.			Tension of Vapor.			Humidity of Air.			Direction of Wind.			Mean direction of Wind.	Velocity in miles per hour.			Snow in Inches.	Rain in Inches.	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0.		
	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 PM	6 A.M.	2 P.M	10 P.M.		6 A.M.	2 P.M.	10 PM			6 A.M.	2 P.M.	10 P.M.
1	29.838	29.810	29.902	49.5	62.0	50.1	.251	.421	.335	.69	.75	.88	w s w	s w	s w b s	w 44 s	7.00	2.12	3.60	...	...	Clear.	Cum. Str. 8.	Clear.
2	.849	.783	.789	47.4	71.7	61.2	323	559	483	94	74	89	w by s	swbyw	s s w	w 40 s	0.00	1.26	0.70	...	Inp	Fog.	Cir. Cm. St. 4.	Cir. Str. 8.
3	.758	.741	.800	60.0	61.8	52.6	494	322	326	94	59	81	E by s	E N E	s s w	E 34 N	5.00	5.06	0.05	...	0.066	Rain.	Cir. Str. 10.	Str. 2.
4	.731	.699	.813	52.1	51.6	49.6	304	361	336	76	93	92	NE by E	N E	N by E	E 34 N	0.20	4.32	8.55	...	0.136	Do.	Do. 10.	Do. 4.
5	.887	.936	30.010	47.0	68.0	53.9	299	412	315	90	60	76	NE by E	E N E	E N E	E 34 N	5.12	3.05	7.52	...	...	Clear.	Do. 4.	Clear. Aur. Bor.
6	.908	.943	29.977	54.0	71.0	57.0	373	458	355	87	61	74	SE by s	s s E	s s E	s 33 E	2.52	11.51	8.76	...	...	Cir. Str. 8.	Cum. Str. 6.	Cum. Str. 4.
7	.817	.687	.661	56.6	79.4	63.4	385	597	488	84	61	84	E s E	s s E	s E	s 33 E	6.42	6.00	5.25	...	...	Cum. Str. 10.	Clear.	Str. 2.
8	.699	.552	.548	66.0	70.4	63.9	574	597	565	89	82	93	s	E N E	s E by s	s 33 E	0.47	0.42	3.90	...	Inp	Cum. Str. 6.	Cir. Str. 10.	Cum. Str. 8.
9	.437	.438	.494	61.0	68.1	60.6	490	496	493	90	72	90	s w	w by s	s w by s	w 34 s	1.54	8.12	7.46	...	0.533	Rain.	Do. 6.	Do. 4.
10	.564	.537	.626	66.4	83.0	67.7	544	619	506	85	57	76	w s w	w by s	w s w	w 31 s	5.21	3.00	5.36	...	...	Cir. Str. 4.	Do. 4.	Do. 8.
11	.687	.594	.683	66.3	86.0	69.9	544	648	541	85	53	75	w s w	s s w	s by w	w 33 s	2.52	4.28	1.30	...	...	Clear.	Clear.	Clear.
12	.629	.490	.565	73.0	89.9	75.2	571	607	670	72	44	78	s by E	s by E	s by E	s 12 E	1.36	1.64	5.21	...	...	Do.	Cir. 2.	Cir. Str. 9.
13	.538	.488	.523	62.7	80.7	67.0	546	648	536	94	64	83	s w	s w by s	s by E	s 22 w	4.45	3.85	3.96	...	0.130	Rain.	Cum. 2.	Do. 9.
14	.511	.455	.539	64.7	69 0	59.2	534	513	402	89	72	79	s by E	w by s	s w	w 11 s	1.24	6.12	6.00	...	Inp	Rain. Dist. Th.	Cir. Str. 10.	Str. 1.
15	.517	.542	.652	57.6	64.9	57.3	398	425	376	84	71	79	s w b w	w s w	w by s	w 34 s	10.10	5.00	3.20	...	...	Cir. Str. 8.	Do. 10.	Cir. Str. 4.
16	.704	.691	.801	57.2	75.1	62.3	398	578	421	84	67	75	w by N	s s w	w s w	w 33 s	7.63	6.42	7.37	...	...	Cir. Str. 9.	Cum. 2.	Clear.
17	.832	.772	.775	60.8	83.1	64.7	416	597	450	79	55	75	w s w	s w	s by E	w 40 s	2.20	3.40	0.42	...	...	Clear.	Cir. 4.	Str. 4.
18	.740	.653	.727	64.6	86.0	61.6	425	617	483	71	50	89	E s E	s by E	s by E	s 28 E	0.02	1.92	5.33	...	...	Do.	Cir. Str. 8.	Do. 8.
19	.671	.731	.733	66.0	85.5	67.6	516	692	534	80	58	81	s E	s by w	s s w	s 14 E	1.02	0.70	1.02	...	...	Cir. Str. 10.	Cir. Cm. Str. 6.	Do. 2.
20	.638	.622	.667	68.0	85.3	74.3	552	729	648	82	60	78	w by s	w s w	w s w	w 34 s	6.06	6.28	7.40	...	...	Light Cir. 4.	Clear.	Str. 4, dist. light.
21	.727	.667	.659	70.3	94.6	77.9	628	854	638	86	51	67	swbyw	sw b w	sw b w	w 34 s	4.21	7.10	6.12	...	...	Clear.	Cir. Cm. Str. 6.	Cum. Str. 4.
22	.643	.675	.763	74.1	74.2	64.3	643	588	450	78	70	75	s w	N E	N W	w 34 s	9.39	9.07	7.10	...	...	Cir. Str. 9.	Cir. Str. 8.	Clear.
23	.902	.829	.876	51.9	76.7	60.3	255	568	416	66	64	76	N W	s	s E by E	N 10 E	7.92	2.11	2.51	...	...	Cir. 4.	Clear.	Do.
24	.887	.715	.611	58.2	77.9	65.4	412	617	497	84	62	80	E by N	s	w by s	E 33 s	2.21	1.92	2.02	...	...	Clear.	Cir. Cm. Str. 4.	Cir. Str. 10.
25	.541	.478	.516	70.4	88.6	73.1	571	801	628	80	62	78	w by s	w s w	s w	w 34 s	10.00	11.39	2.09	...	Inp	Rain.	Cir. Str. 4.	Clear.
26	.557	.485	.470	65.0	84.2	69.9	430	670	570	69	58	81	swbyw	swbyw	s w	N 36 w	6.40	9.26	10.71	...	...	Clear.	Clear.	Cir. Str. 2.
27	.662	.663	.683	61.0	73.4	61.8	431	489	407	79	61	75	s w	N W	w N w	s 40 w	7.70	11.30	8.93	...	...	Do.	Cum. 2.	Clear.
28	.609	.355	.239	62.0	82.0	79.3	460	541	659	81	50	67	s w	w s w	w by s	s 40 w	0.23	5.31	1.46	...	...	Do.	Cir. Str. 10.	Cum. Str. 9, rain
29	.269	.202	.360	60.0	63.4	57.3	481	516	470	90	89	96	E N E	NE b E	NE b E	E 30 N	2.09	4.00	7.37	...	2.025	Cir. Str. 10.	Rain. Thunder	Do. 9. [at 10 p.m.
30	.420	.485	.384	60.5	71.0	64.6	499	648	556	96	86	89	E s E	NE b N	N W	E 2 N	1.37	1.86	9.70	...	1.435	Do. 9.	Cir. Str. 4.	Do. 6.

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

(NINE MILES WEST OF MONTREAL.)

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

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

Day.	Barom. corrected and reduced to 32° Fahr.			Temp. of the Air.			Tension of Vapor.			Humidity of Air.			Direction of Wind.			Velocity in miles per hour.			Mean direction of Wind.	Rain in Inches.	Snow in Inches.	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0.		
	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.				6 A.M.	2 P.M.	10 P.M.
1	29.779	29.796	29.897	53.1	68.2	54.6	.337	.422	.349	81	.62	.81	N W b W	N W	W S W	26.24	19.22	11.42	W ° 44 N	...	...	Clear.	Clear.	Clr. Aur. Bor.
2	.893	.800	.748	48.9	83.2	65.1	.302	.648	.558	.86	.58	.89	S by W	S W	S	0.40	0.75	1.45	W 44 S	...	...	Cir. Cm. St. 4.	Do.	Cir. Str. 4.
3	.559	.447	.475	84.2	83.0	70.5	.534	.721	.604	.89	.65	.84	S W by W	W	W	3.05	9.83	2.41	W 34 S	1.370	...	Cir. Str. 10.	C. S. S Thun.	Rain.
4	.555	.596	.632	56.0	70.7	57.3	.323	.665	.422	.70	.64	.89	N by N	W by N	N W b W	8.56	4.17	8.77	W 36 N	0.483	...	Clear.	Clear.	Clear.
5	.601	.500	.474	60.1	81.0	60.9	.467	.523	.494	.89	.50	.94	S W	W S W	S S W	1.50	6.79	11.64	W 34 S	...	...	Do.	Cr. Cm. St. 4.	Cir. Str. 10.
6	.412	.513	.727	61.9	57.4	50.0	.500	.399	.314	.89	.84	.85	W	N W b W	W	4.75	5.74	19.05	W 10° N	1.476	...	Cir. Str. 9.	Cir, Str. 10.	Cir. Thun. Stm
7	.794	.712	.852	50.8	71.2	56.5	.326	.560	.343	.87	.75	.74	N W b W	S W	N N W	0.70	2.12	0.11	W 34° W	...	...	Clear.	Cir. Str. 9.	Str. 2.
8	.904	.852	.882	56.5	71.1	62.0	.243	.590	.472	.74	.72	.84	N E by N	E N E	E by N	3.51	6.77	0.05	E 23 N	Inp	...	Cir. Cm. St. 4.	Clear.	Cir. Str. 10.
9	.904	.860	.801	66.0	74.9	64.1	.574	.638	.531	.89	.74	.89	S S E	E by S	E	0.00	0.00	0.00	E 23 N	0.253	...	Cir. Str. 4.	Cr. Cm. St. 9.	Clear.
10	.801	.746	.755	65.2	85.1	66.7	.546	.727	.574	.94	.61	.89	N E by E	S by W	S by W	0.20	0.51	0.21	E 11 N	...	...	Clear.	Cir. Cum. 4.	Do.
11	.778	.714	.617	73.1	90.7	75.4	.670	.776	.739	.86	.56	.86	S b W	S E	S E	0.22	1.40	1.23	S 1 E	...	...	Do.	Cum. Str. 2	Cum. 4.
12	.540	.518	.519	74.4	71.2	64.1	.681	.681	.565	.82	.90	.93	S E	W N W	E by N	0.12	1.32	0.12	E 40 S	0.416	...	Clear.	Rain.	Cir. Str. 10.
13	.546	.513	.620	65.1	87.9	70.5	.586	.896	.628	.94	.71	.86	E N E	W by S	W by S	2.02	0.85	5.12	W 14 S	...	...	Cir. Str. 10.	Cir. 2.	Cl. S't. Light.
14	.671	.595	.567	69.0	86.0	75.2	.601	.860	.607	.85	.70	.71	W by S	W S W	S W	1.63	3.95	8.21	W 34 S	...	...	Do. 4.	Clear.	Do.
15	.544	.557	.665	70.4	81.0	65.5	.659	.704	.555	.90	.68	.88	W S W	N W	W	5.05	8.62	5.62	W 24 N	0.816	...	Nimb. 10.	Do.	Do.
16	.734	.630	.632	66.5	86.0	72.0	.574	.787	.607	.89	.66	.78	S W b W	W S W	W b S	0.12	5.07	5.93	W 14 S	...	...	Cir. Str. 6.	Cr. Cm. St. 4.	Str. 4. S't. L'g.
17	.744	.633	.507	73.0	92.1	77.8	.739	.840	.829	.89	.71	.90	W	S S W	S S W	2.64	0.05	0.74	W 11 S	0.453	...	Rain.	Do. 4.	Cir. Str. 4.
18	.420	.351	.382	75.1	85.3	70.1	.628	.628	.471	.78	.53	.65	W b S	W S W	W N W	4.40	9.32	13.07	W 23 S	0.280	...	Cir. Str. 10.	Cir. Str. 4.	Do 4.
19	.416	.426	.517	62.1	70.4	58.3	.472	.576	.462	.84	.79	.94	W N W	N W	W N W	11.45	14.90	18.62	W 23 N	...	...	Do. 9.	Do. 4.	Rain.
20	.588	.630	.756	59.4	74.0	60.0	.478	.681	.467	.94	.82	.89	W N W	N W	W by N	8.00	15.25	7.42	W 23 N	0.826	...	Do. 8.	Do. 4.	Str. 2.
21	.840	.825	.883	61.2	85.8	65.0	.491	.628	.527	.89	.53	.85	W b S	S by E	S	0.12	1.22	2.22	W 23 S	...	...	Clear.	Clear.	Cir. Str. 4.
22	.663	.909	.980	67.0	80.1	66.5	.534	.648	.574	81	.64	.89	S S W	S by E	S by E	1.40	3.90	0.00	S 40 W	...	...	Do.	Cir Str. 10.	Str. 4.
23	.974	.824	.850	65.8	84.1	72.0	.555	.617	650	97 0	.54	.84	S W by S	S S W	S E	0.20	1.31	3.11	S 22 W	...	...	Cir. Str. 10.	Do.	Do. 2.
24	.819	.710	.735	70.5	94.5	80.0	.868	.985	.790	.78	.59	.78	W	W S W	S W b W	0.60	7.12	5.65	W 34 S	...	...	Clear.	Clear.	Do. 4 F't. A. B.
25	.713	.595	.634	74.0	94.1	76.0	.648	.776	.628	.78	.46	.71	W b S	W by S	S W b W	6.80	9.00	7.85	W 14 S	...	...	Do.	Do.	Clear.
26	.677	.602	.634	70.9	96.7	81.1	.659	.986	.670	.80	.56	.64	S W	S W b S	W	0.70	1.60	2.62	W 40 S	...	...	Do.	Cir. Str. 2.	Cir. Str. 8.
27	.633	.606	.652	71.6	87.2	75.1	.617	.776	.739	.82	.62	.80	S W b W	W	W S W	1.80	6.34	7.35	W 14 S	...	...	Hazy.	Do. 4.	Clear. St. Ligt.
28	.603	.628	.683	74.9	89.9	77.5	.681	.854	.751	.82	.62	.82	W by S	W	W by S	1.02	7.70	3.20	W 10 S	...	...	Clear.	Clear.	Clear. do. do.
29	.632	.627	.545	96.5	97.0	73.3	.692	.986	.736	.78	.51	.91	S W by S	S S W	S by W	0.46	1.95	3.60	W 44 S	Inp	...	Do.	Cum. 4.	Do.
30	.500	.433	.552	80.2	85.5	71.0	.751	.840	.715	.75	.71	.95	S by W	W by S	W by S	1.83	4.81	1.90	S 44 W	Inp	...	Do.	Cir. Str. 8.	Do. Thundr.
31	.739	.648	.735	70.1	87.1	67.2	.659	.739	.593	.89	.78	.89	N N W	W S W	S W by S	1.60	1.87	0.30	W 11 S	...	...	Do.	Clear.	Do. Met. 9.30.

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

Barometer	Highest, the 5th day	30.010
	Lowest, the 29th day	29.202
	Monthly Mean	29.653
	Monthly Range	0.808
Thermometer	Highest, the 21st day	94°.6
	Lowest, the 1st day	41°,0
	Monthly Mean	66°.83
	Monthly Range	53°.6
Greatest Intensity of the Sun's Rays		110°.2
Lowest Point of Terrestrial Radiation		39°.1
Amount of Evaporation		3.74
Mean of Humidity		.754

Rain fell on 10 days, amounting to 4.323 inches—was accompanied by thunder and lightning on 3 days; it was raining 23 hours and 50 minutes.

Most prevalent Wind, the S W by W—1113 miles.

Least prevalent Wind, N N E—1 mile.

Most windy day, the 26th; mean miles per hour, 8.45.

Least windy day, the 2nd; mean miles per hour, 0.65.

Most windy hour, from 2 to 3, p.m., on the 4th—20.10 miles.

There were 168.40 hours calm during the month.

Total distance traversed by the Wind, 3.130 miles; resolved into the Four Cardinal Points, gives, N. 350 miles, S. 768 miles, W. 1430 miles, E. 582 miles.

There was only one day perfectly cloudless.

Aurora Borealis visible at observation hour on one night.

The electrical state of the atmosphere has been marked by rather high tension.

Ozone was in small quantity.

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

Barometer	Highest, the 22nd day	29.986
	Lowest, the 18th day	29.351
	Monthly Ranger	.635
	Monthly Mean	29.664
Thermometer	Highest, the 29th day	97°.1
	Lowest, the 20th day	51°.0
	Monthly Range	46°.1
	Monthly Mean	72°.15
Greatest Intensity of the Sun's Rays		121°.4
Lowest Point of Terrestrial Radiation		46°.7
Amount of Evaporation		4.39
Mean of Humidity		.784

Rain fell on 12 days, amounting to 6.373 inches—it was raining 21 hours 25 minutes, accompanied by thunder on 3 days.

Five days cloudless during the month.

Most prevalent Wind, S. W. by W.

Less prevalent Wind, S. E.

Most windy day, the 1st; mean miles per hour, 18.96.

Least windy day, the 6th; calm.

Most winday hour, from 8 to 9, a.m., on the 1st, 26 miles per hour.

There were 174 hours and 20 minutes calm during the month.

Total amount of miles traversed by the Wind, 2884.20; which being resolved into the Four Cardinal Points, gives, N. 776 miles; S. 345 miles; W. 1,652.20 miles; E. 111 miles.

Bright Meteor, at 9.30 p.m., on the 31st; passing from the *Scutum Sobieski* to *Xi Sagitarii*

The Electrical state of the Atmosphere has been marked by moderate Intensity—maximum on the 30th, 365°. in terms of Volta's Electronometer, No. 1.

Ozone was in moderate quantity.

MONTHLY METEOROLOGICAL REGISTER, QUEBEC, CANADA EAST, APRIL, 1856.

BY MR. WM. DARLING CAMPBELL.

Latitude, 46 *deg.* 49.2 *min. North*; *Longitude*, 71 *deg.* 16 *min. West.* *Elevation above the level of the Sea*, 200 *feet.*

Date.	Barometer corrected and reduced to 32 degrees, Fahr. 6 A. M.	2 P. M.	10 P. M	MEAN.	Temp. of Air. 6 A. M.	2 P. M.	10 P. M.	M'N.	Tens. of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N	Humid'y of Air. 6 A.M.	2 P.M.	10 P.M.	M'N	Direc'n of Wind. 6 A.M.	2 P.M.	10 P.M	Vel'ty of Wind, miles per hour. 6 A.M	2 P.M	10PM	Rain in Inches.	Snow in Inches.	REMARKS.
1	30.060	29.972	29.954	29.999	13.4	35.4	26.1	25.0	.057	.057	.073	.062	.67	27	.51	.48	W N W	W	Calm.	6	9	0	...	...	1st—Auroral light and arch 5° alt.
2	29.892	.653	.512	.686	26.0	44.9	37.5	36.1	084	080	101	088	59	27	45	44	W	Calm.	Calm.	5	0	0	...	...	
3	.493	.426	.365	.428	34.0	49.4	40.5	41.3	207	201	195	202	97	58	74	76	Calm.	E S E	E S E	0	6	9	.256	...	
4	.438	.501	.537	.492	35.3	35.4	32.9	34.5	191	189	194	191	86	84	95	88	Calm.	E N E	E by S	0	4	10	Inap	...	
5	.531	.521	.599	.550	33.0	34.1	32.9	33.3	190	212	206	203	92	99	1.00	97	E by N	E by N	Calm	4	4	0	.053	...	
6	.672	.632	.654	.646	32.6	35.4	32.5	33.5	185	174	183	181	91	79	90	87	E N E	E	E	19	18	11	...	...	
7	.625	.631	.721	.659	31.3	47.7	40.7	39.9	181	184	196	187	95	55	74	75	S W	W S W	Calm.	2	4	0	...	...	
8	.824	.850	.938	.871	35.7	51.7	40.2	42.5	175	177	191	181	78	47	73	66	S W	W S W	E S E	5	5	2	...	...	
9	.946	.660	.422	.676	38.6	46.0	39.0	41.2	189	197	197	194	76	62	78	72	S S E	E N E	Calm.	4	5	0	...	...	
10	.434	.713	.787	.645	28.8	31.6	31.7	30.7	090	085	071	082	53	44	31	43	W N W	W N W	W N W	19	27	10	...	...	
11	.752	.544	.455	.577	24.8	45.2	37.4	35.6	094	131	138	121	55	44	59	53	W by S	W	Calm.	6	16	0	...	3.1	
12	.286	.112	.511	.303	35.3	29.6	17.2	27.4	144	168	052	121	66	92	48	69	W S W	E N E	N N W	4	15	10	...	...	
13	.776	.634	.633	.681	6.4	23.6	26.8	18.9	053	076	112	080	70	53	69	64	W	W	Calm.	6	18	0	...	...	
14	.637	.510	.544	.564	32.3	39.0	36.5	35.9	145	138	183	155	73	56	79	69	W S W	W S W	Calm.	8	5	0	...	...	14th—8 P. M. to 11 P. M. lunar halo 25° dr.
15	.580	.577	.757	.638	30.1	49.5	34.4	38.0	147	135	156	146	80	39	73	64	Calm.	Calm.	E N E	0	0	10	...	...	
16	.867	.788	.681	.779	32.0	42.3	37.4	37.2	146	152	153	150	75	55	65	65	E N E	E N E	W N W	16	3	10	...	...	
17	.552	.358	.276	.395	41.0	50.3	38.2	43.2	217	265	120	201	82	71	51	68	W S W	W S W	E N E	4	13	32	...	...	
18	.382	.408	.521	.437	29.0	44.9	40.0	38.0	126	159	131	139	71	52	51	58	E N E	W S W	W S W	29	6	14	...	...	18th—Auroral arch 4° alt.
19	.643	.613	.730	.662	29.6	52.2	37.7	39.8	130	130	119	126	72	34	51	52	W	W S W	N	5	14	11	...	...	19th—10 P. M. lunar halo 40° dr. and corona.
20	.934	.942	30.001	.959	28.8	34.5	32.5	31.9	120	120	125	122	69	57	63	63	E N E	E N E	E N E	14	10	18	...	...	
21	30.011	29.875	..	....	31.8	36.3	....	{34.2	125	145	...	...	65	64	...	..	E N E	E N E	....	23	32	...	...	...	20th—Auroral light.
22	...	.474	29.391	.692	...	36.7	34.4		...	201	201	160	...	86	93	78	....	E N E	E N E	...	28	20	.416	...	
23	29.471	.537	.601	.536	39.2	48.4	43.7	43.8	211	240	253	245	94	70	85	83	W S W	W S W	Calm	7	14	0	...	...	
24	.667	.640	.761	.689	40.4	55.3	42.9	46.2	259	243	210	237	97	56	73	75	Calm.	Calm.	E N E	0	0	10	...	...	
25	.893	.981	30.109	.994	39.0	41.9	35.2	38.7	162	119	160	147	65	44	73	61	E N E	E N E	E N E	28	25	12	...	...	
26	30.110	30.010	...	.....	33.4	51.8	39.8	41.7	120	130	139	130	59	35	56	50	E N E	S E	Calm.	9	5	0	...	...	
27	..	29.720	29.714	.896	43.4	54.9	49.1	49.1	243	344	318	302	83	79	89	84	W S W	N W	Calm	6	5	0	.165	...	
28	29.903	.722	.648	.758	37.0	44.9	37.6	39.8	168	192	201	187	72	88	84	81	E N E	E N E	E N E	14	18	15	.541	...	
29	.557	.617	.748	.641	37.4	39.2	34.1	36.9	241	257	215	238	1.00	1.00	1.00	1.00	E N E	Calm.	E N E	7	0	14	.073	...	
30	.877	30.062	30.061	30.000	34.5	41.5	39.5	38.5	175	179	204	186	81	66	.80	76	E N E	E N E	W	18	9	5	...	...	
M	29.7076	29.6594	29.6640	29.673	32.21	42.46	36.15	36.9	1588	1694	1654	1645	.767	.608	.708	.693							1.504	3.1	

THE

CANADIAN JOURNAL

OF

INDUSTRY, SCIENCE, AND ART:

CONDUCTED BY

THE EDITING COMMITTEE OF THE CANADIAN INSTITUTE.

NEW SERIES. NUMBER VI.

NOVEMBER, 1856.

TORONTO:

PRINTED FOR THE CANADIAN INSTITUTE,

BY LOVELL AND GIBSON, YONGE STREET.

CANADIAN INSTITUTE.

The Canadian Journal is printed exclusively for gratuitous distribution among the Members of the Canadian Institute, and such Institutions and Societies as the Council may determine; but Members may purchase extra copies at 2s. 6d. per number, and Provincial Literary and Scientific Societies may obtain the Journal at the same rate, by an annual payment in advance.

⁂ *Communications for the Journal to be addressed to the General Editor,* Dr. Wilson, *University College, Toronto.*

THE CANADIAN JOURNAL.

NEW SERIES.

No. VI.—NOVEMBER, 1856.

SUPERSTITIONS AND TRADITIONS OF THE ABORIGINES OF AUSTRALIA.

BY JAMES BROWNE, TORONTO.

In a former paper communicated to the Canadian Institute, the manners and customs of the Aborigines of the western coast of Australia have been sketched from personal observation.* I shall now endeavor to complete the picture of that singular phase of savage life which came under my own notice, while resident on the Australian continent, by depicting the psychological characteristics of the same degraded race, and narrating some of the most remarkable superstitions and traditional ideas, which a long residence among them brought to my knowledge. It has been often affirmed that there is no people so savage and ignorant as not to have some idea of a Supreme Being, or belief in a superior power, whom they worship in some form or character, and of whom they live in awe and dread. But if such is not the case with the natives of the western coast of Australia, and indeed of Australia generally, they so nearly approximate to it, that I believe it can be asserted without a doubt, that so far as religion, or any rudiment of divine worship is concerned, these savages are as ignorant as the beasts of the forest. From them no prayers ascend to propitiate good spirit or evil. They have neither temple nor idol,—neither object of worship, nor any semblance of religious rites.

* Vide: "The Aborigines of Australia," ante, p. 251.

Nevertheless, even the Australian savage manifests such vague traces of the rudiments of religious belief as are implied by a faith in some supernatural power. The aborigines occasionally refer to an imaginary evil-being, whom those I am describing call Jahnac, to whom they give credit for all sickness and misfortunes that may befal them, and whose principal occupation, they say, is to roam about the earth at night, watching to harm such stragglers as may unfortunately happen to fall in his way. Some of the valiant ones, indeed, will even boast of personal encounters and interviews with him; but what Jahnac is like, or what his powers are, none can distinctly tell. Even to those who boast of having encountered him Jahnac remains a mystery. Still they appear to have an indistinct idea of something that has the power of injuring them. Anything and everything accordingly, which frightens them, is Jahnac; but, however much they may dislike leaving their fires at night for fear of coming in contact with him, Jahnac is not worshipped by them, nor do they seek in any way to propitiate him, or manifest respect for him otherwise than what is implied by abject fear.

But although entertaining such vague and grovelling ideas of any spiritual power, and, properly speaking, destitute of all conception of a Supreme Being—these savages, nevertheless, labor under many strange delusions, tantamount, in some cases, to what might be called a religious belief. It generally follows that where the mind is not pre-occupied by any higher form of religious belief, it becomes the dupe of designing cunning and craftiness. This is strikingly exemplified in the Australian savage.

In the description of the different Tribes given in a former paper, it was mentioned that the Cockatoo-men, or a portion of that tribe, had acquired a strange and mysterious influence over their neighbors. I shall now endeavor to relate in what manner this influence is exercised, and the light in which its possessors are regarded, by those who do not belong to the exclusive circle.

The Cockatoo-men are believed to control the elements, and to direct the heavenly bodies; through Jahnac, their ally, they are supposed to have the power of inflicting disease and death upon whomsoever they will. The voice of the Cockatoo-man is heard in the thunder, and lightning is the bursting forth of his wrath, or the manifestation of his displeasure and approaching vengeance. No sooner does the vivid flash dart along the horizon, and the distant murmur of thunder fall upon the ear, than the native crouches within his wigwam, and cries:—"The Cockatoo-man speaks—he is sulky!" Should the husband, the wife, or the child, feel the pains of sickness, again is the cry raised :—"The Cockatoo-man is sulky!"—and should death not follow, to him alone is the recovery due, for his wrath has passed away. In like manner, the Sun, Moon, and Stars, are all the handiwork of the Cockatoo-man. Night by night does he ascend from this, his terrestrial dwelling place, to hold a glorious banquet on the moon, whose phases are accounted for by these nocturnal expeditions and feasts. They are continued, according to native belief, until the whole is demolished, but one small piece, which is allowed to remain and again expand to its original dimensions, when the feasting is once more resumed.

All the individuals of this tribe are supposed to possess these attributes in a greater or less degree; but some few are endowed with powers of a still more extensive and controlling range than others, and they are therefore flattered and sought after by the surrounding tribes, upon all occasions of danger and great sickness. The gravity with which these medicine men go through their incantations, and the implicit faith in which those operated on appear to submit themselves to the tender mercies of the operator, is ludicrous in the extreme. The patient, in all probability, is suffering from internal pain, or is possibly in the last stage of exhaustion. Jahnac has been put into him by the Cockatoo-man—and the Cockatoo-man alone can get him out. He is therefore sought after, without reference to distance or trouble, and brought (sometimes many days journey) to administer relief to the afflicted.

The Cockatoo-man approaches, and, gravely gazing on the sick man, begins to probe with his knuckles, to find the exact spot where lies the pain. Having determined this, he commences to rub down or shampoo the body, from the part affected, towards one of the extremities, either the feet, the hands, the head, or the ears—his object being to force Jahnac out at one of these points. During the operation, he frequently blows upon his fingers with great solemnity, as if to disperse the infection of the evil one. Suddenly ceasing his rubbing and seizing the patient by the hair of his head, or back of the neck, he treats him to a most energetic shaking; and thus he proceeds, with alternate rubbing, and blowing and shaking, until Jahnac is forced out of the afflicted one, and appears in the hand of the operator, in the shape of a small piece of wood or quartz. The cure being thus satisfactorily performed, this bit of wood or stone is handed over to the individual from whom it was extracted, and by whom it is cherished ever afterwards as an object of peculiar value.

Such are the wonderful powers supposed to be possessed by these men, and, to those who believe all that they have credit for, innumerable are the miracles they perform. It is needless, however, to enlarge on the subject. I have related sufficient to prove the influence they have over the minds of the savages, their dupes. How they contrived to gain this influence appears extraordinary, as I am not aware that they possess one qualification superior to their neighbors;—but that they have gained it, and that they do their best to retain it, are equally true.

This is the extent of the influence of superstition on this people, and there I think it ceases; but here, also, must be noted a vague and partial idea which they appear to entertain of a state of being hereafter. I say partial, in as much as it applies but to one portion of the community, and that is to the young men, who, they say, upon taking their departure from this world, go to the moon, or to a place beyond it, where they remain in the midst of abundance of Kangaroos, upon which they have unlimited feasting, an idea conveying to the mind of an Australian a picture of the very essence of true felicity. But those dying old and infirm enjoy no such happiness;—on the earth, where they lived and died, there they remain, and conclude their career by furnishing a repast for the wild dog.

The traditions current amongst these people, like those of most other barbarous tribes, usually relate to some familiar object or event. Nevertheless, they generally contrive to confer on them an originality and marvellousness, not only amusing, but tending also in a great measure to enlighten us relative to the ideas and modes of thought of those from whom they are obtained. As specimens, let me relate one or two narrated to me by a native youth, as we lay around our bush fire; and in doing so, I shall endeavour to follow, as much as possible, the peculiar and simple language of my swarthy companion.

"The Kangaroo," said he "now jumps far—very far; he jumps too like the frog, but it was not always so. A very long time ago it was not all jump, jump, jump. No, he then walked all the day, and when the black man was hungry, he did not run after the Kangaroo, as he now does, for the whole day, but arose from his fire, and knocked him down with his Waddie, and so he ate plenty, and without trouble. One day a Frog came up out of the River to take a walk and look at the country, and away he went, jump, jump, jump, and then sat down and looked about him, again he started, jump, jump, jump, and once more sat down in the glare of the Sun. And so he went on jumping and resting until he found himself in the midst of the Kangaroos, who were crawling about eating the grass with their fore paws to the ground, and noses very low, and backs very high. The Frog laughed when he saw the hind legs of the Kangaroo, so much like his own, so long and so strong, used in crawling along like a miserable Opossum or Bandicoot, and he thought the Kangaroos very lazy and very foolish, and so he commenced to talk with them, and demanded why they did not jump with their long legs as he did. The Kangaroos replied that they knew but of one way of using their legs, and that way was as he then saw them doing. The Frog said: No, long legs are made for jumping, try and do as I do; and off he started jump, jump, jump, and jump also went the Kangaroos, then jump, jump, jump, the first jump awkward, but improving as they leapt, until at last away they bounded altogether, Frog and Kangaroos, and the Kangaroo was glad when he jumped away from the Black man; but the Black man said it was no good, and he was sulky with the Frog."

It is the Frog accordingly that the Kangaroo has to thank for the first idea of that system of locomotion which he now employs, and it is the Frog too, according to the same native belief, that the Australian has to blame for having to exert those same powers in order to supply himself with food.

The following was the purport of the native youth's account of the manner in which fire was diffused over the land, although the language may differ somewhat from his narrative.

A long long time ago, a little Bandicoot, (a small and sharp nosed animal, not unlike our Guinea Pig,) was the sole owner of a fire-brand, which he cherished with the greatest jealousy, carrying it about with him wherever he went, and never once laying it aside or allowing it out of his own special care; so selfish was he in the use of his prize, that he obstinately refused to share it with the other animals, his neighbors; and so they held a general council, where it was decided that the fire must be obtained from the Bandicoot either by force or strategy. A Hawk and a Pigeon were deputed to carry out this resolution, who, having formed their plan, awaited their opportunity to accomplish it.

This Bandicoot lived on the banks of a small stream where he amused himself during the sunny hours of the day in walking and frisking about. It was on one of these occasions that the Hawk and Pigeon ventured to try their chance, and thus went about their work. The Pigeon strolled down the bank of the river where the Bandicoot was walking; the Hawk, at the same time, kept flying about in their vicinity. Coming up with the Bandicoot, the Pigeon entered into conversation with him, and asked him for a portion of the fire he carried with him. The Bandicoot as usual refused his request. The Pigeon then asked him why he continued so selfish as not to divide his fire with his neighbors. The Bandicoot replied that the fire was his alone, by right, and therefore it was his intention to maintain his claim, and to keep it to himself. The two continued to wrangle, when suddenly the Pigeon, seizing, as he thought, an unguarded moment, made a dash to obtain the prize. The Bandicoot quickly saw that affairs had come to a crisis, and, in desperation, determined to set matters at rest effectually; he therefore threw the fire towards the water, there to quench it for ever. But fortunately for the Black man, the sharp eyed Hawk was hovering near the river, carefully watching the whole transaction, and seeing the fire falling into the water, he made a dart towards it, and with a stroke of his wing, knocked the brand far over the stream into the long dry grass of the opposite bank, which immediately ignited and the flames spread over the face of the country. The Black man then felt the fire and said it was good.

I shall conclude this sketch by mentioning a species of trial by ordeal,—a singular and by no means impartial method of testing suspected guilt. Occasions for its exercise are not rare.

One of the tribe, for instance, is found dead ; having fallen by the hands of violence, suspicion falls upon some member of the tribe and he is called upon to prove his innocence; he proceeds therefore to kill a kangaroo. Having cooked a portiou of this, he gives it to the nearest relative, or adopted brother of the murdered man to eat. If this meat goes down the individual's throat smoothly and without obstruction, and no ill effects follow, it is proof that the suspicion is unfounded, and the accused is accordingly looked upon as guiltless. But if on the contrary the meat stick in the throat of the judge, or afterward cause pain or any disagreeable sensations in the stomach, it is proof positive of the guilt of the party suspected, and he has to answer for the deed. It may be seen at a glance that this is a one-sided proceeding, as the result will, in many cases, to a considerble extent, depend upon the feelings and good will of the party most interested, the accuser : who, in giving his decision, can of course please himself whether or not he allow the meat to stick in his throat on its way down, or can as easily exhibit subsequent symptoms of pain or convulsions, should such be necessary.

I have thus endeavoured to give some idea of the Australian savage in his wild state. Had I been of a more mature age when thrown amongst the natives of Western Australia there is little doubt but that much interesting information could have been added in illustration of the subject I have attempted to elucidate. Before concluding, however, I may be permitted to answer the question frequently put to me : "Whether the condition of the Australian has been improved by his intercourse with the White man?" The question admits of no doubt or hesitation in framing a reply; and I regret to say it must be answered in the negative. It is a strange fact, but one no less painful than true, that, wherever the white man plants his foot, the native of the soil gradually disappears. Unable to withstand temptation, he acquires the vices without partaking of the benefits of civilization. To this may be further added the fruits of his own natural spirit of treachery and revenge; which unhappily neither the civilization nor the Christianity of the white man has affected in any perceptible degree. Incapable of adapting himself to the changes which agriculture, and a numerous settled population, effect on a wild country, his former means of subsistence disappears, and that which has displaced it lies entirely beyond his reach. Disease and want accordingly work their will on the miserable savage, and his extinction is speedy and inevitable.

The Australian above all others is specially exposed to these evils, and the last of his race must soon be numbered with the things that were. Already every vestige of the native population of Tasmania has vanished from that beautiful island, although within so recent a period as my visit to it, the Tasmanian was still to be seen living on his native soil. The various tribes on the coasts of Australia are fast following in his wake, and most of those who form the subject of this paper, have, I believe, by this time passed away from that strange world of the Southern Ocean, which is now so rapidly filling with a new and hardy population of industrious settlers, derived—it may almost be said without figure of speech—from every nation under heaven; but controlled and guided in the progress of civilization by the hardy, practical Anglo-Saxon race.

DISCOVERY OF INDIAN REMAINS, COUNTY NORFOLK, CANADA WEST.

BY DANIEL WILSON, LL.D.

PROFESSOR OF HISTORY AND ENGLISH LITERATURE, UNIVERSITY COLLEGE, TORONTO.

During the progress of agricultural operations in the course of last autumn, Mr. James W. Wilson, a farmer resident on the third lot, thirteenth concession, in the township of Windham, County Norfolk, ploughed up a skeleton, along with Indian relics, some of the characteristics of which are peculiar, and calculated to confer a special interest on the discoveries. The remains were met with accidentally when ploughing above the decayed roots of a large pine stump; and unfortunately the skull—which escaped the edge of the ploughshare and was perfect when found,—was carelessly handled, and broken into fragments. Having visited that district during the summer, some researches then made by me with a view to the discovery of traces of Indian occupation, had suggested the likelihood of such remains being regarded by me with interest. Accordingly the greater number of pieces of the fractured skull, along with various portions of the principal bones of the skeleton, and the accompanying relics, were forwarded to me through the kind intervention of my friend Dr. Covernton, of Simcoe, and I have succeeded in putting the pieces of the skull together, so as to present it in a restored form, complete, with the exception of part of the occipital bone.

The first impression formed from a view of this skull, and the seemingly disproportionate delicacy of such portions of the skeleton as accompanied it, was that it was part of a female dwarf, of the old Indian race; and this tended to give additional interest to any details in reference to its discovery. The skull is delicately formed, the cerebral developement, especially in the frontal region, unusually large; and while the jaws are prognathous, the malar bones and the zygomata are comparatively small and slender in their proportions, very markedly so indeed for one of Indian birth, and the under jaw is of light and delicate structure. In the superior maxillaries the dentes sapientiæ are fully formed, though not come down, and the frontal consists of a single bone, without the slightest trace of any suture being apparent. The entire cranium, apart from the bones of the face, presents a striking contrast in the largeness of its cerebral developement, and its symmetrical proportions, to another Indian female skull in my possession, obtained from an ancient cemetery on the Oak Ridges, County of York, and evidently that of a full grown adult. While such are the characteristics of the skull, the bones of the skeleton are small, slight, and delicate in structure. These various appearances seemed to corroborate the first convictions of the abnormal character of the skeleton, and to suggest the idea already referred to, of its possibly being that of an Indian dwarf, though more careful observations have not tended to confirm this supposition.

In addition to the bones of the skull, the various portions of the skeleton forwarded to me included those of the upper and lower extremities, along with the principal parts of the pelvis, and these I submitted to Dr. E. M. Hodder, who kindly permitted me to avail myself of his well-known skill and experience. The conclusion arrived at from his observations on them, he thus communicates to me: "I have carefully examined, measured, and compared, the several portions of the pelvis. The result of this has impressed me with the belief that the bones belonged to a female child of small size, but not of dwarfish stature, and who had not yet reached the period of puberty.

In the pelvis the union of the illium, ischium, and pubis,—which at the approach of puberty become firmly united or ankylosed together,—had not commenced. In the measurements which I have been able to make of the fragments,—due allowance being made for the attrition of their processes and fractured surfaces,—there is not that marked and striking difference which would exist had they belonged to a dwarf, neither is there any trace of deformity in the bones of the body: a result generally met with in persons of that description. I am therefore led to the conclusion, not only from the examination of the bones of the pelvis, but from the attenuated appearance of the long bones which you have in your possession, that they belonged to a child not exceeding eleven or twelve years of age, who was of a scrofulous constitution, and who died of some lingering disease, most probably consumption."

The skeleton to which these remarks refer was turned up in a hollow, on ground which has been many years cleared, and under the roots of a pine tree of the very largest size, the pine stump had been long removed, and only some of the lateral roots remained, so that the interment belongs to a period anterior to the commencement of the Anglo-Saxon settlements on the shores of Lake Erie. The body lay east and west, under the main root of the pine tree, and along with the skeleton there had been deposited rude clay pottery, a round ball of gypsum, a bone bodkin, and a stone gouge or chisel. The pottery is of the usual description, of rude burnt clay, decorated with incised lines, crossing one another with sufficient regularity to form ornamental patterns round the border; and one fragment is perforated, indicating a vessel designed for suspension; but the pieces forwarded to me are too small and imperfect to show more than that they have belonged to more than one vessel. It is unfortunate that this sepulchral deposit,—evidently presenting some features of peculiar interest,—should have been brought to light by the rude ploughshare, which here, as elsewhere, generally defaces and destroys more than it reveals. From the different character of the fragments of pottery, there would appear to have been, at least, three vessels in the grave, one of them considerably thicker, and probably larger than the others. The broken fragment of a large thin flat stone, ground to a sharp edge, was also found, and the whole contents of the grave appear to have indicated the traces of Indian sepulchral rites employed under special circumstances, and practised with peculiar care. The discovery of the skeleton, as in various other cases, lying directly under the roots of a large tree, naturally suggests the idea that the latter is altogether of subsequent origin and growth, aud hence that its size and age supply some evidence tending to fix the period to which the inhumation may be assigned. It may be, however, that in some cases the grave was hollowed out beneath the roots of a full grown tree, which, would serve alike as a protection to the sacred remains deposited beneath, and also as a monumental grave-post, on which might be painted the inverted symbols, that told of the departed. If such should prove to have been a practice of Indian sepulture, it will suggest additional caution as to the inferences to be drawn from the size and supposed age of the trees found over such graves; but there can, under no circumstances, be any doubt as to the one now in question belonging to a period anterior to the settlement of the Norfolk district by the white man. Indeed, Mr. Paul Kane informs me that he has never seen any pottery resembling the specimens found in this grave, in use among any of the tribes of the North West, although fragments of such are of frequent occurrence in the district, and must once have formed a common object of native manufacture there.

In the Canadian Journal for October, 1855, * special directions were given with a view to the formation of a Collection of Ancient Crania, illustrative of Canadian Ethnology, and some of these may be recalled with advantage, in the hope of securing a more careful attention to the preservation of such relics as those above described. Collections of this nature are exciting the highest interest among men of science both in Europe and America. A section of the British Association for the Advancement of Science is devoted to this special department, in connection with Geographical discovery, and recent exploring expeditions have had their attention particularly directed to the same subject.

When the importance of such evidences of the physical characteristics both of extinct and living races, in relation to historical investigation, as sepulchral remains disclose, is thus becoming so widely appreciated, it appears to be desirable that Canada should not lose the opportunity of contributing her share to the elucidation of ethnological science, afforded by her numerous public works, as well as by the rapid progress in the clearing and settling of wild land. Such a collection of native crania as that with which Dr. Morton has en-

* Canadian Journal, Old Series, Vol. iii. p. 345.

riched the Cabinet of the Academy of Sciences of Philadelphia would form a valuable addition to the museum of the Canadian Institute, and many facilities exist for its attainment. Every year agricultural operations are extending into new districts, and breaking up virgin soil. In the progress of clearing the ancient forests, and bringing the land into cultivation, places of sepulture must frequently be invaded, where the remains of the long-buried chief lie undisturbed, alongside of specimens of the rude arts which furnish proofs of the condition of society to which he belonged. Railway and other operations are in like manner leading to extensive excavations in regions hitherto untouched by the spade or plough; and these also frequently expose to view similar relics of the ancient or more recently displaced aborigines; though it is just cause of regret that they have hitherto, in so very few cases, been rescued from destruction. When, however, we remember the apathy with which many educated men have witnessed, and even countenanced the destruction of interesting memorials of the past, in the old world, it is scarcely to be hoped that the rude railway navy, or the first agricultural explorers of the wild lands of the North and West, will greatly interest themselves in objects of scientific curiosity; but now that the members of the Canadian Institute are scattered over nearly every district of the Province, it may be hoped they will be found prepared for hearty co-operation in the accumulation of facts, and in the preservation of the material evidences whereby the ancient history of this continent and its people may be elucidated.

In many cases the condition in which the skulls and other remains of the former occupants of our Canadian clearings are found, is such as to present no obstacle to their preservation. It is to be noted, however, that the more ancient such remains are, the greater is the interest and value they are likely to possess. No indications have yet been noticed of a race in Canada corresponding to the Brachycephalic or square-headed mound-builders of the Mississippi, although such an approximation to that type undoubtedly prevails throughout this continent as, to a considerable extent, to bear out the conclusions of Dr. Morton, that a conformity of organisation is obvious in the osteological structure of the whole American population, extending from the southern Fuegians, to the Indians skirting the Arctic Esquimaux. But such an approximation—and it is unquestionably no more—still leaves open many important questions relative to the area and race of the ancient mound-builders. On our northern shores of the great chain of lakes, crania of the more recent brachycephalic type have unquestionably been repeatedly found in comparatively modern native graves. Such however are the exception, and not the rule. The prevailing type, so far as my present experience extends, presents a very marked predominance of the longitudinal over the parietal and vertical diameter; while, even in the exceptional cases, the brachycephalic characteristics fall far short of those so markedly distinguishing the ancient crania, the distinctive features of which some observers have affirmed them to exhibit. In point of archæological evidence of ancient occupation, moreover, our northern sepulchral disclosures have hitherto revealed little that is calculated to add to our definite knowledge of the past, although the traces of ancient metallurgic arts suggest the probability of such evidence being found. The discovery of distinct proofs of the ancient extension of the race of the mound-builders into these northern and eastern regions, would furnish an addition of no slight importance to our materials for the primeval history of the Great Lake districts embracing Canada West.

Such ancient osteological remains, of whatever type, are likely to be in a very fragile state, and will require much care in their removal. As it is not to be doubted that some are to be found among the members of the Institute, to whom investigations of this nature will present a just object of careful and persevering research, it may not be useless to add a few hints for collecting and preserving such ancient remains. It is not to be overlooked that, to those who have made such the subject of special study, the entire skeleton frequently possesses features of interest and value, as evidence of peculiar distinctions of race, or as traces of habits and conditions of life. It is manifestly, however, only under very rare and peculiar circumstances, as in that of the Norfolk County Grave described above, that it can be expedient to attempt the preservation of the whole of the skeleton; but as the determination of the sex has a very marked bearing on the relative form and proportions of the skull, the pelvis may be considered as, next to it, the most important part to be secured or specially observed.

In reference to crania, it must be borne in remembrance that it is desirable to possess the whole of the bones of the head and face, including the lower jaw and the teeth. The slender and fragile bones of the nose are of special importance, and when remaining in their place should be carefully protected from injury. In all cases they are highly characteristic, and in none more so than in the races of American Indians, whose strongly marked profiles derive much of their character from the prominence and peculiar form of the nose. It is also to be observed in the case of remains found under circumstances indicative of great antiquity, and consequently possessing peculiar value for the purpose which the Ethnologist has in view, that though the bones may be wholly disjointed and even fractured, if the whole, or the greater number of the fragments be collected, and carefully packed so as to protect them from further injury, it may be quite possible to rejoin them, and so reconstruct the cranium, or such other portions as may be desired.

When ancient barrows, grave-mounds, or other sepulchral depositories, are explored with the express purpose of adding to archæological or ethnological data, the zeal of the investigator is likely to suggest due care in prosecuting the research; but in Canada it is to be presumed that, in the great majority of cases, such remains will be discovered by chance, and their preservation from further injury in the hands of their original exhumers will be more a matter of accident than design. By and by, however, we may hope to create an intelligent interest in this department of scientific inquiry, and so find zealous explorers of the sepulchral chronicles of Canada, as well as of those of Egypt, Britain, or Central America. To such, the following additional hints, derived from practical experience, may be of some value.

In exploring any locality in search of such memorials of the past, whether it be a grave-mound, ossuary, or cemetery, that is uncovered,—the ruder instruments of excavation, such as the pick-axe and spade, should be laid aside as soon as any portion of a skull or skeleton has been exposed. The whole must then be cleared from the surrounding earth by means of some light implement, such as a garden trowel, with the assistance of the hand. In removing the earth, strict attention should be paid to any small objects contained in it: as the practice of the Indians of this continent, as well as of most other savage races, of burying weapons, implements, personal ornaments, and relics of various kinds, with the dead, is well known. And here the distinctions of sex, above referred to, become of special interest, so that it is of great importance to avoid mixing the contents of two or more graves, before the peculiarities of each are noted. With the male skeleton will generally be found the weapons of war and the chase, and the peculiar decorations of the warrior or the priest, while that of the female is accompanied with domestic implements, personal ornaments, and other relics, properly pertaining to her sex.

Numerous personal ornaments, however, which closely correspond to those used in civilized life as parts of female decoration, are reserved by the savage exclusively for his own personal adornment; and hence, an additional reason for carefully apportioning to each skeleton its accompanying relics.

In order to avoid injuring the most essential parts of the skeleton, it is advisable for the explorer, where he can do it, without great inconvenience, to pursue the final process of laying it bare, by proceeding from the feet towards the head. No parts of an ancient uncoffined skeleton are so difficult to recover perfect and complete as the bones of the hands and feet; but these are frequently portions of considerable moment. The small size of the hands has been noted by Mr. Stephens as characteristic of the ancient temple builders of Yucatan, and the same feature has been observed in reference both to the hands and the feet, in various primitive races. In seeking to exhume these, as well as the larger bones, they ought not to be moved from the inclosing soil when they indicate the slightest fragility, until the earth has been cautiously removed all round them so as to admit of their being lifted out. Where the skull has been fractured, or any of the bones of the face are displaced by the pressure of the earth, every fragment should be carefully collected; and if the soil has been damp, or the bones are rendered soft by moisture, they should be exposed to the sun, before being wrapped up in paper.

Care must also be taken to note all the circumstances attendant on the discovery, which are likely to throw any light on the characteristics of the race, their mode of sepulture, their arts, or customs; due discrimination being made between the contents of the different sepulchral deposits, when more than one has been explored. Nothing should be trusted to memory, but all the facts noted at the moment and on the spot. Some of the most important facts to be observed are: the position of the body: whether lying at full length, on the back or side, or with the knees bent or drawn up; also, the direction of the body, and the position of the head in relation to the points of the compass.

The nature and relative position of any relics, such as urns, implements, weapons, &c., should next be carefully noted; and among such, particular attention is to be paid to animal remains, such as the bones and skulls, horns or teeth, of beasts, birds, and fishes, and marine or fresh-water shells. It is a common fashion among savage tribes to hold a burial feast over the grave of the dead, and such relics may tend to throw considerable light on the habits of the people, as well as on the period to which they belong.

In transmitting ancient skulls, they should be first wrapped up in paper—an old newspaper will be found the most suitable for the purpose. Where there are detached pieces, each should be put in a separate wrapper. The whole may then be placed in a box with hay, which furnishes an inclosure sufficiently elastic to protect the most fragile bones from injury during carriage.

With these and all other ancient relics, the object of the intelligent collector is not the mere gratification of an aimless curiosity, or the accumulation of rarities of difficult acquisition, but the preservation of objects calculated to furnish valuable scientific or historical truths. As, however, such remains lose much of their value when the locality and circumstances of their discovery are unknown, it is extremely desirable not only to attach to each skull, package of bones, or accompanying relics, the name and description of the locality where they have been found, but also as soon as possible to mark this neatly and indelibly upon the object itself. Where more than one skull has been procured, and any of them are in a fragmentary state, it is scarcely necessary to add that the utmost care should be taken to keep the several portions of each skull distinct from the others ; as even where it may be possible afterwards to separate them, this must always be attended with much additional labor, and generally with some uncertainty. In most cases the greater number of the teeth, if not already loose, will be apt to fall out so soon as the skull becomes dry ; it is therefore extremely desirable to prevent those belonging to different skulls from becoming mixed. If this is attended to, there can be no difficulty in correctly replacing them. When perfect they add considerably to the value of such remains, as indications of the physiognomical characteristics of the race to which they pertain, while their condition supplies evidence of the nature of the food, and the consequent habits and degree of civilization of the race. Finally, however, it may be added that even very imperfect osseous fragments, and relics of an apparently trivial character, are frequently well worthy of preservation ; and many valuable and interesting deductions may be based, by the intelligent scientific observer, on what would appear to others insignificant trifles, or even, perhaps, a mere handful of rubbish.

AN EXAMINATION OF LEGENDRE'S PROOF OF THE PROPERTIES OF PARALLEL LINES.

BY THE REV. GEORGE PAXTON YOUNG, M. A.,
PROFESSOR OF LOGIC AND METAPHYSICS, KNOX'S COLLEGE, TORONTO.

In order to establish the properties of parallel straight lines, Euclid assumed it as an Axiom, that "if a straight line meet two other "straight lines, so as to make the interior angles on the same side of "it less than two right angles, these straight lines, being continually "produced, will at length meet on the side on which the angles are, "that are less than two right angles." As this so-called Axiom is far indeed from being self-evident, many attempts have been made by geometricians, both ancient and modern, to demonstrate the properties of parallel lines without its aid. Playfair, in his edition of Euclid's Elements, discusses the principal of these; distinctly shewing the unsatisfactory character of them all, except that of Legendre, which he pronounces "strictly demonstrative." It may be proper to mention, that Legendre has treated the subject of parallel lines in two different ways, one in the text of his "Elements of Geometry," and the other in the notes to that work. Playfair considers the former method "quite logical and conclusive," as well as the latter: only objecting to it, that it is "long and indirect," and too "subtle" for "those who are only beginning to study the Mathematics." But, as the admission of Legendre himself is on record, that this method is *not* conclusive; as it is, in fact, palpably the reverse—taking for granted what requires proof, as much as Euclid's Axiom does; no further attention need be given to it. In the present paper, I am to speak only of the proof advanced by Legendre in the Notes to his Geometry. This proof was keenly assailed by Sir John Leslie; whose strictures, which proceeded upon an entire misapprehension of Legendre's meaning, were refuted by Playfair in an article that appeared in the Edinburgh Review for July, 1812. Since that time, the validity of Legendre's reasoning seems to have been admitted by the general consent of mathematicians. Having been recently led, however, to examine the subject, I feel myself unable to concur in this verdict; and I venture to bring my objections under the notice of the Institute: which I do, not merely because the point in dispute is one of considerable interest in itself, but also, and more especially, because its settlement has an important connection with what may be called the philosophy of Mathematics—that is, with the question as to the principles on which Mathematical reasoning proceeds.

Legendre endeavours to make it appear, without the assistance of any special Axiom, that C, the third angle of a triangle ABC, is determined from the other two, A and B, independently of the magnitude of c, the intervening side. If this be made out, all the properties of parallel lines can easily be deduced. The difficulty is, to demonstrate the fundamental position: but here it may be well to quote Legendre's own words. "Soit l'angle droit égal à l'unité, alors les angles A,B,C seront des nombres compris entre 0 et 2; et puisque $C = \phi(A,B,c,)$ je dis que la ligne c ne doit point entrer dans la fonction ϕ. En effet, on a vu que C doit être entierement determiné par les seules données A,B,c, sans autre angle ou ligne quelconque, mais la ligne c est heterogene avec les nombres A,B,C ; et si on avait une equation quelconque entre A,B,C et c, on en pourrait tirer la valeur de c en A,B,C, d'où il resulteroit que c est egale à un nombre, ce qui est absurde. Donc c ne peut entrer dans la valeur de C, et on a simplement $C = \phi$ (A,B.)" Leslie committed the unaccountable mistake of supposing the argument here stated, to be, that "that the line c is of a nature heterogeneous to the angles A and B, and therefore cannot be compounded with these quantities"—whereas the argument plainly is, that c, which is a line, cannot be expressed in terms solely of A,B, and C, which are numbers. "The quantities A,B, C," says Playfair, in his exposition of Legendre's reasoning, "are angles; they are of the same nature with numbers, or mere expressions of ratio, and, according to the language of Algebra, are of no dimension. The quantity c, on the other hand, is the base of a triangle, that is to say, a straight line, or a quantity of one dimension. Of the four quantities, therefore, A,B,C,c, the first three are of no dimensions, and the fourth or last is of one dimension. No equation therefore can exist, involving all these four quantities and them only: for if there did, a value of c might be found in terms of A,B, and C; and c would therefore be equal to a quantity of no dimensions: which is impossible."

In this reasoning it is assumed, that, because C is *determined by* A,B,c, therefore C can be *expressed in terms of* A,B,c. Now Legendre does not prove that when a quantity is determined by certain others, it can be expressed in terms of them; and I affirm that *such a prineiple, without limitation, is not true.*

For example, consider the angle C of the triangle A B C. And let it be observed that I mean the angle itself, that is, the inclination of a and b to one another, and not the numerical value of the angle, calculated upon the supposition that a right angle, or any other angle, has been assumed as a unit of measure. The angle C is *determined by* the sides a,b,c; yet it cannot be expressed in terms of these quantities alone; because *the value of an angle can only be indicated by pointing out its relation to some other angle or angles*; and therefore cannot be expressed by means simply of lines. It is true that *the numerical value* of C may be expressed in terms of a,b, and c: viz, in an equation where only the ratios of a,b, and c occur, the ratios being numbers. Thus, if $b = \beta a$, and $c = \gamma a$, we might have

numerical value of $C = f(\beta,\gamma.)$

But this is altogether a different thing from saying that *C itself*, the angle properly so called, the inclination of a and b to one another, can be expressed in terms of a,b, and c. Now if C itself (not its numerical value, but the absolute angle) is determined by a,b, and c; and if, nevertheless, it cannot in the nature of things be expressed in terms of a,b, and c; Legendre's demonstration, the very foundation of which is, that a quantity which is determined by certain others, can be expressed in terms of them, must be pronounced erroneous.

Should it be maintained that C (the angle itself) may be expressed in terms of the numbers β and γ, *a right angle being understood to be the unit of measure;* or more fully, thus:

$$C = \text{right angle} \times f(\beta,\gamma);$$

I reply that in the same manner the line c, in Legendre's reasoning, may be expressed in terms of A,B,C, *some line L being understood to be the unit of linear measure;* thus:

$$c = L \times f(A,B,C.)$$

I am inclined to believe, from metaphysical considerations, that it is impossible to demonstrate the properties of parallel lines without a special axiom. As it would be difficult, however, to bring out the grounds of this belief without entering into a somewhat lengthened discussion of the nature of our conceptions of geometrical magnitudes, I content myself in the meantime with the above remarks on Legendre's treatment of the subject. Had the reasoning of that distinguished mathematician been valid, it would have been a standing and conclusive refutation of any theory of our conceptions of geometrical magnitudes, in which the impossibility of proving the properties of parallel straight lines without a special axiom was involved. But as Legendre's demonstration, like all others in which the same thing has been attempted, has been shewn to be erroneous, the ground is clear; and a theory of our geometrical conceptions, such as has been referred to, is at least not exposed to the ready-made fatal objection that it is at variance with unquestioned fact.

REVIEWS.

Narrative of the Expedition of an American Squadron to the Chinese Seas and Japan, performed in the years 1852, 1853, *and* 1854, *under the command of Commodore M. C. Perry, U. S. Navy, by order of the Government of the United States. Compiled from the original notes and Journals of Commodore Perry and his Officers, at his request and under his supervision.* By Francis L. Hawks, D.D., LL. D. Washington: A. O. P. Nicholas, Printer, 1856.

When Columbus set sail, in 1492, on his memorable voyage of discovery, he was specially stimulated and encouraged in his venturous expedition by the conviction that the Asiatic continent stretched away so far eastward from Europe into the unexplored ocean, that it could be most easily reached by sailing westward, and so, as it were, meeting it on the way. The special points, accordingly, towards which the great discoverer of this New World aimed were Cathay and the Island of Cipango: in other words, China and Japan. It is needless to say that an authentic knowledge of these countries is of an older date than the recent expeditions of England and the United States: known as they have undoubtedly been, by means of the narratives and travellers' tales of such old authors as Marco Polo, the Venetian, our English Mandeville, and Mendez Pinto. With the last of these travelled for a time the catholic Xavier; though such good company has not saved that gasconading Portuguese from the title of "Prince of liars!" Nevertheless, the narrative compiled by Dr. Hawks from the intelligent notes and observations of the American officers, lifts the veil from scenes hitherto altogether hid from European or American eyes. Dutch, English, Russian, and American adventurers have attempted to penetrate the mystery by turns; but at best, it has been but a mariner's glimpse we have had of the "Golden Zipango" of Marco Polo. Nor does even this American expedition reveal to us greatly more than the all-important fact that the gates have at length been opened, and that this strange scene of an old civilization, in some respects more remarkable than even that of China, is about to disclose all its quaint and picturesque inner life to the outer barbarian world.

Europeans have learned to look without surprise, on the evidences of a civilization far older than their own, which China can boast of; on gun-powder, the compass, with its magnetic needle, wood-engraving, and above all, the printing press, only re-discovered for Europe, if not derived from the older use in Cathay. But in the Japanese we see an eastern people, not only similarly gifted, and working out a civilization which was in advance of that of Europe in the fourteenth century, but who exhibit little of that dread of innovation which has so singularly arrested the development of the national intellect of China. The American Commodore found he had to deal with a government, shrewd, intelligent, firm of purpose, and far-seeing in its policy; while the acquirements in mathematics, geography, and languages, and the general knowledge of the sciences, were such as would discredit no European Court. It became manifest moreover, in the course of his intercourse with this interesting people, that they too have their conservative and liberal parties in the State: the sticklers for precedent and routine, who adhere to the "good old ways," and devoutly protest against all innovation; and the advocates for progress who, in replying to the President's letter, protest against a bigoted adherence to ancient laws as unworthy of *the spirit of the age.* In effecting satisfactory arrangements with the Japanese Government, accordingly, great tact and skilful diplomacy were found absolutely requisite. "Not an article of the treaty was made but upon the most serious deliberation by the Japanese..............probably nothing but the exercise of the most perfect truthfulness and patience, would ever have succeeded in making with them a treaty at all." How far the official explanations, processions, and formal state ceremonial and parade, in which the Commodore deemed it politic to indulge, precisely merit so superlative a designation as that of "the most perfect truthfulness," may surely admit of question. When, for example, we read of his reply to the inquiries of the Japanese Commissioners relative to the number of his proposed official retinue, that "It is the custom of the United States, when an officer of high rank bears a communication from the President to the Sovereign of another country, for him to go with such an attendance as is respectful to the power to which he is sent:" it is difficult to avoid some remembrance of republican state-official battles with European Court lackeys, on the all important questions of regulation small-clothes, yellow waistcoats, and round hats! Here is the manner in which the same republican simplicity manifested itself when it was desirable to produce a "moral influence" on an Asiatic Court:

"The marines led the way, and the sailors following, the Commodore was duly escorted up the beach. The United States flag and the broad pennant were borne by two athletic seamen, who had been selected from the crews of the squadron on account of their stalwart proportions. Two boys, dressed for the ceremony, preceded the Commodore, bearing in an envelope of scarlet cloth the boxes which contained his credentials and the President's letter. These documents, of folio size, were beautifully written, on vellum, and not folded, but bound in blue silk velvet. Each seal, attached by cords of interwoven gold and silk with pendant gold tassels, was encased in a circular box six inches in diameter and three in depth, wrought of pure gold. Each of the documents, together with its seal, was placed in a box of rosewood about a foot long, with lock, hinges, and mountings, all of gold. On either side of the Commodore marched a tall, well formed negro, who, armed to the teeth, acted as his personal guard These blacks, selected for the occasion, were two of the best-looking fellows of their color that the squadron could furnish!"

It is much to be regretted that the narrative of the American Expedition to Japan could not have been prepared for us by the pen of the distinguished officer under whose able guidance it was brought to a successful termination. Whatever advantages may spring from the well-known learning and special acquirements of the editor, his work certainly lacks the freshness and vigor of personal narrative, and in the hands of the gallant Commodore, it may be presumed we should have escaped exhibitions of such questionable taste as the eulogies and laudations of the United States and its officers, here "compiled from the original notes and Journals of Commodore Perry and his officers, at his request and under his supervision," and "published by order of the Congress of the United States." This is the more to be regretted, as it was so totally uncalled for in a narrative really creditable to the nation, and got up in the same liberal style as other works recently issued from the government press at Washington. At the same time it is only justice to the compiler to quote the statement in his preface, that "every word of the work was read to the Commodore in MS, and received his correction before it went into the printer's hands; every proof-sheet also was read by him before it was sent back to the press."

The illustrations are numerous, and, though in the case of the wood-cuts, careless and defective printing materialy detracts from their effect, many of them are curious and characteristic. This is specially the case with the colored fac similes of native drawings, which exhibit not only great freedom of outline, but also quaint touches of humor,—as in the "crossing the Oho-e-ga-wa river,"—and strikingly contrast with the more familiar specimens of Chinese art.

One of the examples of Japanese illustrative art described in the "Narrative" is a Child's Book, purchased in Hakodadi for a few Chinese copper "cash." After commenting on the knowledge of perspective, and other proofs of advancement in art which its illustrations display, its contents are thus further described:

"On another page there is what appears to be some Tartar Hercules, or Japanese St. Patrick, clearing the land of reptiles and vermin, and the doughty destroyer is brandishing his sword in most valiant style. This is drawn with a freedom and humorous sense of the grotesque and ludicrous, that are rarely found in similar Books prepared for the amusement of children with us. In one of the illustrations there is a quaint old shopman peering through a pair of spectacles stuck upon his nose, and made precisely like the double-eyed glasses just now so fashionable. A glass globe of gold fish, which have awakened the hungry instincts of a cat that wistfully watches their movements in the water, is among the pictures. A couple of chairmen, who have put down their sedan to take their rest, are engaged lighting their pipes; and a professor, seemingly of Phrenology, is standing amid the paraphernalia of his art, whatever it be, and is taking the measure with a pair of compasses of a bald-headed disciple. All these scenes occur among the illustrations of this little book. All show a humorous conception, and a style of treatment far in advance of the mechanical trash which sometimes composes the nursery books found in our shops. A people have made some progress worth studying who have a sense of the humorous, can picture the ludicrous, and good naturedly laugh at a clever caricature............................

There were no printing establishments to be seen either at Simoda or Hakodadi, but books were found in the shops. These were generally cheap works of elementary character, or popular story books or novels, and were evidently in great demand, as the people are universally taught to read, and are eager for information. Education is diffused throughout the Empire, and the women of Japan, unlike those of China, share in the intellectual advancement of the men, and are not only skilled in the accomplishments peculiar to their sex, but are frequently well versed in their native literature. The higher classes of the Japanese, with whom the Americans were brought into communication, were not only thoroughly acquainted with their own country, but knew something of the geography, the material progress, and contemporary history of the rest of the world. Questions were frequently asked by the Japanese which proved an information that, considering their isolated situation, was quite remarkable, until explained by themselves in the statement that periodicals of literature, science, arts, and politics, were annually received from Europe through the Dutch at Nagaski; and that some of them were translated, republished, and distributed through the Empire."

Here it is obvious that effectual steps have at length been taken, for opening up free intercourse with an inquiring, sagacious, and highly intelligent, though suspicious, people. The Americans are justly entitled to all honor for their successful carrying out of an expedition which can scarcely fail to prove advantageous to the whole civilized world,—and not the less so that it is the result of peaceful and friendly negotiation, and not of a barbarous warfare against a sensitive but weak nation. When we consider, with the natural surprise of the members of the American Expedition, that the Japanese were found quite ready to converse intelligently with them about railroads, telegraphs, daguerreotypes, Paixhan guns, steamships, the Mexican war, &c., as subjects already familiar to them, we cannot fail to appreciate the intellectual powers and cultivation of this remarkable people. They have no such self-sufficient faith in their own intellectual supremacy as with the Chinese bars all further progress; and when we consider that in the fourteenth century they were not less advanced than western Europe in the chief elements of civilization, we can scarcely evade the question: "What has arrested their progress?" nor avoid the suggestive answer which the contrasting Christianity of the freest and most civilized states of the Old and New World present, when compared with the degraded worship of this otherwise enlightened people. On this subject the following brief compendium is suggestive:—

"Whatever may be the moral character of the inhabitants of Simoda, it might be supposed, from the great number of places of worship, that they are a highly devotional people. Though the peculiar religious of the Japauese seemed to be sustained in a flourishing condition, the people are rather remarkable for their toleration of all kinds of worship, except that of the Christian, for which, in consequence of the political intrigues of the Roman Priesthood, centuries ago, they have an intense hatred, carefully inculcated by those in authority, who keep alive the traditional enmity engendered at an epoch when the Portugese were expelled from the Empire. The Buddhist and Siutoo worships are those most prevalent in Japan, and the lower classes are strict but formal devotees, while it is suspected that the higher and better educated, are indifferent to all religions, and entertain various speculative opinions, or seek refuge in a broad scepticism."

The description of the Japanese "Praying Machine" may not inappropriately complete this subject.

"There was a curious contrivance found in one of the burial places at Simoda, consisting of a tall post, placed upright, and being square, it presented four surfaces on each of which was one or two inscriptions or prayers. The post was nearly eight feet in length, and near the centre, at a convenient height to be reached by the hand, was affixed vertically a wheel, moved readily on an axle that passed through the post Two small iron rings were strung upon each of the three spokes of the large wheel. Every person who twisted this instrument in passing was supposed to obtain credit in Heaven for one or more prayers on the post, the number being graduated according to the vigor of the performer's devotiou, and the number of revolutions effected. The jingle of the small iron rings was believed to secure the attention of the Deity to the iuvocation of the devotional, and the greater the noise, the more certain its being listened to. This praying by wheel and axle would seem to be the very perfection of a ceremonious religion, as it reduces it to a system of mechanical laws, which, provided the apparatus is kept in order,—a result easily obtained by a little oil, moderate use, and occasional repairs,—can be readily executed with the least possible expenditure of humau labor, and with all that economy of time and thought which seems the great purpose of our material and mechanical age. Huc, in his interesting account of his travels in Thibet, speaks of an improvement on the machine, where the apparatus was turued by water-power, and very appropriately styles it a Prayer Mill. In the course of the progress of the Japanese in the mechanical arts, this, with their usual readiness for adopting new improvements, will no doubt be introduced, or perhaps the more effective power of steam will be applied to their Praying Machines, and with the introduction of Steam boats and Railroads, may commence an era of locomotive devotion!"

We have not attempted in this brief notice any comprehensive analysis of the work, of which only one portion is yet published. Issued from the official press of Washington in a massive quarto volume, and accompanied also, we should add, with a series of maps which constitute an important feature of the work; it has been re-printed in a cheap form, by Messrs. Appleton & Co., of New York, for general circulation. The official publication, however, will be followed, as speedily as the labors of the government press can produce them, by three other volumes, some of the contents of which may be expected to present even more valuable features, than the interesting, though somewhat diffuse, narrative of Dr. Hawks. The first of these forthcoming volumes will be devoted chiefly to Natural History; the second is set apart for the Astronomical Observations; and the third will complete the work by furnishing an account of the Hydrography of the Expedition.

D. W.

Typical Forms and Special Ends in Creation: By Rev. James McCosh, LL. D., Professor of Logic and Metaphysics, in the Queen's University in Ireland, and George Dickie, A. M., M. D. Professor of Natural History, in the Queen's University, in Ireland.

Writers on Physico-theology have for the most part been accustomed to restrict themselves within what Dr. McCosh, with his coadjutor Professor Dickie, consider too narrow a field. They have labored—and with all success—to point out instances of design in the works of nature; but have stopped here, as if this exhausted their case. Physico-theology has thus been virtually identified with Teleology. But this, the writers of the work before us think, is doing injustice to the subject. Equally significant, in their opinion, with the special ends contemplated in creation, is the circumstance, that, in the contrivances made with a view to these ends, a general plan or pattern has been adhered to. Physico-theology—or, to employ the much better name suggested in the work under review, Cosmology, an excellent term, which deserves to be rescued from the unworthy uses to which it has hitherto been put—comprehends, besides the science of SPECIAL ENDS, or Teleology, the science of TYPICAL FORMS, or Typology.

When a man builds a house, he has in view certain *special ends.* He constructs windows, to admit light; doors, for ingress and egress; and so forth. But at the same time, it will be invariably found, that, at least in some measure, the architect follows a *general* *plan*, which is not in itself indispensable for the main purposes on account of which the house is built. He proceeds on a principle of Order, as well as on one of Special Adaptation. He makes his building according to a certain style, suited to the prevailing taste of the period; and in no style of architecture are the windows and doors, and other parts of the structure, arranged without some regard to symmetry. Witness—as illustrative of the same point—the general resemblance in the forms of the weights used in a merchant's shop—the regularity in the plaits of a wicker basket—the mould in which a water-jug is cast—and the countless devices for ministering to the sense of beauty, irrespectively of the direct and proper use to which an article of manufacture is intended to be put. It would probably be impossible to mention a single object fashioned by human intelligence, in which, while some special end is aimed at, the influence of the principle of order is not at the same time manifest. Now, what thus holds good regarding the works of man, holds good also regarding the works of God. While special adaptations are every where met with in nature, the Creator has been pleased, for the most part, if not invariably, to conform himself to a general type or pattern. It was at one time a subject of fierce controversy among scientific men, whether the phenomena of the universe are to be explained by reference to the principle of Adaptation, or to that of Order; one party, with Cuvier, maintaining the former opinion; and another, with Geoffrey St. Hilaire, the latter. But both sides (as has often happened) were so far right, and so far wrong. The question between the disputants was: Adaptation *or* Order? The truth of the case is: Adaptation *and* Order united. On the one hand, for instance, the eye was expressly fitted to be an instrument of vision; on the other hand, however, a general plan is discernible, according to which the eyes of all creatures are formed; and only such departures have been made from the typical form—the normal eye, as we may term it—as were rendered necessary or desirable by the circumstances in which particular animals were designed to live.

The law, that the works of nature, while exhibiting special adaptations, are formed upon a general plan, did not altogether escape the notice of the reflecting minds of antiquity. They had glimpses of it, though dim and imperfect. The formal and scientific exposition which it has received of late from several eminent writers, has been one of the fruits of the progress of physical investigation; and Drs. McCosh and Dickie are entitled to the highest praise for having gathered together into a focus all the light which the different natural sciences, as far as we are at present acquainted with them, shed upon this interesting subject. In particular, they have made admirable use of the most recent discoveries in Animal and Vegetable Physiology; shewing, that, in every animal and plant, a system of serially repeated parts (Homotypes) can be traced; that we likewise meet, in each of the great leading divisions both of the animal and vegetable kingdoms, with a system of answering parts (Homologues); and that, moreover, when we compare the two organic kingdoms with one another, we can, to a certain extent, detect parallelisms in developement, (Homœophytes.) In the course of their discussion of these points, our authors advance a theory regarding the structure of plants, which distinguished botanists, though hesitating in the meantime positively to accept, appear to regard as by no means unworthy of consideration. It is now universally acknowledged that all the parts of a plant are formed on one or other of two types, the stem or the leaf—a discovery due (strange to think) to a poet, whose delight in nature and loving observation of its forms, enabled him to detect what the mere men of science not only had overlooked, but were long reluctant to admit, even after it was pointed out. The sepals, the petals, the stamens, the pistils, are—not indeed metamorphosed leaves, as Gœthe rather loosely termed them—but parts formed on the model of the leaf. In like manner, the branches, in all their subdivisions, with the roots, must be classed typically with the stem. Buds and seeds are virtually repetitions of the entire plant. This is now (we say) an established doctrine; but Dr. McCosh— for the idea would seem to have originated with him—is of opinion that the generalization may be carried still further, and that the stem and leaf have themselves a common typical form; so that only a single primitive model must be recognised, after which all the parts of a plant, without exception, are constructed. We merely advert to this theory as a proof of the suggestive character of the work under review, and of the original and independent thinking which it contains. Among the minor illustrations given of the principle of order, we were much struck with the chapter on the colors of plants. To a careless observer, nothing in nature would seem to be more irregular than the distribution of color; yet even this is found to be guided by laws pretty well defined. Most interesting it is to notice, that, as a general rule, colors in nature are associated on the very principles which artists have pointed out as necessary, in order that an effect pleasing to the human eye may be produced. There are harmonies of color as truly as of musical sounds; and in the aspect of creation ungrateful discords never appear. Professor Dickie believes that he has established certain conclusions regarding the relation of form and color in the flower, of which it may be sufficient to mention the following; viz: "in regular corollas the color is uniformly distributed, whatever be the number of colors present"; and, "different forms of corolla in the same inflorescence often present differences of color, but all of the same form also agree in color."

We have hitherto spoken of the principles of order and of adaptation, as though they were perfectly distinct from one another; yet it is not to be understood that this is, strictly speaking, the case. Our authors, while they have illustrated the two principles separately, look upon order—and, we think correctly,—as nothing else than adaptation of a higher and less obvious kind than is seen in the arrangements popularly regarded as the best illustrations of design. Their opinion—an opinion first advanced by Dr. McCosh in his treatise on the Divine Government, physical and moral—is, that the final cause of the typical forms of nature, is to aid the intelligent creatures of God in their study of what he has made. Were there no uniformity of structure and appearance in the objects around us; were those typical characters wanting, on which natural classification depends; physical science would be impossible. In a world not constructed on the principle of order, rational creatures would be unable to make any thing beyond a very slight advancement in their acquaintance with the works of Him who called them into being. Confusion on this point is apt to arise from our failing to contemplate the possibility of what may be termed non-mechanical purposes. Professor Owen justly pronounces it absurd to suppose "that every segment and almost every bone which is present in the human hand and arm should exist in the fin of the whale, because they were required in such number and collocation for the movement of that undivided and inflexible paddle." Would it be right to conclude, however, that the instance of order here specified cannot be referred to the principle of adaptation at all? By no means. The correspondence between the fin of the whale and the human hand and arm is not indeed necessary for the function which the fin has to perform: but it aids the comparative anatomist in his investigations; and the purpose of the Creator, in establishing this and similar homologies, may just have been to simplify the task of the student of nature. But we may quote the words of our authors:

"Without some such governing principle (as that of order,) nature would be incomprehensible by human intelligence, and this because of the very number and multiplicity of the objects which it presents, each eager to catch our notice; and the mind, in trying to apprehend them, would have felt itself lost, as in a forest through which there is no pathway, or as in a vast storehouse, where the seeds of every species of plant on the earth's surface are mixed in hopeless confusion. By what means is it that man is enabled to arrange into groups the objects by which he is surrounded, and thus acquire a scientific knowledge of them, and turn them to practical purposes? Plainly by reason of the circumstance that there are numberless points of resemblance and correspondence between them. Scientific men have so long been familiar with this process that they are not impressed by it as they ought, and seldom do they enquire into the ground on which it proceeds. It is only when something new, such as the discovery of homologies in the animal kingdom, comes to light, that they are led to reflect on what has been too common to be specially noticed. But if they but seriously reflect on the subject, they will find that it is because of the universal prevalence of points of resemblance and correspondence, that man is enabled to group the infinity of objects which fall under his view, into classes and sub-classes, which can be comprehended by the intellect, and treasured up in the memory." And again:

"*Everything has, after all, a final cause.* The general order pervading nature is just a final cause of a higher and more archetypal character. In the special principle we have every organ suited to its function; in the more general principle, we find all the objects in nature suited to man, who has to study and to use them. Professor Owen has declared that his practical assistant found himself greatly aided in setting up the bones of the skull, by proceeding on the principle that they were constructed on the vertebrate type. Lecturers on anatomy find their students following them much more readily when they expound the skeleton on the archetypal idea. It is only by proceeding on some such method that the nomenclature of comparative anatomy can be retained by the memory. Without some such principle there would require to be one set of names for the bones in man, another set for the bones in quadrupeds, and a third and a fourth set for the bones of birds and fishes. By the discovery of homologous parts running through all, it has been found possible to devise a common nomenclature, admitting of application to all vertebrate animals. But let it be observed that it is not the unity of nomenclature which gives the unity to nature, but it is the unity of nature which has given a unity to human science, and the nomenclature which science employs."

With the view expressed in these quotations we fully agree. Taking for granted that there is a God, "the Almighty Maker of heaven and earth;" and seeking reverently to interpret the order, "standing behind, as it were, and in reserve of the principle of special adaptation;" it does commend itself to our minds as a thing not unworthy (but the reverse) of the Divine Architect, to limit himself, in those creatures of his hand which were designed to come under our notice, to a few well-defined patterns; out of condescension to the weakness of our faculties, and from a desire that we might not be utterly bewildered in our efforts to make ourselves acquainted with his works.

Another view of the subject, however, has been taken. It has been supposed that there are certain typical forms which, in themselves, and altogether irrespectively of their adaptedness to the minds of men or of other finite intelligent beings, are agreeable to the Creator; that there are arrangements with which the Divine mind is pleased, in virtue of their essential harmony—models which it delights to contemplate, for their intrinsic grace or beauty. The poet or painter who has completed a composition to which the highest efforts of his genius have been devoted, will dwell upon the glorious creation of his own mind with emotions of admiration and ecstacy, arising solely from his view of what the poem or picture is in itself, and having no reference to the light in which others are likely to regard it. Even so (it is conceived) the Divine Being may "rest in his love" and "joy over" the Cosmos which he has produced; feeling that in itself, and quite apart from its relation to the minds of finite intelligences, it is "very good."* Not, by any means, that the rela-

* We cannot forbear quoting here one of those fine passages which give such a charm to the scientific works of Dr. Hugh Miller. After referring to the boundless variety of beauty by which the ichthyolites of the Old Red Sandstone are distinguished, he adds: "Nor does it lessen the wonder, that their nicer ornaments should yield their beauty only to the microscope. There is unity of character in every scale, plate and fin—unity such as all men of taste have learned to admire in those three Grecian orders from which the ingenuity of Rome was content to borrow, when it professed to invent—in the masculine Doric, the chaste and graceful Ionic, the exquisitely elegant Corinthian; and yet the unassisted eye fails to discover the finer evidences of this unity: it would seem as if the adorable Architect had wrought it out in secret with reference to the Divine idea alone. The artist who sculptured the cherry-stone consigned it to a cabinet, and placed a microscope beside it; the microscopic beauty of these ancient fish was consigned to the twilight depths of a primeval ocean. There is a feeling which at times grows upon the painter and the statuary, as if the perception and love of the beautiful had been sublimed into a kind of moral sense. Art comes to be pursued for its own sake; the exquisite conception in the mind, or the elegant and elaborate model, becomes all in all to the worker, and the dread of criticism or the appetite of praise almost nothing. And thus, through the influence of a power somewhat akin to conscience, but whose province is not the just and the good, but the fair, the refined, the exquisite, have works, prosecuted in solitude, and never intended for the world, been fraught with loveliness. Sir Thomas Lawrence, who finished with the most consummate care, a picture intended for a semi-barbarous foreign court, was asked why he took so much pains with a piece destined, perhaps, never to come under the eye of a connoisseur. "I cannot help it," he replied, "I do the best I can, unable, through a tyrant feeling, that will not brook offence, to do any thing less." It would be perhaps over bold to attribute any such over mastering feeling to the Creator; yet certain it is, that among his creatures well nigh all approximations towards perfection, in the province in which it expatiates, owe their origin to it, and that Deity in all his works is his own rule."—*Old Red Sandstone, Ch. V.*

tion of the typical forms in nature to our minds is denied. On the contrary, that is not only recognised, but is held as demonstrating that man—intellectually as well as morally—was made in the image of God. The patterns according to which creation is fashioned, and which we may therefore regard as expressing what is pleasing in the Divine sight, are the very same with those which afford the highest gratification to a pure and cultivated human taste. God would thus appear—it is contended—to have constituted our understandings with as great a conformity to himself, as it was possibly for finite intellects to have to the infinite. In regard to this interpretation of the order of nature, our authors express themselves as follows: "We are indisposed to advance a single word against this view; possibly it may be as true, as it is certainly striking and sublime. It is certainly a doctrine which cannot be disproved; we may venture to doubt whether it admits of absolute proof. Do we know so much of the Divine nature as, *a priori*, to be able to affirm with certainty, how that nature must manifest itself in creation? There may even be presumption implied in declaring, in some cases, that the harmonics of nature are after the taste or character of God; for example, that complementary colors are more beautiful to His eye, as they are to ours, when seen in collocation, than non-complementary colors."

The theory upon which Professors McCosh and Dickie here—somewhat hesitatingly—pass sentence of disapproval, is one which—striking and sublime as it undoubtedly is, and calculated, when first announced, to fill and carry away the mind—we cannot accept. Our authors, indeed, have said nothing tending to shew that it is erroneous. The only thing which they adduce in the shape of argument against it, is contained in the sentence about complementary colors above quoted—a sentence which, as it stands, is pointless. There may be presumption (we are told) in declaring that it is a character of the Divine mind to delight in certain arrangements of colors, rather than in others. Now, perhaps there *may*: but surely it is too slight a mode of dealing with the subject, to assert this without a word of explanation, and, having done so, to pass on *Why* may there be presumption in making the declaration in question? In the absence of anything to evince that the declaration is presumptuous, those against whom the statement of our authors is directed, might answer—and it would be sufficient—that they cannot see where the presumption lies. The main objection which we feel to the theory under consideration, is, that the typical forms which we discern in nature depend upon our sensitive modes of perception, and therefore exist only to beings organised as we are. We believe that this is true of the typical forms of nature universally; but we shall confine our remarks to the instance of *color*, to which our authors refer, and which may be most easily treated. The colors which excite our admiration in the flowers of the field, in the bright plumage of the birds, or in the rainbow spanning the sky, have no existence apart from ourselves. It seems, therefore, a contradiction to say that the Divine Being delights in such colors, as intrinsically suitable to his nature; and that their harmonies and melodious combinations would—even had neither man, nor any similarly constituted beings, ever looked out upon creation — have still rendered the flowers, the birds, the rainbow, objects of grateful contemplation in his sight. Let us for a moment assume that the doctrine of perception taught in what is termed the Scottish school is correct. On that doctrine, the sole connection between an external object—for example, a rose —and the colors popularly supposed to be inherent in it, is, that it acts as a stimulus, more or less remote, through means of which our nervous organism is affected; and it is the affection thus excited in the living nerve, that determines the colors which we fancy ourselves to see in the object.* Should the organism be similarly affected by any other stimulus, however different — even by an extra-organic stimulus—the same colors would appear to present themselves to our view. Now we do not say that we agree altogether with this doctrine: but supposing it to be correct, what then? Color depends upon organization; so that if we consider the face of nature, as it must appear to the Creator, to whom no organization can be ascribed, it is impossible to speak of it as colored at all; without, at least, using the word *colored* in some sense entirely different from that in which, when describing our own perceptions, we speak of it as colored. No doubt, the order of the universe, as regards the colors with which it is invested, is, like its order in every other particular, perpetually present to the Divine mind; but the point to be observed, is, that *this is not an Order which exists irrespectively of organized sensitive creatures, or can be conceived apart from them.* A doctrine of sensitive perception, which should approximate more nearly than that of the Scottish school, as above stated, to what we ourselves consider the truth, would only render the conclusion which has been established, more obvious.

We are disposed, therefore, to be content with the explanation

---

* Reid supposes that the nervous affection is the arbitrarily constituted antecedent to the sensation of color: Sir William Hamilton, that the sensation of color consists in the mind's immediate apprehension of the nervous affection.

which our authors give of the fact that nature is formed on certain prevailing types or patterns—an explanation which makes the Order of the universe only a peculiar kind of adaptation. And this will shew in what light we must regard a criticism that has been passed upon the work before us in a contemporary review. "There is a difficulty," it has been said, "lying at the very threshold of the discussion, which the learned authors have not troubled themselves to engage with; viz: How is the existence of these antagonist principles (of order and of special adaptation) compatible with the doctrine of the Divine unity? If one Being is the author of order and law; diversity and multiplicity must be already given. If He is a designer, contriver, adapter; a primordial homogeneous material must be coexistent with Him. Is the one God to be identified with the principle of order, or with the principle of variety? The forces are really antagonistic, void against form, unity against multiplicity, the uniform against the various, the homogeneous against the heterogeneous, and death against life. Neither is victorious over the other. If form issues from void, it sinks back into it; if variety diversifies the uniform, it is again overcome by it; if life emerges from death, it is again absorbed into it. The professors have not, as it seems to us, precluded a dualistic doctrine."* Now, upon these apparently profound, but in truth, hazy and somewhat unmeaning sentences, we remark *in the first place* that order and adaptation are not "antagonistic principles." On the contrary, we believe with Drs. McCosh and Dickie, that the order of nature is adaptation of the highest kind: it is the Creator adapting his works to the capacities of the intelligent beings, by whom they are to be studied. But *in the second place*, as it is affirmed that the recognition of the principle of adaptation in nature would involve the conclusion that there must have been two independent principia rerum, what ground is there, we ask, for such an assertion? Not the slightest. We do not mean to attempt proving the Divine unity; but we deny that there is any thing incompatible with the Divine unity, in the notion that the world exhibits design. Where is there even the semblance of contradiction in our supposing that there is a living God, the sole self-existent Being, who created the world, and created it endowed, in its various parts, with those properties, and standing in those mutual relations, which the terms *Order* and *Adaptation* set forth? Why, if He be a designer, contriver, adapter—does it follow that a primordial homogeneous material must be coexistent with Him? When a human workman, indeed, fits together the parts of a watch, he employs his skill upon existing materials; but we must

* Westminster Review, April, 1856.

not conceive of the Divine operations, as if they were analogous to those of finite creatures like ourselves. What absurdity is there in believing that God created the world, as a Cosmos, already "teres atque rotundus," with all its arrangements and adaptations complete and perfect in the very instant of its flashing into being? "Is the one God" (it is said) "to be identified with the principle of order, or with the principle of variety?" The assumption on which this question proceeds, viz: that adaptation implies variety, (that is, a variety or multiplicity of primordial principles,) we again deny; and if asked whether the one God is to be identified with the principle of order or with that of adaptation, we answer—pantheistically, with neither; but, as the author of nature, with both: both being at bottom the same.

We have sought to interpret the typical forms and special ends in creation, from the Theistic position, supposed to be already attained; but they may also be considered from another point of view—the Apologetic; that is to say, we may inquire what is the value of the evidence which they furnish for the Divine existence.

The Cosmological argument for the Being of God is based, in both its branches: the teleological and the typological, on the doctrine of probabilities. Why must we in any case suppose intelligence, to account for special adaptation or for order? Because, where the traces of adaptation or of order are of a marked kind, all probability is against their being accidental. To take an illustration which, since the days of Cicero, has become common-place: we find a number of words arranged in such a manner as to form the Paradise Lost. Could this have happened by chance? Strictly speaking, it might. If the words composing the poem were shaken together in a bag, and then drawn out, one after another, by a man blind-folded; and if this process were repeated indefinitely; there is a positive chance—which, in fact, by increasing the number of trials, can be made as great as we please—that, after a certain number of times, the words would be drawn out in the precise order which they have in the poem. Even on a single trial, there is a chance, which any person acquainted with the elements of mathematics is able to calculate, in favour of such a result. But the fraction expressing the amount of the chance is so small, that, for all practical purposes, it may be taken as zero. We never hesitate to assert, therefore, that the words composing the Paradise Lost, could not have been fortuitously thrown into their present order; while at the same time, it will be seen that our certainty of this is nothing else at bottom than an immense probability. Now such precisely—as far as its essential nature is concerned—is the conviction which we feel, on the one hand, that the innumerable and varied special adaptations, and, on the other hand, that the order, manifest in the universe, have been the result of intelligence; only, in either of these cases, the unlikelihood of the effect being due to chance, is so great as to transcend, not only the power of numbers to express, but even of imagination to conceive it.

From this it follows, that, if we desire to arrive at a strictly scientific persuasion of the existence of God—a persuasion having the character of absolute certainty, and in which there shall be no place for even the most infinitesimal element of doubt—we must have recourse to other than Cosmological considerations. Whether we argue from the special adaptations, or from the order, of nature, we cannot possibly infer more than that there is an incalculable probability in favour of the conclusion that the universe has been fashioned by intelligence. But what is of still greater moment: even were it absolutely certain that the order and special adaptations which we perceive in nature, must be ascribed to an intelligent Being, this is not tantamount to saying that the Being whose agency we recognise, is *infinite*, or that the universe was *created* by Him. Our authors admit that Cosmology is insufficient to prove the Being of an infinite Creator. "It is not pretended," they observe—after giving some instances of the principle of order—"that these facts do of themselves prove that there is a living and personal God, clothed with every perfection. But they are fitted to deliver us from several painful and degrading notions, which may be suggested by the human heart in times of unbelief, or by persons who have been lost in a labyrinth built by themselves, and who are not unwilling that others should become as bewildered as they are. They prevent us from feeling that we, and all things else, are the mere sport of chance, ever changing its procedure, without reason and without notice, or, what is still more dreadful, that we may be crushed beneath the chariot wheels of a stern and relentless fate, moving on without design and without end. They show us what certainly looks very like a method pursued diligently and systematically—very like a plan designed for some grand end; so very like it, that it behoves the sceptic to take upon himself the burden of demonstrating that it can be anything else. Taken along with their proper complement; the special adaptation of parts, they exhibit to us an enlarged wisdom, which prosecutes its plans methodically, combined with a minute care, which provides for every object, and every part of that object."

Some persons, in their zeal for the great fundamental doctrine of religion, may be displeased at our plainly affirming the inadequacy of the Cosmological argument to prove that there is a God; but no good end is ever served by the concealment of truth. We apprehend that it would be doing a serious injury to Natural Theology to attempt to maintain the ground, that the Divine existence can be proved—in the proper sense of the term—either from the special adaptations, or from the order, of the universe. Cosmology has its use: which is, however, to enlarge our conceptions of God, rather than to prove that there is a God. Details like those contained in the work before us, are invaluable, as illustrating the perfections of the Creator, and leading our minds to a lively apprehension of His universal presence, and of His wise and powerful and beneficent agency; but it is impossible that they can be felt to have much apologetic weight, where a question as to the Divine existence is seriously raised; and Natural Theology—especially considering the assaults to which it is in the present age exposed—will not be efficiently defended, till this is thoroughly understood. It is high time for those who aspire to grapple scientifically with the mighty problem of the Divine existence, to seek something more than a popular solution of it: yea, to seek what must of necessity be an unpopular solution of it. Pantheism is now making its influence more decidedly felt than ever; and against its deadly errors, we must have other aid than a continuation of Paley, and other champions than Burnet Prize Essayists.

While persuaded that the doctrine of the Divine existence has the warrant of scientific, no less than of religious certainty, we are convinced, at the same time, that this can be made to appear, only as the result of lengthened and profound metaphysical investigation. Far be it from us to insinuate that the simple faith of the great mass of Christians, who believe in God, while yet they are utter strangers to Metaphysics, is not well founded. We hold on the contrary, that their faith is warrantable,—scientifically so,—though they themselves are unable to explain precisely what its warrant is. The common belief suffers injustice, not from us, but from those who speak as though Cosmology were its sole, or main foundation; and who—when they cannot altogether shut their eyes to the fact that a proof resting upon such a basis must needs be defective in the most essential points—endeavor to buttress up their feeble case by insisting that the conviction of the Divine existence which may be obtained from Cosmology has at least as much in its favor as the beliefs upon which the ordinary business of life proceeds, and is amply sufficient for practical purposes. For our part, we protest against the supposition that the faith which mankind at large have in an infinite, self-existent Being, the Creator of the universe, is of this unsatisfactory and imperfectly grounded character. We maintain that it is not a mere probable persuasion, but absolute strict knowledge, requiring only to have its real nature unfolded and its perfect validity formally exhibited.

Before parting with Drs. McCosh and Dickie, we must express our high admiration, not merely of the scientific expositions which they have brought forward, but likewise of the general tone in which their work is written. A vein of pure and refined sentiment runs through every part of it, and there are occasional passages of remarkable sweetness and moral beauty. Take the following as an example:

" It is indeed of vast moment to have the mind stored with a variety of noble images to enliven and elevate it: to be as Quintilian says —*incitamenta mentis.* This end is much promoted by an early training among natural objects which are picturesque; by travelling at a later period of life into foreign countries, and by the opportunity thus afforded of holding communion with Nature in her grander forms and of inspecting the noblest products of the fine arts. But, while gathering these material pictures, let the young man and the old man not forget that there are others which he should not be losing, and which, if he part with, his gain will be more than counterbalanced by his loss. For these are images which it is still more important to have treasured up in his mind; they are the images of domestic peace, the images of home and friends, of the affectionate mother, (we can never have more than one mother) and devoted wife, and kind sisters and smiling children; and to these let us add, by personal intercourse with them, or by elevated reading, the images of the great and good, of heroic men who toiled and bled for noble ends, and of equally heroic women who lost sight of themselves in works of disinterested love and sacrifice. These are in themselves vastly more exalted, and ten thousand times more exalting, than all your statues draped and undraped, about which connoisseurs so talk and rave; they are fitted to become excitements to all excellence, and he who has been at the pains to collect them and hang them around the chambers of his mind, is like one dwelling in a portrait gallery, from which the forms of ancestors are looking down upon him, with a smile, and exhorting him to all that is great and good."

Nothing is wanted to render this exquisite passage perfect, except the absence of a little stiffness and formality. But our authors while always clear in their style are at times deficient in ease and gracefulness of expression.

There is a chapter, of some parts of which we regret to be under the necessity of recording our decided disapproval: on the "Typical Systems of Nature and Revelation." We abstain from further comment in the mean time; but earnestly hope that the able and (generally) judicious authors will revise the chapter referred to, and that future editions of so valuable a production as that which we have had under review, will be purged from the only considerable blemish which the work, in its present state, exhibits.

G. P. Y.

Bothwell: A Poem in six parts. By W. Edmondstoune Aytoun, D. C. L., Author of "Lays of the Scottish Cavaliers, &c," W. Blackwood and Sons. Edinburgh and London, 1856.

Leaves of Grass. Brooklyn, New York, 1855.

In the works named above we have two not unmete representatives of the extremes of the Old and of the New World poetic ideal: "Bothwell," the product of the severely critical, refined, and ultra-conservative author of the "Lays of the Scottish Cavaliers;" and "Leaves of Grass," the wild, exuberant, lawless offspring of Walt Whitman, a Brooklyn Boy, "One of the Roughs!"

The historical poem has been heralded by rumor with her hundred tongues; and expectation has been whetted by anticipations naturally suggested by the promise of a work destined for posterity, from the caustic pen already glittering in the "Bon Gaultier" ranks, and trenchant in the satiric pages of "Firmilian; a Spasmodic Tragedy." He who has lashed, with such biting keenness, the poets and the critics of his day; and laughed to scorn, alike the metaphysical poetics of an "In Memoriam," the morbid tristness of "A Life-drama," the transcendental theosophy of a "Festus," and all the vagaries of a Carlyle, a Ruskin, or a Gilfillan: must be assumed to offer something which he, at least, believes to approach more nearly the true requisites of poetic perfection. More than one of the *dramatis personæ* of "Firmillian" have a character for critical reprisals, not overlooked by the caustic author of that "spasmodic tragedy;" yet here he enters the lists, and, doffing all quaint humor and satiric guise, he gravely flings down his knightly gauge of battle, as if he had never sported with the mummers, and made game of the literary guild of modern cavaliers.

The hero of Professor Aytoun's "Bothwell," is that grim Scottish Baron, the murderer of Darnley, and the ravisher of the unhappy Mary of Scotland: in himself dark enough for all the shadow that might be required to set off a theme otherwise neither deficient in poetry nor romance In dealing with his subject the poet claims credit for having taken no liberties with history. "I have not deviated," he says in his preface, "from what I consider to be the historical truth;" thereby, as it seems to us shackling the free wings of his muse to extremely little purpose; since his conscientious adherence to historic truth, only brings out more prominently the neglect of that higher truth of nature, involved in the one all-pervading conception of the dungeoned ruffian thus communing with his remorseful conscience in six coherent cantos of smoothly flowing verse. Such professions of adherence to literal history are altogether misplaced; for nobody out of the nursery wants to study history in rhymes. But our dissatisfaction with the claim finds other grounds, when we discover that the history adhered to is the old vulgar popular conception, which pictures Mary of Scotland an angel, Knox a morose fanatic, and Elizabeth of England a wrinkled and jealous shrew! The following picture of Darnley may pass without dispute:

"She wedded Darnley—and a fool
In every sense was he,
With scarce the wit to be a knave
If born in low degree.
But folly, when it walks abroad
In royal guise and strain,
Will never lack for knavery
To loiter in its train.

Folly walks *in royal strain* here, we presume, for the sake of the rhyme. But what shall we say of the portraiture of Elizabeth?—the sole sinner, according to the historic bard, even in the unpatriotic defections of Scotland's nobles:

But at the gate the Temptress stood,
Not beautiful nor young;
Nor luring, as a syren might,
By magic of her tongue;
High and imperious, stately, proud,
Yet artful to beguile,
A woman, without woman's heart,
Or woman's sunny smile;
By nature tyrannous and vain,
By king-craft false and mean—
She hated Mary from her soul,
As woman and as queen!
* * * * * * *
What mattered it that flattering knaves
Proclaimed her Beauty's Queen,

And swore in verse and fulsome rhyme,
That never since the birth of time,
Was such an angel seen?
Each morn and eve, her mirror gave
Their wretched words the lie;
And though she fain would have believed,
She could not close her eye.

John Knox is dealt with in like manner, in a piece that reads not unlike an anti-sabbatarian Westminster Review article turned into verse! With such history we could have pardoned a pretty free use of the poet's license. But to return to the hero of the poem: the wild career of Bothwell is familiar to the student of Scottish story, and is not without materials for the poet's pen. Its close is nearly coeval with that of Mary's royalty and freedom; and with a poetic justice rare in actual history, the remaining years of her betrayer's life were passed in a Danish dungeon, where, listening to the moaning voices of the lonely sea, and preyed on alike by the tortures of ungratified ambition and remorse, he at length died a raving maniac. The poet lays his scene in this Danish fortress of Malmoe, in the lone dungeon of which he presents Bothwell as his own biographer, wailing forth in bitter retrospect the strange romance in which he acted so prominent a part. In giving form to this, the author must be acredited with the somewhat rare merit among modern poets, of actually saying what he means, in sober intelligible verse, nor once indulging in hidden meanings, such as elude the unreflective reader—still less in the mysticism and metaphysical subtleties of poetics, which not only leave all readers in doubt of what is meant, but a good many in greater doubt whether they ever had a meaning known to writer or reader! The author of "Bothwell" has, moreover, as in duty bound, kept steadily free from all spasmodic exuberance of fancy. Perhaps it may be thought by some that he even verges on the opposite extreme of insipidity and common place.

The following opening scene, representing the captive writhing in his dungeon, within sound alike of the Christmas revels of his jailors, and the wild swoop of the wind and wave on the northern sea, is well designed for awakening the sympathy of the reader, and may be accepted as one of the most vigorous passages in the whole poem:

Cold—cold! The wind howls fierce without:
It drives the sleet and snow;
With thundering hurl, the angry sea
Smites on the crags below.
Each wave that leaps against the rock
Makes this old prison reel—

God! cast it down upon my head,
  And let me cease to feel!
Cold—cold! The brands are burning out,
  The dying embers wane;
The drops fall plashing from the roof
  Like slow and sullen rain.
Cold—Cold! And yet the villain kerns
  Who keep me fettered here,
Are feasting in the hall above,
  And holding Christmas cheer.
When the wind pauses for its breath,
  I hear their idiot bray,
The laugh, the shout, the stamping feet,
  The song and roundelay.
They pass the jest, they quaff the cup,
  The Yule-log sparkles brave,
They riot o'er my dungeon vault,
  As though it were my grave.
Ay, howl again, thou bitter wind,
  Roar louder yet, thou sea!
And drown the gusts of brutal mirth
  That mock and madden me!
Ho, ho, the Eagle of the North
  Has stooped upon the main!
Scream on, O eagle, in thy flight,
  Through blast and hurricane—
And when thou meetest on thy way
  The black and plunging bark,
Where those who pilot by the stars
  Stand quaking in the dark,
Down with thy pinion on the mast,
  Scream louder in the air,
And stifle in the wallowing sea
  The shrieks of their despair!
Be my avenger on this night,
  When all, save I, am free;
Why should I care for mortal man,
  When men care nought for me?
Care not? They loathe me, one and all,
  Else why should I be here—
I, starving in a foreign cell,
  A Scottish prince and peer?"

The captive, thus dungeoned on a foreign strand, recalls to memory the wild incidents of love and crime, and unavailing remorse; but it may be questioned whether the poet has not lost, by this artifice, the vigor and life of action, as well as the richer variety which would have been begot by his own direct recital of the tale. The most charitable fancy challenges the truthfulness of such an autobiographic monologue, coherently running on from canto to canto; prologued and epilogued with these measured ravings of despair. The diction is perfect, the verse sweet, and only too smoothly written, and the imagery such as a "Firmilian" critic must pronounce unexceptionable. We are anxious to exhibit the poet at his best; and here accordingly are a couple of scenes painted from the landscape around the Scottish capital. They can scarcely fail to provoke a comparison with passages in "Marmion," where Scott has drawn a richer inspiration from the same magnificent panorama:

Methinks I can recall the scene,
That bright and sunny day;
The Pentlands in their early green
Like giant warders lay.
Upon the bursting woods below
The pleasant sunbeams fell;
Far off, one streak of lazy snow
Yet lingered in a dell.
The westlin' winds blew soft and sweet,
The meads were fair to see;
Yet went I not the spring to greet
Beneath the trysting tree.
For blades were glistening in the light,
And morions flashing clear:
A thousand men in armour bright
Were there with jack and spear.
A thousand men as brave and stout
As ever faced a foe,
Or stemmed the roaring battle-tide
When fiercest in its flow.

This is unexceptionable, yet what does it amount to? The ideas are old as the Pentland hills, and even some of the lines seem scarcely new. The other passage deals with a scene almost unrivaled in its luxurious combinations of all that is grand and beautiful and picturesque in art and nature. The rugged crags, and vales, and grassy peaks of Arthur's Seat, looking out, on the one hand, on the castle-crowned city, on the other, on the hill-engirdled sea; the ruined chapel and holy-well of St. Anthony; the Abbey and palace of Holyrood rich with the memories of seven centuries; and, add to all, the Poet's eye, repeopling them with the most romantic of all their old historic dramas:—all these, and this as the result:

The troopers in procession wound,
Along the slant and broken ground,
Beneath old Arthur's lion-hill.
The Queen went onward with her train;
I rode not by her palfrey's rein,

But lingered at the tiny rill
  That flows from Anton's fane.
Red was the sky; but Holyrood
In dusk and sullen grandeur stood.
It seemed as though the setting sun
  Refused to lend it light,
So cheerless was its look, and dun,
  While all above was bright.
Black in the glare rose spire and vane,
No lustre streamed from window pane;
But, as I stood, the Abbey bell
Tolled out, with such a dismal knell
As smites with awe the shuddering crowd,
When a king's folded in his shroud—
  Methought it said "Farewell!"

One more specimen we select from the fifth canto, in which, and still more in the concluding one, the captive, having traced out the chequered incidents of his wild career, rises to a more elevated tone, as he gives utterance to the last fierce wailings of remorse and despair:

Beneath the flags that, day by day,
Return dull echoes to my tread,
A grave is hollowed in the clay:
It waits the coming of the dead—
A grave apart, a grave unknown,
A grave of solitude and shame,
Whereon shall lie no sculptured stone
With legend of a warrior's name.
O, would it yawn to take me in,
And bind me, soul and body, down!
O, could it hide me and my sin,
When the last trumpet-blast is blown!
O, might one guilty form remain
Unsummoned to that awful crowd,
When all the chiefs of Bothwell's train
Shall rise from sepulchre and shroud!
How could I meet their stony stare—
How could I see my father's face—
I, the one tainted felon there,
The foul Iscariot of his race?"

In contrast with this we have named the effusions of the Brooklyn Bard. If the accredited author of "Firmilian" has now shown us what a poem ought to be, assuredly Walt Whitman is wide of the mark. Externally and internally he sets all law, decorum, prosody and propriety at defiance. A tall, lean, sallow, most republican, and Yankee-looking volume, is his "Leaves of grass;" full of egotism, extravagance, and spasmodic eccentricities of all sorts; and heralded by a sheaf of double-columned extracts from Reviews— not always the least curious of its singular contents. Here, for example, is a protest against the intrusion of the British muse on the free soil of the States of the Union, which must surely satisfy the most clamant demand for native poetics and republican egotism :

"What very properly fits a subject of the British crown, may fit very ill an American freeman. No fine romance, no inimitable delineation of character, no grace of delicate illustrations, no rare picture of shore or mountain or sky, no deep thought of the intellect, is so important to a man as his opinion of himself is; everything receives its tinge from that. In the verse of all those undoubtedly great writers, *Shakespeare, just as much as the rest*, there is the air which to America is the air of death. The mass of the people, the laborers and all who serve, are slag, refuse. The countenances of kings and great lords are beautiful; the countenances of mechanics are ridiculous and deformed. What play of Shakespeare represented in America, is not an insult to America, to the marrow in its bones? How can the tone—never silent in their plots and characters—be applauded, unless Washington should have been caught and hung, and Jefferson was the most enormous of liars, and common persons, North and South, should bow low to their betters, and to organic superiority of blood? Sure as the heavens envelop the earth, if the Americans want a race of bards worthy of 1855, and of the stern reality of this republic, they must cast around for men essentially different from the old poets, and from the modern successions of jinglers and snivellers and fops."—and here accordingly is something essentially different from all poets, both old and new.

The poet, unnamed on his title page, figures on his frontispiece, and unmistakeably utters his own poem:

"I celebrate myself,
And what I assume, you shall assume;
For every atom belonging to me as good belongs to you.
I loafe, and invite my soul;
I lean and loafe at my ease—
Observing a spear of Summer grass."

Such is the starting point of this most eccentric and republican of poets; of whom the republican critic above quoted, after contrasting with him Tennyson, as "The bard of ennui, and the aristocracy and their combination into love, the old stock love of playwrights and romancers, Shakespeare, the same as the rest,"—concludes by confessing his inability to decide whether Walt Whitman is "to prove the most lamentable of failures, or the most glorious of triumphs, in the known history of literature."

Assuredly, the Brooklyn poet is no commonplace writer. That he is startling and *outré*, no one who opens his volume will doubt. The conventionalities, and proprieties, and modesties, of thought, as well as of language, hold him in no restraint; and hence he has a vantage ground from which he may claim such credit as its licence deserves. But, apart from this, there are unmistakeable freshness, originality, and true poetic gleams of thought, mingled with the strange incoherencies of his boastful rhapsody. To call his "Leaves" poems, would be a mistake; they resemble rather the poet's first jottings, out of which the poem is to be formed; the ore out of which the metal is to be smelted; and, in its present form, with more of dross than sterling metal in the mass.

To find an extractable passage is no easy task. Here a fine suggestive fancy ends in some offensive pruriency; there it dwines into incomprehensible aggregations of words and terms, which—unless Machiavelli was right in teaching that words were given us to conceal our thoughts,—are mere clotted nonsense! Were we disposed to ridicule: our selections would be easy enough; or gravely to censure: abundant justification is at hand. We rather cull—not without needful omissions—the thoughts that seem to have suggested the quaint title of "Leaves of Grass."

"Loafe with me on the grass......loose the stop from your throat,
Not words, not music or rhyme I want: not custom or lecture, not even the best,
Only the lull I like, the hum of your valved voice.

. . . .

I know that the hand of God is the elderhand of my own,
And I know that the spirit of God is the eldest brother of my own,
And that all the men ever born are also my brothers....and the women my sisters and lovers,
And that a kelson of the Creation is love;
And limitless are leaves, stiff or drooping in the fields.
A child said, what is the Grass? fetching it to me with full hands;
How could I answer the child?....I do not know what it is any more than he.
I guess it must be the flag of my disposition, out of hopeful green stuff woven.
Or I guess it is the handkerchief of the Lord,
A scented gift and remembrancer designedly dropped,
Bearing the owner's name some way in the corners, that we may see and remark, and say Whose?
Or I guess the grass is itself a child ...the produced babe of the vegetation.
Or I guess it is a uniform hieroglyphic,
And it means, Sprouting, alike in broad zones and narrow zones,

Growing among black folks as among white,
Kanuck, Tuckahoe, Congressmen, Cuff,
I give them the same, I receive them the same.
And now it seems to me the beautiful uncut hair of graves.

....

....

All truths wait in all things,
They neither hasten their own delivery nor resist it,
They do not need the obstetric forceps of the surgeon,
The insignificant is as big to me as any,
What is less or more than a touch?
Logic and sermons never convince,
The damp of the night drives deeper into my soul.

....

I believe a leaf of grass is no less than the journeywork of the stars,
And the pismire is equally perfect, and a grain of sand, and the egg of the wren,
And the tree-toad is a chef-d'œuvre for the highest,
And the running blackberry would adorn the parlors of heaven,
And the narrowest hinge in my hand puts to scorn all machinery,
And the cow crunching with depressed head surpasses any statue,
And a mouse is miracle enough to stagger sextillions of infidels."

This passage is far from being the most characteristic of the poem, and even in it we have stopped abruptly for one line more, and .... Yet this will show that the punctuation is as odd as any other feature of the work; for the whole is full of conceits which speak fully as much of coarse vain-glorious egotism as of originality of genius. Any man may be an original, whether in the fopperies of the dress he puts on himself or on his poem. We are not, therefore, disposed to rate such very high, or to reckon Walt Whitman's typographical whims any more indicative of special genius, than the shirt-sleeves and unshaven chin of his frontispiece. If they indicate any thing specially, we should infer that he is a compositor by trade, and, for all his affectations of independence, could not keep "the shop" out of his verse. But that he sets all the ordinary rules of men and poets at defiance is visible on every page of his lank volume; and if readers judge thereby that he thinks himself wiser than all previous men and poets—we have no authority to contradict them. That some of his thoughts are far from vain or common place, however, a few gleanings may suffice to prove; culled in the form, not of detached passages but of isolated ideas,—lines, or fragments of lines:—

"The friendly and flowing savage....Who is he?
Is he waiting for civilization or past it and mastering it?"

"The welcome ugly face of some beautiful soul."

"The clock indicates the moment....but what does eternity indicate?"

"Afar down I see the huge first Nothing, the vapor from the nostrils of death,
I know I was even there....I waited unseen and always,
And slept while God carried me through the lethargic mist,
And took my time....and took no hurt from the fœtid carbon."

"See ever so far....there is limitless space outside of that,
Count ever so much....there is limitless time around that.
Our rendezvous is fitly appointed....God will be there and wait till we come."

These doubled and quadrupled points, let us add, pertain to the original, whatever their precise significance may be. Here again is a grand idea, not altogether new; and rough in its present setting, as the native gold still buried in Californian beds of quartz and debris. Nevertheless it is full of suggestive thought, and like much else in the volume—though less than most,—only requires the hand of the artist to cut, and polish, and set, that it may gleam and sparkle with true poetic lustre :—

"A slave at auction!
I help the auctioneer....the sloven does not half know his business.
Gentlemen look on this curious creature,
Whatever the bids of the bidders they cannot be high enough for him,
For him the globe lay preparing quintillions of years without one animal or plant,
For him the revolving cycles truly and steadily rolled.
In that head the allbaffling brain,
In it and below it the making of the attributes of heroes.
Examine these limbs, red, black or white....they are very cunning in tendon and nerve;
They shall be stript that you may see them.
Exquisite senses, lifelit eyes, pluck, volition,
Flakes of breastmuscle, pliant backbone and neck, flesh not flabby, good sized arms and legs,
Aud wonders within there yet.
Within there runs his blood..the same old blood..the same red running blood
There swells and jets his heart....There all passions and desires....all reachings and aspirations:
Do you think they are not there because they are not expressed in parlors and lecture-rooms?
This is not only one man....he is the father of those who shall be fathers in their turns,
In him the start of populous states and rich republics,
Of him countless immortal lives with countless embodiments and enjoyments.
How do you know who shall come from the offspring of his offspring through the centuries?
Who might you find you have come from yourself?"

> "Great is life. . and real and mystical. . wherever and whoever,
> Great is death. . . . sure as life holds all parts together, death holds all parts together;
> Sure as the stars return again after they merge in the light, death is greater than life."

Such are some of the "Leaves of Grass," of the Brooklyn poet who describes himself on one of them as:

> "Walt Whitman, an American, one of the roughs, a Kosmos!"

But if the reader—recognising true poetry in some of these,—should assume such a likeness running through the whole as pertains to the blades of Nature's Grass, we disclaim all responsibility if he find reason to revise his fancy.

In the two very diverse volumes under review it seems to us that we have in the one the polish of the artist, which can accomplish so much when applied to the gem or rich ore; in the other we discern the ore, but overlaid with the valueless matrix and foul rubbish of the mine, and devoid of all the unveiling beauties of art. Viewed in such aspects these poems are characteristic of the age. From each we have striven to select what appeared most worthy of the space at command, and best calculated to present them to the reader in the most favorable point of view consistent with truth. And so we leave the reader to his own judgment, between the old-world stickler for authority, precedent, and poetical respectability, and the new-world contemner of all authorities, laws, and respectabilities whatsoever. Happily for us, all choice is not necessarily limited to these. The golden mean of poesie does not, we imagine, lie between such extremes. There are not a few left, both in England and in America, for whom old Shakspeare is still respectable enough, and poetical enough,—aye and free enough too, in spite of all the freedom which has budded and bloomed since that year 1616, when his sacred ashes were laid beneath the chancel stone whose curse still guards them from impious hands. Nevertheless we have faith in the future. We doubt not even the present. When a greater poet than Shakspeare does arrive we shall not count him an impossibility.

D. W.

SCIENTIFIC AND LITERARY NOTES.

GEOLOGY AND MINERALOGY.

ORIGIN OF ROCK CLEAVAGE.

Few subjects connected with the physics of Geology have attracted of late years more attention than that of rock cleavage. Long considered, in accordance with the views of Sedgwick, as the result of a peculiar crystalizing force produced by electrical action or by heat, its origin has more recently been attributed, and evidently with truth, to the effects of mechanical causes. In other words, cleavage in rocks may be regarded as the result of enormous or long-continued pressure, exerted at right angles to the direction of the cleavage planes. Amongst those who have chiefly labored in support of this latter view, the late President of the Geological Society of London, Daniel Sharpe, with Mr. Sorby, and Professor Tyndall, may be especially cited. Observations of great interest on this subject will be found in some of the recent numbers of the Philosophical Magazine.

MEAN DENSITY OF THE EARTH.

According to the computations of the Astronomer Royal, based on his late pendulum experiments at the Harton Coal Pit, South Shields, the mean density of the Earth is equal to 6.566. This value is about one degree higher than any previously obtained.

The Rev. Samuel Haughton of Trinity College, Dublin, in a paper communicated to the Philosophical Magazine for July, 1856, has deduced from these experiments, by another mode of calculation, the value 5.480.

The officers engaged on the Trigonometrical Survey of the United Kingdom, have also taken up the question of the Earth's density. Observations on the deflection of the plumb-line at Arthur's seat, Edinburgh, conducted by Colonel James, R. E., and re-calculated by Captain A. R. Clarke (proceedings of the Royal Society, May 8, 1856,) give for the Earth's mean density, the value 5.316. A further set of observations on the Stack Mountain, Sutherlandshire, pointed out by the late Dr. Macculloch as the best adapted in all Scotland, for the estimation of the Earth's density by the deflection of the plumb-line, are also promised.

We have collected the above, and other earlier results, into the following table:

A. *Estimated by Plumb-line Deviation.*

1. From Dr. Maskelyne's observations on the Schehallien Mountain in Perthshire, (corrected by Hutton)........	4.9999
2. From Colonel James' Observations on Arthur's Seat .... (The first calculations gave 5.14.)	5.316

B. *Estimated by the Ball Apparatus.*

3. By Cavendish (corrected by Baily).............	5.448
4. By Cavendish (corrected by Schmidt)............................	5.52
5. By Reich, in Freiberg (1837)......................................	5.44
6. By Baily (mean result of over 2,000 observations).................	5.67

C. *Estimated by Pendulum Movements upon and beneath the Earth's surface.*

7. By Airy, (Astronomer Royal)..	6.566
8. Do. Do. (computed by the Rev. G. H. Haughton)................	5.480

MINERALOGICAL NOTICES.

Lake Superior Copper.—M. Hautefeuille (Comptes Rendus, July 21, 1856) has detected the presence of Mercury in the argentiferous copper of Lake Superior. A sample of 200 kilogrammes, shewed, according to his analyses, the following composition:

Copper....	138.560
Silver	10.906
Mercury	0.038
Veinstone..	50.496
	200.000

Stafsfurtite.—The so called compact boracite, from the salt beds of Stafsfurt, near Magdeburg, is considered by G. Rose (Pog. Ann. 1856, No. 5) to be distinct in its crystalline structure from the ordinary or monometric boracite, although according to Karsten's analysis it agrees with this in composition. It dissolves, however, with rapidity in heated hydrochloric acid (the solution depositing hydrated BO^3 on cooling;) and it fuses likewise with great ease. These effects may arise, nevertheless, from admixtures. G. Rose has bestowed upon it the name of Stassfurtite, but its assumption as a distinct species is at least premature.

Carnallite.—A soluble substance occurring with the above, has been analysed by Oesten in the laboratory of H. Rose. In its composition it is essentially a double chloride of potassium and magnesium after the formula (K Cl + 2 Mg Cl) +12HO. H. Rose has named it Carnallite, in honor of Herr Von Carnall, of the Prussian mines.

Tachhydrite.—Rammelsberg has examined a kindred salt from the same locality as the above. His analysis leads to the formula (Ca. Cl. + 2 Mg. Cl.) + 12HO He has called the substance Tachhydrite, in allusion to its rapid deliquescence when exposed to the air. It occurs in rounded yellow masses, transparent to transludecent, and distinctly cleavable in at least two directions.

Voigtite.—This mineral (see above, p. 484) is named after M. Voigt, of the Saxe-Weimer mines.

Leucophane and Melinophane.—Rammelsberg (Pog. An. 1856, No. 6) has analysed specimens of these minerals, and proved their mutual identity. He deduces from his analyses the formula Na Fl + (3 CaO, 2 SiO^3 + Be^2O^3, SiO^3.) For descriptions of these substances, see Dana's System of Mineralogy, 4th Ed., vol. 2, p. 182-3.

Vanadinite.—Rammelsberg has also given an analysis (with notice of the crystalline form) of Vanadinite from the limestone of Mount Ovir, near Windisch—Kappel in Carinthia. The substance is isomorphous with the pyromorphite group of minerals. System. Hexagonal. Prism $\infty \overline{\infty}$, on pyramid $\overline{\infty}$ = 130° ; $\overline{\infty}$ over polar edge =142° 30'; a (vert. axis.) to $\overline{a}$, as deduced from the latter angle=·727 : 1·0. Sp. gr. =6·886. Formula, as given by Rammelsberg, [Pb Cl + 3 (3 PbO

PO^5)] + 15 [Pb Cl + 3 (3 PbO, VO^3)]. Hence it appears that PO^5 and VO^3 are isomorphous.

ERRATUM.—In the note on Graptolites (p. 388) for Bryoza read Bryozoa.

The Curator of the Institute will feel greatly obliged by the loan of any specimens of Graptolites or Trilobites in the possession of members.

E. J. C.

ETHNOLOGY AND ARCHÆOLOGY.

INDIAN REMAINS.

The principal facts contained in the following notice of the discovery of Indian remains in the vicinity of Orillia, County of Simcoe, accompanied with tropical marine shells, and copper and other relics, are derived from an account in a recent number of the Toronto *Globe*. Indian mounds have been repeatedly opened in that neighbourhood; and we have in our possession crania and sepulchral relics found in one of these, which was explored in 1854. One of the skulls betrays unmistakeable evidence of the stroke of the tomahawk with which the old Indian met his death. The relics in the present case, however, have been found in hollows to which it would appear the term *Burrow* is applied: probably as a distinctive variation from that of the old Saxon Barrow, or Sepulchral Mound.

"About six miles from Orillia the North River crosses the Coldwater road, which runs on the old portage between Lake Couchiching and the Georgian Bay, and forms a natural valley with low heights on each side. On the northern height, about a quarter of a mile from the road, an Indian burrow was found last spring. Perhaps," adds the writer from whom we quote, "our readers may understand by a burrow a raised mound of a peculiar shape, but such is not the case. It is merely a slightly depressed hollow, of an oval shape about ten feet in length, and eight in breadth. Sometimes it is difficult to distinguish it from the depression caused by the roots of a fallen tree. The discoverers of the one in question, on removing the surface earth, came upon layers of bones in various stages of decay and near the bottom they found a number of copper kettles, two large shells, some beads made of bone, and a quantity of hair. No pipes or tomahawks were found. The number of dead interred there must have been at least from 150 to 200, as one individual counted no less than 70 sculls that were thrown out, exclusive of those left in the burrow. The kettles are of superior workmanship, of various sizes, in excellent preservation, and tastefully formed; all of them have had iron handles, some of which are much corroded or entirely gone. A few have rims of iron, very much decayed around their tops."

Some of the beads have also been described to us as of glass, coarsely made; and the shells appear to have been specimens of the large tropical pyrulæ, repeatedly found along the shores of our northern fresh-water lakes, furnishing unmistakeable evidence of an intercourse carried on with the Gulf of Mexico, or the regions of Central America. In the present case the accompanying relics appear to indicate no very remote date for the sepulchral depository. From the iron rims and handles of the vessels, and the glass beads, they must at least be assigned to a period subsequent to the intercourse of the Indians with Europeans;

and the remains of some of their fur wrappings indicated a much shorter interval since their deposition.

The writer in the *Globe*, while hesitating to offer any very decided opinion, is inclined to believe that the remains are those of warriors, slain in battle. The chief grounds for this view are stated as follows :—

1. "In the spring, a skeleton was found at a short distance from the burrow, with every evidence of having been struck down by a tomahawk.

2. The height, where the remains were found, is one admirably fitted for a battle field.

3. The bodies seem to have been hastily interred. Most of them had on their ordinary dresses. A few remains of these were found with the fur yet perfect, the skins neatly sewn, and the fringe-like ornaments peculiar to Indian dresses, still distinct and undecayed. The corpses appear to have been hastily thrown in, and little or no earth thrown over them, as the only covering found over them was that formed by the accumulation of leaves that have fallen since their interment."

The relics, however, with which these human remains were accompanied seem irreconcileable with this view of the case. There was not only an absence of weapons of war,—which we cannot suppose would have been entirely removed when such objects as copper kettles, and the cumbrous tropical shells were left; but the latter are not objects with which a war party would be likely to burden themselves. The so-called burrow was more probably an Ossuary, into which the remains of the dead were promiscuously heaped, in accordance with known Indian customs, after the final honors and sacrifices had been rendered to the deceased. One of these Ossuaries, in the Township of Beverly, from which specimens of the same class of tropical shells were procured, has been noticed in this Journal, (Old Series, vol. III, p. 156.) The depression by which the locality of these recently discoved relics was indicated, is no doubt mainly ascribable to the decay of the human remains interred there. Dr. Schoolcraft speaks of some of these cemeteries as "Sepulchral trenches or Ossuaries, in which the bones of entire villages would seem to have been deposited;" and the appearance of hasty and partial inhumation described above has been noted in other examples.

The locality where these relics have been found appears to present a rich field for investigation; and it is gratifying to find such discoveries meeting with the attention evinced on this occasion. The narrator of the above facts observes: "The elevated ground that lies between Lakes Simcoe and Huron, seems to have been, in former ages, a favorite home of the Red Man. Abounding with numerous valleys, and studded with hills of various sizes, it has formed an admirable field for those sudden surprises and those stealthy attacks that distinguish Indian warfare. From its central position, it was probably a battle field for the hostile tribes residing in Canada, on the one hand, and the north-western nations on the other. This advantageous position of the district was discerned by the military genius of Sir John Colborne, who, with his wonted sagacity, foresaw that only amid those glens and wooded heights could a successful resistance be made to an invasion from the neighboring States. He accordingly matured a scheme for settling the district with military colonists, and establishing a chain of Indian settlements along the line of portage that connects Lake Couchiching and Georgian Bay. Various circumstances, however, prevented his plan from being successfully carried out. This whole section of country is studded with Indian remains. In many places Indian burrows have been discovered, containing the remains of dead bodies, pottery, copper kettles, pipes, and other articles peculiar to the Red man. And a few years ago, a farmer in the township of Medonte found the remains of a small manufactory of pottery, in which were utensils of all kinds and sizes in various states of preparation. The writer of this has visited the spot. It lay on the side of a rocky eminence, and resembled one of those limekilns so common throughout the Province." As no knowledge of the potter's art seems to have survived among our north-western tribes, an account of the discovery of this native potter's kiln with a minute notice of its contents, and the condition in which they were found, if still recoverable, would be well worth putting on record.

SANDWICH ISLANDERS.

In the *Montreal Medical Chronicle* of June last, an interesting communication on "Diseases peculiar to the Sandwich Islands," from the pen of Dr. John Rae, a Canadian physician resident there, supplies some curious particulars relative to the physical idiosyncracies developed among the natives by contact with Europeans. Many of these are cutaneous diseases, but accompanied with peculiar symptoms, painfully suggestive of their origin from the vices of Europeans. One of these diseases, termed by the natives the *puupuu*, manifests its presence by red boils appearing at various parts, sometimes over the whole body. These ultimately form into fleshy prominences, projecting a quarter of an inch from the surface, and frequently an inch in diameter, which break and discharge. But what struck Dr. Rae as peculiar, when treating some of these cases, at Kaoli Hana, Maui, he thus describes:

"I was here first led to remark the extraordinary vigor with which the renovation of skin and cuticle goes on among this race. Although, in these cases, the original skin had been completely destroyed, yet, in a month or two, the scars were scarcely perceptible, being only noticeable, on a cursory view, by a more polished surface, and requiring a close inspection to trace the line of demarcation between the old and newly organized substance."

We shall not follow Dr. Rae into the purely professional details of his subject, but some of his observations on the changes produced on the natives by "the breaking up of the old order of things," consequent on European intrusion, are possessed of a wider interest. After referring to the increasing frequency of prevailing maladies, and to the effects resulting from a change of diet, consequent on the partial adoption of European habits; he adds the following remarks in reference to the influence of dress, which admit of a very extensive application:

"Again, the general adoption of something like the dress of civilized men, seems to have produced a change in their habit of body, which, physiologically, and perhaps ethnologically, is worthy of notice. Their hue has less of red and more of black in it. It would seem, that, when the surface of the body is exposed to the skyey influences, there is a greater rush of blood to the minute external vessels, reddening the hue. The whole person becomes, in a measure, face. May not this be one cause of the change of complexion which to a great extent has taken place in the Celtic and Germanic races? We know from Cæsar and Tacitus, that even in the severe winters of the Germany and France of those days, the hardy natives scorned much encumbrance of clothing as a mark of effeminacy, and that fair hair and blue eyes were universal; cœrulei oculi rutilæque comæ. The present Gaul is generally swart, and so are very many Germans; and civilization a thousand years since gave these a general and warm covering to the whole person. However that may be, the alteration in hue, which I have noted, is a fact of which I have no doubt. It has been accompanied by a greater susceptibility to cold, and to the inroads of those diseases which that susceptibility produces."

D. W.

CHEMISTRY.

Chinoline.—Greville Williams has published *in extenso* his very beautiful researches upon the products of the distillation of cinchonine. Formerly chinoline was supposed to be the sole product, but Williams has shewn that it is a complex body containing two or more homologous alkaloids. He has now examined various chlorides, oxysalts and double salts of chinoline, also the action of æthylic, methylic and amylic iodides upon it, by which substitution bases are produced. Moreover, he has proved that lepidine, which accompanies chinoline, is also to be found in coal-tar, and he has succeeded in obtaining æthylo lepidine. He has also discovered a new base in coal tar, which he names cryptidine. These three are homologous nitrile bases.

Chinoline, $C^{18}H^{7}N$,
Lepidine, $C^{20}H^{9}N$,
Cryptidine, $C^{22}H^{11}N$.

Iodine.—Kletzinsky denies the assertion of Chatin, that the absence of iodine from the air, is one of the causes of goitre and cretinism, inasmuch as he found no iodine in the air of Vienna, which is free from those complaints. This experiment was continued over a period of four months, and the potash-solution, through which the air was passed, was found to contain no iodine, but unmistakable traces of nitric acid. Ch. G. 329.

Test for Iodine.—Knop substitutes bromate for the iodate of potassa, employed by Liebig in testing for iodine, in those cases where a reducing agent, such as sulphurous acid, is present, by which of course iodine would be separated from the iodate. An excess of the bromate must be avoided, as the blue colour is destroyed. Ch. G. 332.

Nitric Oxide.—A. Brüning has examined the action of nitric oxide upon anhydrous sulphuric acid, and arrives at the conclusion that the nitric oxide absorbs one equivalent of oxygen from the sulphuric acid, forming sulphurous acid, and nitrous acid, which latter then unites with two equivalents of sulphuric acid, forming the solid substance described by Prevostaye and Rose, and which the latter considered to be a compound of nitric oxide. Ch. G. 332.

Fluorescence.—Von Babo and Müller have observed that the flame of sulphuretted hydrogen has remarkable power in producing fluorescence, as exhibited by a solution of quinine, an ætherial solution of chlorophyll, green and violet crystals of fluor-spar, and more especially by the yellowish-green uranium glass. Ch. G. 329.

Sulphate of Nickel.—Marignac has found that the quadratic crystals of sulphate of nickel contain six and not seven atoms of water. At a temperature of 59°—68° F., he obtained rhombic crystals with 7 H O, at 86°—104° F., quadratic crystals with 6 H O, and at 122°—158° F., monoclinometric crystals with 6 H O. These remain transparent above 104° F.; at ordinary temperatures, they gradually become opaque, without loss of weight. Dimorphism, therefore, exists in the salt with 6 H O, but not in that with 7 H O.

From solutions of sulphate of magnesia at 158° F. of sulphate of zinc at 131° F., and of sulphate of cobalt at 122° F., he obtained compounds analogous in composition, and isomorphous with the above mentioned monoclinometric crystals. Ch. G. 329.

Silver.—Deville finds that silver is rapidly dissolved by hydriodic acid with evolution of hydrogen, especially if heat be applied; the iodide separates in large hexagonal prisms; palladium is also attacked, but slowly. Gold and platinum do not evolve any sensible amount of hydrogen, but are gradually dissolved. while all the common metals are dissolved with remarkable energy by hydriodic acid. Deville is inclined to class silver with mercury or even with lead.

Sesqui-Salts of Manganese.—Carius prepares the anhydrous sulphate of the sesquioxide, by forming an artificial brown oxide, by passing chlorine through a solution of carbonate of soda, in which proto-carbonate of manganese is suspended. This, when dry, is triturated with sulphuric acid into a thin paste. The mixture being heated in an oil bath, oxygen is evolved, but at 230° F., the evolution stops, and a violet gray mass is produced. At 270° the green sulphate is formed. It can be washed with nitric acid, and heated to 266° to drive off excess, and is then pure. It is very easily decomposable, and can only be kept in closed tubes. By absorption of water, hydrated sesquioxide is produced. It is not soluble in diluted sulphuric acid, unless some of the proto-salt be present, when it readily dissolves, forming a red solution.

Antimony.—Rose mentions some experiments by Weber to determine the atomic weight of antimony, the terchloride was precipitated by sulphuretted hydrogen, and the chlorine determined as usual; unless tartaric acid be used, a little chlorine remains with the sulphide. In this way, the number 1508.67 was obtained, agreeing closely with that of Schneider, viz., 1503. Rose adds that many years ago he determined the atomic weight from the two chlorides, and found 1513.14 and 1508.5.

Non-precipitation of Metals.—Martin has made some experiments on the influence of strong hydrochloric acid in preventing the precipitation of metals by sulphuretted hydrogen. Lead, cadmium, antimony, tin, mercury, bismuth, copper, and silver, are not wholly precipitated unless a large quantity of water be employed. Lead requires the smallest quantity of acid to retain it in solution, and the other metals in larger quantity, in the above order. The portion of the chlorides of copper, mercury, and bismuth, which remains dissolved, is converted into sub-chloride.

Arsenic Acid.—E. Kopp having prepared large quantities of this substance as a substitute for tartaric acid in the discharge style of calico-printing, was led to examine the different hydrates. As O^5 + 4 aq. separates from the gently evaporated solution in large crystals, heated to 202° F., a creamy substance, consisting of little needles, is formed, which is the terhydrate, As O^5 + 3 aq. If the solution be heated up to 284° or 356° F., rectangular prisms are formed, they are hard and brilliant, having the formula As $O^5 + 2$ aq. If kept at 392° for some time, and then raised to 402°, the liquid becomes pasty, and at length forms a nacreous white mass of, As O^5 + aq.

The different hydrates, heated to a dull red heat, give the anhydrous acid, which is quite inert, being insoluble in water, ammonia, &c., and not reddening litmus. It gradually liquefies.

Kopp found that if the hands be exposed to the arsenic acid, they at length swell considerably, and serious symptoms may be produced, washing with lime water seems to counteract its effects; the acid could be detected in the excretions, and although no alteration in general health was observed, a very visible increase took place in the weight of the body.

Phosphoric Acid—Reissig has given a modification of Reynoso's process for the determination of this acid by means of tin; the acid being separated from the oxide by means of sulphuretted hydrogen, and determined by magnesia and ammonia. The process seems to give excellent results, and to be free from some of those objections, which render Reynoso's method inapplicable. Ch. G. 331.

H. C.

ENGINEERING AND ARCHITECTURE.

PRESERVATION OF TIMBER.

Plans for the preservation of timber have frequently attracted the attention of men of science, as wood is the most common material used in the arts, and from the acids contained in the sap, the decomposition of the woody fibre speedily commences, where these remain after the vital principle is extinguished by felling the tree. The method employed to eradicate the sap in the ordinary way is by cutting the tree into planks, and exposing the surface of such to the action of the atmospheric air during the heat of Summer. It is found that, according to the climate, from one to two years' exposure, render planks sufficiently seasoned or free from sap, but for large beams, joists, or girders, three or four years, or even a longer time, is necessary. Expensive means have been adopted in England, France, and on the continent of Europe, to imitate this natural process of drying, by placing the beams and planks in a large chamber of wood or metal and passing a current of air through the chamber by means of a fan at a heat considerably more elevated than the natural temperature. This system, although a very good one, involves too great an expense to render its adoption universal; and the joist or plank has to remain from two to three, or even four weeks under this action of hot air, before it is fully seasoned. Another and greatly simpler plan, adopted with some success, is by laying the trees, when fresh felled, in a running stream, when it is found that, after some weeks of immersion, the current has washed out the sap from the minute pores, and substituted the water of the stream.

The principle adopted in Mr. Kyan's patent process was the exhaustion, by means of an air pump, of a large cylinder, into which the wood to be seasoned was placed, and when fully exhausted, a solution of corrosive sublimate (chloride of mercury,) was allowed to flow in and enter the pores. Another process adopted by Mr. Kyan, was the injection of the same solution by direct pressure; but, in both cases, the great expense prevented the general adoption of plans otherwise perfectly successful.

The consideration of these methods have induced an engineer of Hamilton, Mr. Wm. G. Tomkins, to apply the same ideas more directly and more simply, and we propose to give a short description of a patent obtained by him, from his Excellency the Governor General, dated May 16, 1856, which in its heading enumerates the benefits to be derived as follows: "This Patent consists in the simple manner of inserting in the body of a tree different chemical compounds, by a hydrostatic process, or, by a hydrostatic apparatus, and in the use of a pneumatic apparatus for exhausting and drawing off the sap from a newly felled tree, or by vessels of compressed air, forcing out the sap, thereby seasoning the wood and rendering it more sound and marketable."

The manner in which this is effected, is of the utmost simplicity, and can be performed in a few hours at a nominal cost. A tree, newly felled and full of sap, or one in which the sap has been retained, by its lying immersed in water, is laid on the ground and the end cut off by a cross-cut saw, at right angles to the axis of the tree. On to this end is fixed a cap of metal, held firmly by small bolts, which pass through a ring kept in its place by screws or wedges. This hollow cap forms an air-tight chamber, and into the back a pipe is screwed, to connect with a vertical pipe of a quarter inch bore, and a cistern at twenty-five or thirty feet above, for the hydrostatic apparatus, or with a receiver and an air-pump for the pneumatic apparatus. By the former process it will be found that, with a head of 25 feet, and pure water in the cistern, a tree of 16 feet in length is permeated by the water in a few seconds, and a stream of sap will run continuously from the other end. By using the pneumatic apparatus, a pressure of 14lbs. to the square inch, equal to a head of water of 28 or 30 feet, will be acting by the weight of the atmosphere, drawing, or so to speak, sucking out the sap which falls into the receiver prepared for it, rendering the tree in a few hours perfectly free from sap; and this without any danger of warping or splitting which constantly takes place in the slower process of seasoning. The quantity of sap which is extracted by this mode equals from 20 to 40 per cent. of the weight of the tree, and hence the saving in carriage, by rail, by ship, or by canal, is of the utmost importance, besides having lumber worth ten per cent. more in the market, as its elements of decay have been withdrawn. After having abstracted the sap, the end of the tree may be immersed in a preservative liquid of any kind, such as corrosive sublimate, sulphate of copper, alum solution, or solution of sulpharic acid, to render the entire body of the tree free from dry-rot and incombustible; or if desirable, a coloring matter may be applied to dye the whole body of the tree, of any hue which may be wanted. In like manner, also, the patentee has impregnated a tree by the hydrostatic process, in a few hours, with the same substance. A tree twelve feet long became brilliantly red throughout in the course of three hours, with two penny worth of logwood: and all other dye stuffs may be used in the same manner. He proposes in his patent, likewise, to use heated air in the pores of the tree, either by the pneumatic process drawing it through the tree, or by compressing the heated air to 10 or 12 pounds to the inch; and then, as it were, blowing out the sap. Either mode may be adopted, and the expense is trifling. In our large Canadian saw mills, where 250 or 300 logs are passed under the saw in the day, all might be prepared the previous day with one or two pumps, and a sufficient number of caps, the fixing of which would not occupy more than the attention of one man. The pumps at a cost of $30 or $40, would be worked by the motive power of the mill. The utility of this simple invention cannot be overrated, when we consider that Canada produced in 1853 the enormous quantity of 218,480,000 feet of lumber, and 38,740.000 cubic feet of squared timber, which would be worth, as declared by the Government accounts, £2,355,255. This is entirely for export, and we may safely estimate that the quantity required for home consumption, for railroads, bridges, shipping, houses, &c., must considerably exceed double this quantity. Any method which can be adopted to prevent the ravages of dry rot and decomposition, must prove an absolute saving to the country to a very considerable amount. These processes which we have briefly attempted to describe, seem to embody the requirements of simplicity and easiness of application; and, if they are proved by practical experience to accomplish all that their patentee promises, could be introduced. at a very slight expense, in the largest as well as the smallest lumber mills. With such a simple method, our houses and bridges might be made capable of lasting an indefinite period.

It is worthy of notice, in reference to these processes, that they serve in some degree to illustrate the small amount of pressure which nature seems to employ in the growth of trees. We here find, that with a head of twenty-five feet, water is driven, in about thirty seconds through a tree 16 feet long; so that in the natural process of the sap rising, the pressure must be scarcely perceptible, and probably, is nothing more than capillary attraction. When looking at the end of a beach or oak log, with its extremely minute pores, it would scarcely be believed that so slight a pressue could force the water through its minute channels, yet such appears to be the case, and it is owing to this wonderful provision of nature, that by the processes detailed above. these same pores may be employed as means of drying and seasoning the wood; or conveying through them, to the innermost heart of the tree, chemical substances, to render it incombustible, or completely to impregnate it with any coloring matter we may desire.

Scarcely anything strikes the observant traveller fresh from Europe, on his first arrival in Canada, more than the extent to which wood is used; especially in great public works, such as Railway viaducts, and bridges of all kinds, in piers and esplanades, and in many parts of the most substantial buildings, for which stone or iron would alone be considered suitable in Europe. The cause of this is obvious, from the great abundance, slight cost, and facility in working, of the wood; and if to these important qualities we can only add something of the permanency of stone and iron, by such economical processes as those referred to above; and further render it incombustible, as has been effectually, though not yet economically done, by Kyan's methods, the value of the results to Canada would be almost incalculable. One, if not both of these most desirable objects, Mr. Tomkins, of Hamilton, believes he has attained; and we can only hope his processes will be fairly and fully tested; and that if they prove successful he may meet with the reward he will be so fully entitled to.

F. W. C.

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

Latitude—43 deg. 39.4 min. North. Longitude—79 deg. 21 min. West. Elevation above Lake Ontario, 108 feet.

Day.	Barom. at temp. of 32°.				Temp. of the Air.				Mean Temp. +or— of the Av'age.	Tens. of Vapour.				Humidity of Air.				Direction of Wind.			Mean Direc-tion.	Velocity of Wind.					Rain in Inches.
	6 A.M.	2 P.M.	10 P.M.	MEAN	6 A.M	2 P.M	10 PM	ME'N		6 A.M	2 P.M	10 P.M	M'N	6 A.M	2 P.M	10 P.M	M'N	6 A.M.	2 P.M.	10 P.M.		6 A.M	2 P.M	10 PM	Re-sul't.	ME'N	
1	29.694	29·656	29.581	29·6395	° 59.2	° 81.3	° 71.4	° 71.20	° + 4.23	·426	·525	·462	·485	·87	·51	·62	·67	Calm.	S S E	E N E	° S 70 E	0.0	9·2	3.8	3.11	5.00	...
2	.575	·455	.437	·4843	65·4	80.5	70.4	72.60	+ 5.75	·477	·605	·579	·559	·78	·60	·81	·73	N E b N	S E	N	N 80 E	3.8	8.8	13.4	0.97	6.42	0 145
3	.496	·550	—	—	65·3	74·1	—	—	—	·481	·629	—	—	·79	·77	—	—	N b E	S	N b E	N 8 E	13.4	9·2	5.5	3.50	5·69	...
4	.606	·610	·623	·6158	61.9	74.7	62.5	67.17	+ 0.37	·440	·436	·433	·454	·82	·52	·78	·71	N E b N	S	N W	S 14 E	3.6	7·8	4.7	1.21	4.38	...
5	.656	·633	·654	·6463	62.2	78.3	68.9	70.63	+ 3.83	·371	·614	·402	·454	·68	·64	·58	·61	N b W	S b W	N b E	N 62 W	6.4	10·0	3.3	1.67	5.94	...
6	.649	·612	.582	.6085	64.3	77.5	68.9	70.58	+ 3·82	·460	·484	·419	·459	·78	·53	·61	·64	N N W	S W b S	N	N 12 W	10.3	12·2	9.5	2.67	7.36	...
7	.540	·405	.388	·4357	62·4	68.2	65.3	66.50	— 0·18	·432	·551	·449	·486	·78	·83	·74	·77	N N E	N b W	N W b N	N 83 W	4.0	3·6	8.5	3.43	5.69	0.090
8	.405	·438	.497	.4483	62·5	68.2	61.4	63.82	— 2.85	·418	·481	·414	·444	·75	·72	·84	·77	S W b S	S S W	W	S 75 W	8.8	10·8	7.2	5.96	7·01	0.035
9	.548	·553	.574	·5615	61.0	74.3	58·7	64·77	— 1.78	·451	·601	·384	·472	·86	·73	·79	·78	W S W	W	N W b W	N 56 W	6.0	8·8	3.6	6.54	7·61	...
10	.561	·459	—	—	56.4	72·9	—	—	—	·394	·509	—	—	·89	·67	—	—	Calm.	S S W	S W b W	S 40 W	0.0	15·8	3.2	5.38	6·38	Inap
11	.434	·407	·402	·4125	61.2	79.8	58.0	67.63	+ 1.20	·436	·401	·356	·379	·83	·40	·76	·61	W S W	W b N	S W	N 83 W	4.2	15·8	2.6	7.16	7·81	0.020
12	.371	·360	.388	·3757	61·4	71.4	57.2	63.52	— 2.32	·446	·592	·374	·450	·84	·80	·82	·78	N W	W	N N W	N 80 W	2.6	11·2	5.0	5.81	7·87	0.040
13	.394	·374	·445	·4050	54·2	67.7	62·8	63·67	— 2.57	·458	·392	·488	·418	·87	·60	·88	·74	Calm.	S W	N	S 85 W	0.0	4·0	3.5	1.49	4·63	...
14	.496	·499	.566	·5250	58·0	73.4	59.1	63.10	— 3.13	·397	·373	·344	·360	·84	·47	·70	·66	N W b N	S S W	N N W	N 59 W	10.4	14·0	10.4	5.76	9·31	...
15	.602	·601	·665	·6252	53·8	67.5	57.1	59.88	— 6.27	·357	·425	·372	·383	·87	·64	·82	·76	N W	S W b S	N N W	N 48 W	6.8	8·0	6.0	6.15	8·39	0.050
16	.692	·685	·730	·7075	55.6	68.3	57.1	60.73	— 5.30	·366	·375	·345	·361	·85	·55	·76	·71	N W b N	S W b S	N N W	N 31 W	7.6	7·5	9.2	5.56	7·78	0.085
17	.753	·719	—	—	57·4	70.4	—	—	—	·352	·395	—	—	·77	·54	—	—	N b E	S b W	S W b W	S 33 W	12.5	10·2	2 0	3.18	5·00	...
18	.628	·532	·381	·5087	58·9	67·8	61.5	62·17	— 3.67	·419	·397	·439	·419	·86	·60	·82	·77	S E b E	E S E	E N E	S 86 E	1.7	11·0	7.5	5.81	6·65	...
19	.257	·201	.174	·2043	61·9	60.4	60·7	61.13	— 4·63	437	·470	·489	·462	·81	·92	·94	·88	E b N	E S E	N N E	S 87 E	9.3	14·8	5.0	5.75	7·26	0.405
20	.182	·215	.257	.2178	58.1	70·5	61.7	64·27	— 1.28	·438	·454	·417	·446	·92	·65	·77	·77	N W b W	N N W	N W b N	N 34 W	5.0	18·2	17.3	15·22	15·92	...
21	.331	·398	.485	·4107	60.7	64.1	60.4	62·52	— 2.92	·488	·428	·381	·436	·94	·74	·74	·79	N N E	S b W	N b W	N 3 W	7.0	3·6	8.0	5.11	6·86	...
22	.524	·537	·519	·5277	57·8	73.6	62.5	65.18	— 0.17	·406	·467	·491	·466	·87	·58	·89	·78	N b W	S S W	S W	S 28 W	3.0	10·4	2.3	2.56	4·90	0.735
23	.462	·411	·470	·4498	61.1	74.0	62.6	66.45	+ 1·30	·490	·603	·457	·516	·93	·74	·83	·82	S E b E	S W	W b N	N 82 W	4.8	13·8	5.5	6·14	8·63	...
24	.477	·486	—	—	63.2	72·3	—	—	—	·483	·608	—	—	·86	·79	—	—	N W b N	N N W	N N W	N 15 W	19.4	16·4	9.5	10·46	10·63	0.020
25	.563	·616	.710	·6355	50.3	67·7	44.5	50.88	— 13.85	·316	·248	·236	·252	·88	·53	·81	·70	Calm.	N N W	Calm.	N 11 W	0.0	20·5	0.0	8.98	9·09	...
26	.756	·733	.737	·7428	46·7	64.6	54.6	56·58	— 7·95	·271	·312	·308	·299	·86	·53	·74	·68	N N W	S b W	W N W	S 29 W	0.2	9·2	2.4	2.77	3·41	...
27	.756	·701	.680	·7070	47.6	70.0	55·7	59.17	— 5·15	·297	·425	·364	·374	·91	·60	·84	·77	Calm.	S b E	Calm.	S 1 W	0.0	11·0	0.0	2.32	2·80	...
28	.599	·465	·460	·5045	54·9	72.2	62.5	63.88	— 0.25	·370	·428	·423	·423	·88	·56	·76	·74	Calm.	S W b W	N	S 87 W	0 0	12·2	16.5	3.08	5·47	0.055
29	.476	·463	.543	·5013	55.5	61.9	54.8	57·73	— 6.08	·346	·328	·333	·328	·80	·60	·80	·71	N W b W	W N W	W N W	N 65 W	3.2	12·8	4.4	8.57	8·78	...
30	.609	·626	.672	·6390	48·8	67.1	52.1	57.60	— 6.02	·302	·285	·256	·304	·89	·44	·66	·66	N W b W	S S W	N W b N	N 68 W	5.4	12·4	2.8	4.13	6·60	...
31	.743	·797	—	—	51.3	66.4	—	—	—	·312	·239	—	—	·84	38	—	—	Calm.	N b W	N	N 1 E	0.0	11·7	9.5	8.32	8·62	...
M	29.5310	29.5072	29.5238	29.5208	57.90	70.58	60·48	63·59	— 2.17	.401	.450	.402	.419	.85	.62	.77	.73					5.14	11.13	6.20		7·03	1.680

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR AUGUST.

Highest Barometer .... 29.797 at 2 p. m., on 31st } Monthly range=
Lowest Barometer .... 29.174 at 10 p. m., on 19th } 0.623 inches.

Highest registered temperature......... 82°7 at p. m., on 2nd } Monthly range=
Lowest registered temperature......... 41°5 at a. m., on 26th } 41°2

Mean maximum Thermometer........ 73°74 } Mean daily range = 20°79
Mean minimum Thermometer......... 52°95 }

Greatest daily range .... 31°5 from p. m. of 12th to a. m. of 13th.
Least daily range.............................. 8°3 from p. m. of 19th to a. m. of 20th.

Warmest day......... 2nd ... Mean temperature......... 72°60 } Difference = 21°72.
Coldest day.......... 25th ... Mean temperature......... 50°88 }

Greatest intensity of Solar Radiation .... 98°5 on 12th } Monthly range=
Lowest point of Terrestrial Radiation .... 32°5 on 26th } 66°0

Auroral Light observed on 5 nights, viz., 6th, 22nd, 23rd, 24th, and 31st; possible to see Aurora on 22 nights; impossible to see aurora on 9 nights.

No Snow this month. Raining on 12 days,—depth 1.680 inches—raining 23.6 hours.

Mean of cloudiness =0.48; most cloudy hour observed, 2 p. m., mean =0.63; least cloudy hour observed, 10 p. m., mean, =0.25.

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

North.	South.	East.	West.
2601.46	1230.88	606.96	2253.63

Resultant direction of the wind, N 50° W.; Resultant Velocity 2.87 mils.
Mean velocity of the wind......... 7.03 miles per hour.
Maximum velocity .... 24.6 miles per hour, from 4 to 5 p, m. on 20th.
Most windy day........................ 20th...Mean velocity 15.92 miles per hour.
Least windy day .... 27th...Mean velocity 2.80 ditto.
Most windy hour ... 2 to 3 p. m............Mean velocity 10.75 ditto.
Least windy hour ...11 to Midnight......Mean velocity 3.86 ditto.
Mean diurnal variation = 6.89 miles.

2nd—Thunderstorm, 10 p. m. till midnight.
9th—Shooting Stars numerous at night.
15th—Slight Thunderstorm, noon to 1 p. m.
16th—Imperfect Rainbow at 5 p. m.
18th—Imperfect Halo at midnight.
23rd—Heavy Thunderstorm, 3 to 7 a. m.

Lightning not accompanied by thunder occurred on 5 days.

Very heavy falls of Dew almost every night during the month.

The mean temperature of the month and the quantity of rain that fell were respectively 2°5 and 0.974 inches below the average, and the mean velocity of the wind 2.18 miles above the average of 9 years; the month, therefore, may be regarded as cold, dry and windy.

The total displacement of air during the month was equal to that produced by a wind blowing from N 50° W with an uniform velocity of 2.87 miles.

The total displacement during the months of August of the last 9 years, was equal to that of a wind from N 57° W velocity 0.89 miles.

COMPARATIVE TABLE FOR AUGUST.

Year.	Temperature.					Rain.		Wind.		
	Mean.	Diff. from Aver.	Max. obs'd.	Min. obs'd.	Range.	Days.	Inch's.	Resultant. Direction.	Resultant. Velocity.	Mean Force or Velocity.
	°	°	°	°	°					
1840	64.7	—1.4	80.1	47.4	32.7	12	2.905	...	...	...
1841	64.4	—1.7	83.5	46.7	36.8	9	6.170	...	...	0.19 lbs.
1842	65.7	—0.4	80.7	45.3	35.4	6	2.500	...	...	0.30 "
1843	66.4	+0.3	85.5	44.4	41.1	4	4.850	...	...	0.12 "
1844	64.3	—1.8	82.5	44.3	38.2	17	imper	...	...	0.16 "
1845	67.9	+1.8	82.5	44.4	38.1	9	1.725	...	...	0.19 "
1846	68.4	+2.3	86.3	50.4	35.9	9	1.770	...	...	0.17 "
1847	65.1	—1.0	83.1	44.9	38.2	10	2.140	...	...	0.19 "
1848	69.2	+3.1	87.5	49.3	38.2	8	0.855	S 21° E	0.98	4.55 miles.
1849	66.3	+0.2	79.5	51.4	28.1	10	4.970	N 73° W	0.59	3.76 "
1850	66.8	+0.7	84.2	43.0	41.2	13	4.355	N 15 E	0.35	4.46 "
1851	63.6	—2.5	79.8	43.6	36.2	10	1.360	N 63° W	0.40	4.62 "
1852	65.9	—0.2	81.2	46.7	34.5	9	2.695	N 70° E	0.56	3.30 "
1853	68.6	+2.5	91.6	47.6	44.0	11	2.575	S 29° E	0.37	4.23 "
1854	68.0	+1.9	98.1	47.0	51.1	5	0.455	N 62° W	1.75	4.74 "
1855	64.1	—2.0	82.1	44.9	37.2	7	1.455	N 63° W	1.04	6.97 "
1856	63.6	—2.5	81.3	44.0	37.3	12	1.680	N 50° W	2.87	7.03 "
Mean	66.06	...	84.09	46.19	37.89	9.5	2.654			4.85 miles.

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

Latitude—43 deg. 39.4 min. North. Longitude—79 deg. 21 min. West. Elevation above Lake Ontario, 108 feet.

Day.	Barom. at temp. of 32°.				Temp. of the Air.				Mean Temp. + or — of the Av'age.	Tens. of Vapour.				Humidity of Air.				Direction of Wind.			Resultant Direction.	Direction of Wind.					Rain in inches.
	6 A.M.	2 P.M.	10 P.M.	Mean.	6 A.M	2 P.M	10 P.M	ME'N		6 A.M	2 P.M	10 P.M.	M'N	6 A.M	2 P.M.	10 P.M.	M'N	6 A.M.	2 P.M.	10 P.M.		6 A.M	2 P.M.	10 P.M.	Result'.	ME'N	
					°	°	°	°	°												°						
1	29.965	29.968	29.913	29.9587	50.1	61.6	49.0	53.87	— 9.17	.287	.305	.294	.295	.81	57	.86	.71	N N E	S E	S E b E	East	7.8	7.6	2.8	4.66	6.22	...
2	947	907	836	.9035	48.5	67.4	50.3	56.37	— 6.37	268	254	271	268	80	39	75	63	N E b N	S	S E b E	N 89 E	8.0	6.7	4.6	2.47	5.35	...
3	858	808	787	.8155	49.9	68.3	52.8	58.73	— 3.70	252	386	354	335	71	57	90	70	N N E	S E b E	E S E	S 69 E	2.4	4.5	2.2	3.91	4.46	...
4	853	812	803	.8200	50.4	75.1	60.8	63.47	+ 1.35	303	428	414	402	84	51	80	72	E N E	S b E	E S E	S 70 E	3.0	5.4	6.2	2.47	3.82	...
5	806	777	765	.7777	56.7	66.4	63.7	63.10	+ 1.27	381	500	536	493	84	80	93	87	N E	S E b S	S W b S	S 20 E	4.0	3.0	6.0	1.64	3.07	0.240
6	727	697	731	.7205	64.3	74.1	67.1	68.55	+ 7.12	544	630	601	595	93	78	93	88	S W	S W b S	N b W	S 27 W	4.2	11.6	2.2	2.82	5.86	...
7	762	662	—	—	62.6	58.9	—	—	—	484	429	—	—	88	88	—	—	E	E	N E b E	S 88 E	15.0	18.5	2.0	6.72	8.70	0.505
8	711	692	729	.7143	54.6	73.2	59.7	63.35	+ 2.62	389	532	440	454	93	67	87	81	W b N	S W b S	S W b W	S 52 W	5.0	13.3	5.2	5.65	5.99	...
9	739	670	601	.6628	56.2	75.6	65.0	66.35	+ 6.00	337	479	485	435	76	56	80	69	S W	S b E	S b E	S 8 W	6.5	12.2	1.2	3.28	3.72	...
10	554	398	318	.4055	66.1	75.1	73.1	71.83	+ 11.78	586	683	681	646	94	81	86	86	S W b S	S W	W b N	S 64 W	2.6	15.6	13.0	9.71	10.69	0.725
11	358	458	589	.4748	65.7	71.8	56.7	64.70	+ 5.05	501	305	315	357	82	40	70	61	W	W b N	N N W	N 60 W	7.0	24.0	6.6	12.41	13.10	...
12	616	549	412	.5210	47.7	62.5	60.0	57.50	— 1.73	268	338	416	357	82	62	82	77	N N W	S S E	N E b E	S 18 E	5.5	8.5	2.0	3.52	6.22	0.225
13	331	467	625	.4853	57.4	67.6	53.8	59.53	+ 0.68	383	359	321	359	83	54	79	73	W	N W	N W	N 62 W	6.2	21.0	6.0	12.33	12.59	0.020
14	697	651	—	—	45.4	66.0	—	—	—	277	372	—	—	92	60	—	—	N W b W	S S E	S W	South	1.2	5.5	5.8	2.63	4.24	...
15	539	481	667	.5637	53.1	72.5	53.1	60.82	+ 2.90	359	474	291	377	90	61	73	72	Calm	N N W	W N W	N 56 W	0.0	14.2	8.5	8.89	9.75	...
16	728	751	741	.7365	50.4	63.2	54.6	57.22	— 0.30	303	332	341	330	84	59	82	72	N N W	S b W	N N E	S 57 W	5.0	8.2	2.0	1.24	5.57	...
17	597	497	527	.5432	54.2	66.5	59.9	60.62	+ 3.62	368	412	447	429	90	65	88	83	S	E	N E	N 79 E	3.0	7.0	10.6	4.44	5.78	0.640
18	445	317	456	.4043	58.9	68.0	58.1	60.27	+ 3.65	474	391	262	368	97	58	55	72	E b N	W S W	W S W	S 42 W	9.4	22.4	10.2	8.15	11.83	0.050
19	528	541	586	.5573	53.2	64.1	52.8	57.28	+ 1.17	242	266	267	250	61	45	68	56	S W b W	S W b W	W	S 60 W	7.8	17.6	5.3	9.40	10.26	...
20	637	655	769	.6910	42.7	61.0	48.9	52.43	— 3.17	240	231	248	248	89	44	73	66	N W b N	W N W	N W b N	N 62 W	1.3	16.7	1.0	6.28	6.72	
21	774	723	—	—	42.7	49.7	—	—	—	230	301	—	—	85	86	—	—	Calm	N W b W	N W b N	N 28 W	0.0	13.0	3.8	1.93	3.97	0.020
22	685	632	610	.6363	37.4	55.0	48.1	47.67	— 6.97	193	251	263	240	87	59	80	74	N W b N	S b W	N N W	N 33 W	1.4	7.6	5.0	1.15	4.12	...
23	582	541	508	.5365	42.7	52.8	44.5	47.37	— 6.85	223	251	226	232	82	64	78	73	W N W	W S W	N W	N 32 W	5.8	4.0	7.4	4.83	5.74	...
24	463	423	519	.4725	38.8	51.3	41.5	44.43	— 9.32	195	228	202	218	83	62	78	76	W N W	N W	W	N 48 W	2.4	10.6	2.2	6.26	6.59	0.015
25	482	333	341	.3812	41.8	54.2	50.3	48.47	— 4.77	215	290	277	260	82	70	78	77	W S W	S W b S	S W	S 35 W	2.0	15.0	2.9	6.11	6.33	Inap
26	395	434	584	.4775	45.1	60.7	48.2	52.65	— 0.68	263	320	269	290	89	62	80	75	Calm	N W	N W b W	N 79 W	0.0	5.6	2.0	4.82	5.15	...
27	670	637	672	.6648	43.8	59.4	52.8	52.32	+ 0.10	243	287	304	285	86	58	77	74	W N W	S b W	E b N	S 18 E	3.2	3.2	4.2	1.52	4.34	...
28	617	401	—	—	49.5	61.5	—	—	—	314	345	—	—	89	64	—	—	E b N	E b N	W b N	S 59 E	4.0	11.4	19.5	2.77	8.48	0.015
29	480	490	463	.4725	47.8	53.8	48.1	49.90	— 1.42	284	311	304	307	88	76	92	87	S W	S S W	S S W	S 30 W	0.8	0.6	1.2	1.57	1.57	1.195
30	315	165	151	.2050	43.4	51.6	46.3	45.98	— 3.83	265	286	295	287	95	76	91	90	Calm	W N W	W b N	S 84 W	0.0	6.4	17.6	5.05	5.58	0.455
					°	°	°	°	°																		
M	29.6158	29.5800	29.6059	29.6001	50.80	64.33	54.59	57.15	— 0.34	.322	.366	.351	.351	.85	.61	.81	.75	....	....	....	....	4.15	10.70	5.64	...	6.53	4.105

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR SEPTEMBER.

Highest Barometer . . . . 30.013 at 8 a. m. on 1st } Monthly range=
Lowest Barometer . . . . 29.149 at 4 p. m. on 30th } 0·864 inches.

Highest registered temperature . . . . 78°4 on p. m. of 8th } Monthly range=
Lowest registered temperature . . . . 35°0 on a. m. of 22nd } 43°4

Mean maximum temperature . . 66°69 } Mean daily range = 21°03
Mean minimum temperature . . 45°66 }

Greatest daily range . . . . 29°5 from p. m. of 11th to a. m. of 12th.
Least daily range . . . . 10°0 from p. m. of 7th to a. m. of 8th.

Warmest day . . 10th ... Mean Temperature . . . 71°83 } Difference=27°40.
Coldest day . . . 24th ... Mean Temperature . . . 44°43 }

Greatest intensity of Solar Radiation . . 92°2 on p. m. of 9th } Monthly range=
Lowest point of Terrestrial Radiation . 25°5 on a. m. of 25th } 66°7

Aurora observed on 3 nights, viz.: on the 8th, 16th and 26th; possible to see Aurora on 20 nights; impossible to see Aurora on 10 nights.

Raining on 13 days; depth, 4.105 inches; duration of fall, 54.9 hours.

Mean of cloudiness=0.49; most cloudy hour observed, 4 p. m., mean=0.55: least cloudy hour observed, 8 a. m., mean=0.41.

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

North.	South.	East.	West.
1212.64	1496.85	1001.26	2398.08

Resultant direction of the wind, S 79° W; Resultant Velocity, 1.98 miles per hour.

Mean velocity of the wind . . . . 6.53 miles per hour.
Maximum velocity . . . . 27.8 miles per hour, from 10 to 11 a. m. on 13th.

Most windy day . . . . . . 11th—Mean velocity, 13.10 miles per hour.
Least windy day . . . . . . 29th—Mean velocity, 1.57 do

Most windy hour . Noon to 1 p. m—Mean velocity, 10.91 do } Difference
Least windy hour . . . 5 to 6 a. m.—Mean velocity, 3.96 do } 6.95 miles.

Thunderstorms occurred on the 10th, 12th, and 17th.
Lightning, not accompanied by Thunder, on 19th, 22nd, and 26th.

Rainbow (very perfect) at 3 30 p. m., on the 24th.
Hailstones mingled with the rain at 7 a. m., on 13th.
First Frost of the season, a. m., on the 21st.
Heavy Dew very prevalent during this month.

COMPARATIVE TABLE FOR SEPTEMBER.

YEAR.	TEMPERATURE.					RAIN.		WIND.		
	Mean.	Difference from Average.	Maximum observed.	Minimum observed.	Range.	No. of dy's.	Inches.	Resultant. Direction.	Resultant. Velocity	Mean Velocity.
1840	54.0°	— 4.0°	70.2°	29.4°	40.8°	4	1.380	—°	—	—
1841	61.3	+ 3.3	79.9	37.5	42.4	9	3.340	—	—	0.26 lbs.
1842	55.7	— 2.3	83.5	28.3	55.2	12	6.160	—	—	0.45 "
1843	59.1	+ 1.1	87.8	33.1	54.7	10	9.760	—	—	0.57 "
1844	58.6	+ 0.6	81.5	29.6	51.9	4	Impft	—	—	0.26 "
1845	56.0	— 2.0	78.8	35.3	43.5	16	6.245	—	—	0.34 "
1846	63.6	+ 5.6	84.0	39.0	45.0	11	4.595	—	—	0.33 "
1847	55.6	— 2.4	74.8	38.1	36.7	15	6.665	—	—	0.33 "
1848	54.2	— 3.8	80.9	29.5	51.4	11	3.175	N 71 W	2.38	5.81 miles
1849	58.2	+ 0.2	80.6	33.5	47.1	9	1.480	N 75 W	0.69	4.23 "
1850	56.5	— 1.5	76.0	31.7	44.3	11	1.735	S 65 W	1.02	4.78 "
1851	60.0	+ 2.0	86.3	33.4	52.9	9	2.665	N 14 E	1.03	5.45 "
1852	57.5	— 0.5	81.8	36.1	45.7	10	3.630	N 77 W	0.53	4.60 "
1853	58.8	+ 0.8	85.4	36.1	49.3	12	5.110	N 5 E	1.05	4.70 "
1854	61.0	+ 3.0	93.1	36.3	56.8	14	5.375	N 23 W	1.42	4.31 "
1855	59.5	+ 1.5	81.7	36.1	45.6	12	5.585	N 20 E	1.29	7.61 "
1856	57.1	— 0.9	77.3	37.4	39.9	13	4.105	S 79 W	1.98	6.53 "
Mean	58.04	...	81.39	34.14	47.25	10.7	4.436	—	—	5.29

METEOROLOGICAL TABLE FOR KINGSTON, 1854.

Latitude, 44 *deg.* 13.30 *min. North; Longitude,* 76 *deg.* 31.51 *min. West. Height above level of the Sea,* 280 *feet.*

Observations made at 9½ A. M., and 3½ P. M., at the Office of the Royal Engineers.

	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Mean.
Mean Temperature	21.5	17.15	29.	38.25	54.46	62.5	70.	67.	57.5	46.5	35 25	22.5	43.47
Highest Temperature	50.	43.	51.5	61.	79.	86.	87.	89.5	83.	69.	63.	44.	...
Lowest Temperature	14.5	—10.	—18.	10.	30.	39.	48.	46.	29.	25.	13.	—14.	...
Mean Maximum Temperature	29.	27.	35.1	44.8	65.77	71.	80.	77.	67.	54.	41.5	26.	...
Mean Minimum Temperature	14.	7.3	22.9	31.7	43.15	54.	60.	57.	48.	39.	29.	19.	...
Mean height of Barometer	29.728	29.646	29.432	29.716	29.645	29.613	29.681	29.687	29.752	29.745	29.499	29.533	29.6395
Highest Barometer	30.338	30.304	30.136	30.205	30.003	29.962	29.989	29.918	30.164	30.129	30.154	30.274	...
Lowest Barometer	29.123	29.167	28.999	29.221	29.383	29.297	29.378	29.434	29.394	28.974	28.828	28.105	...
Mean of Cloudiness	.5	.5	.4	.45	.24	.3	.30	.3	.94	.45	.725	.7	...
Mean direction of the Wind	W by N	W by S	W	N N E	S W	S E	S W	S W	N	W by S	N by W	N E	...
Mean pressure in lbs.	1.5	1.	1.25	1.	.95	.56	.5	.55	.92	1.04	1.5	1.9	...
Number of days Rain	3	3	9	6	5	10	4	6	8	8	4	4	70
Total amount of Snow (inches)	11	20	4	2	...	...	...	...	...	...	...	21.5	...
Number of days Snow	14	12	5	3	...	...	...	...	...	...	10	9.	53
Number of fair days	15	13	17	21	26	20	27	25	22	23	16	18	243
Number of Thunder storms observed	...	...	1	...	...	3	3	2	1	...	...	...	...

GENERAL REMARKS.—Lake completely frozen over 8th January. Navigation of Lake Ontario opened 11th April—that of River St. Lawrence to Montreal, on 25th April.

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

(NINE MILES WEST OF MONTREAL.)

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

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

Day.	Barom. corrected and reduced to 32°			Temp. of the Air.			Tension of Vapor.			Humidity of Air.		
	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.
1	29.802	29.863	29.808	61.9	91.0	66.9	.527	.638	.600	.96	.46	.89
2	.767	.768	.612	70.6	93.2	75.7	.628	.739	.670	.86	.46	.78
3	.448	.552	.712	74.0	75.0	62.0	.881	.739	.528	.82	.86	.94
4	.754	.728	.726	61.9	76.0	63.3	.499	.400	.516	.89	.45	.89
5	.704	.758	.805	63.5	75.0	62.7	.546	.578	.528	.91	.67	.93
6	.756	.895	.662	61.4	64.4	62.8	.560	.565	.559	.96	.92	.96
7	.587	.501	.551	65.0	72.5	66.5	.586	.704	.615	.96	.90	.96
8	.556	.683	.641	64.9	77.2	62.5	.57[illegible]	.681	.551	.98	.74	.95
9	.641	.612	.690	61.0	79.8	64.4	.521	.692	.560	.98	.71	.90
10	.733	.640	.664	62.1	80.2	65.2	.699	.559	.555	.89	.55	.89
11	.470	.588	.491	64.2	63.0	64.1	.565	.650	.534	.94	.58	.89
12	.517	.484	.427	60.9	62.0	60.1	.457	.512	.514	.89	.90	.94
13	.456	.531	.558	61.1	69.4	59.4	.483	.601	.487	.89	.85	.94
14	.561	.491	.605	67.0	75.3	59.8	.506	.607	.426	.76	.71	.84
15	.667	.707	.652	62.0	74.0	61.2	.472	.617	.456	.84	.74	.84
16	.721	.801	.814	60.8	71.1	60.9	.494	.630	.499	.94	.90	.87
17	.808	.806	.887	58.9	73.4	54.0	.478	.628	.571	.94	.78	.94
18	.810	.853	.770	58.8	79.2	61.2	.462	.659	.483	.95	.67	.89
19	.603	.619	.821	62.4	80.4	61.2	.528	.787	.483	.90	.78	.89
20	.547	.417	.409	59.6	62.0	59.9	.478	.472	.478	.94	.82	.94
21	.400	.411	.440	46.2	59.0	54.2	.282	.422	.426	.86	.85	.94
22	.476	.512	.617	60.1	73.1	59.6	.467	.489	.478	.89	.61	.93
23	.664	.612	.659	64.7	67.0	61.0	.534	.593	.511	.89	.89	.93
24	.513	.472	.609	60.8	69.1	63.0	.511	.521	.467	.94	.70	.89
25	.631	.519	.692	56.6	59.8	43.1	.363	.441	.252	.79	.84	.85
26	.788	.749	.818	49.5	61.6	47.7	.312	.383	.312	.86	.71	.87
27	.887	.865	.901	50.0	70.4	56.4	.340	.515	.432	.89	.70	.91
28	.804	.644	.400	58.4	76.4	64.2	.462	.659	.566	.91	.74	.94
29	.448	.458	.525	62.0	72.2	56.8	.538	.638	.432	.97	.82	.94
30	.578	.613	.734	56.0	72.3	52.5	.326	.473	.326	.87	.64	.81
31	.801	.853	.982	53.6	63.5	46.3	.293	.411	.282	.80	.71	.86

Day.	Direction of Wind.			Velocity in miles per hour.			Mean direction of Wind.	Rain in Inches.	Snow in Inches.	WEATHER, &c. A cloudy sky is represented by 10; A cloudless sky by 0.		
	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.				6 A.M.	2 P.M.	10 P.M.
1	sw by s	w	s by w	0.00	0.62	0.42	w ° 11 s	...	...	Clear.	Clear.	Clear.
2	SE by s	w s w	s by w	0.07	2.04	0.72	w 30 s	...	...	Clear.	Clear.	Do.
3	s s w	s s w	NwbW	4.07	2.63	3.42	w 15 s	0.660	...	Cir. 10.	Cir. Str. 4.	Cir. Str. 3.
4	N N W	sw b w	sw b w	0.23	1.64	0.02	w 15 N	0.010	...	Do. 4.	Do. 4.	Do. 10.
5	N by E	NE by N	s s w	0.01	0.07	1.36	N 5 E	...	...	Do. 10.	Do. 10.	Do 10.
6	N N E	N by E	NE b E	1.28	10.20	12.15	N 30° E	2.100	...	Rain.	Rain.	Do. 10.
7	N by E	s s w	s	13.02	0.55	0.87	N 20° w	0.796	...	Cir. Str. 10.	Rain.	Rain.
8	s s E	s s w	s by E	0.70	1.70	0.06	s 12 w	0.261	...	Rain.	Cir. Str. 6.	Cir. Str. 9.
9	w by s	s w	swbyw	0.00	0.48	2.72	s 11 w	...	...	Cir. Str. 8.	Cir. Str. 4.	Str. 2.
10	w s w	w b s	s s w	1.42	7.17	7.07	w 34.5	...	...	Cir. Cm. St. 6.	Do. 8.	Clear.
11	s	s w b w	swby w	1.32	2.63	1.70	s 40 w	Inp	...	Clear.	Cr. Cm. St. 8.	C. S. 4, Lt. Th.
12	N W	E by s	s by w	0.08	2.26	0.02	E 40 s	0.060	...	Cir. Str. 8.	C. C. St. 8.	Do. 2.
13	s w	swb w	sw byw	2.33	6.76	2.57	w 54 s	...	...	Do. 6.	C. St. 8.	Str. 10.
14	w	w by N	NWbyN	0.57	7.42	6.66	w 11 N	...	...	Clear.	C. C. 2.	Clear.
15	N W	w by N	w by N	1.72	7.52	4.72	w 11 N	...	...	Cum. 2.	C. St. 2.	Cir. Str. 8.
16	w by N	s w	w by s	1.82	0.77	4.63	w 23 N	0.739	....	Cir. Str. 4.	C. C. St. 6.	Cir. Str. 4.
17	N N E	s	NW b N	1.77	2.03	0.00	N 34 E	...	...	Cir. Cum. 4.	C. St. 4.	C. C. S. 8, AB.
18	NE by N	s s E	E	1.20	1.81	1.50	E 55 s	...	...	Cir. Str. 10.	Do. 6.	Clear.
19	SE by E	s E	s s E	4.91	2.30	4.14	s 34 E	...	...	Cir. Cm. St. 4.	C. C. Str. 4.	Clear.
20	E N E	NE by E	E by s	8.92	11.55	7.60	E 24 N	4.102	...	Nimb. 10.	Cum. 2	Cir. Str. 10.
21	s E	s E	E by N	16.09	9.79	0.63	E 16 s	0.732	...	Cir. Str. 6.	C. Str. 10.	Do. 10.
22	N	w	w	0.60	1.49	0.14	s 40 w	...	...	Cr. Cm. St. 4.	C. C. Str. 6.	Clr. Aur. Bor.
23	E	E S E	s s w	1.00	0.07	0.00	s 24 w	Inp	...	Cir. Str. 10.	Rain.	Cir. Str. 10.
24	w N w	N	N N w	0.00	1.25	0.77	N 11 w	0.030	...	Do. 10.	Do. Thunr.	Clear.
25	w N w	N N w	w by N	3.50	5.20	12.51	N 34 w	...	...	Cir. Str. 4.	Cum. Str. 6.	Do.
26	s w	w	s w	3.37	7.47	19.00	w 20 N	...	...	Clear.	C. Str. 4.	Cir. Str. 4.
27	NE by E	w N w	s E	2.30	2.72	0.16	w 24 N	Inp	...	Cir. Str. 9.	C. Str. 4.	Clear.
28	s E	s s E	s s w	0.16	0.20	4.57	s 12 E	...	...	Cr. Cm. St. 8.	C. Str. 8.	Cl. St. 8, Light.
29	s by w	s b w	w	3.22	1.13	7.03	s 8 w	0.333	...	Rain.	C. Str. 8.	C. Str. 4.
30	w b s	w	w N w	9.00	11.60	4.55	w 11 N	0.040	...	Cir. Str. 6.	Do. 4.	Clear.
31	w N w	w N w	N N w	3.02	8.05	11.73	w 33 N	...	...	Clear.	Clear.	C. St. 2, Au. B

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

(NINE MILES WEST OF MONTREAL.)

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

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

Day.	Barom. corrected and reduced to 32° Fahr.			Temp. of the Air.			Tension of Vapor.			Humidity of Air.			Direction of Wind.			Mean direction of Wind.	Velocity in miles per hour.			Snow in Inches.	Rain in Inches.	WEATHER, &c. A cloudy sky is represented by 10; A cloudless sky by 0.		
	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.		6 A.M.	2 P.M.	10 P.M.			6 A.M.	2 P.M.	10 P.M.
1	30.122	30.056	30.072	40.6	68.2	50.1	.260	.422	.320	.90	.62	.86	N W b W	W S W	W by S	W 11 N	5.35	1.32	3.07	...	...	Frost. Clear.	Clear.	Clear. Aur. Bor.
2	.046	29.952	.001	50.2	79.4	58.8	319	597	457	92	61	89	W by N	S W	S S W	S 23 W	0.00	2.80	0.00	...	...	Cir. Str. 4.	Do.	Do.
3	.023	29.882	29.885	51.0	83.0	59.9	371	621	426	90	57	84	W by S	W S W	S S W	W 35 S	0.02	1.21	0.22	...	...	Fog.	Do.	Do.
4	29.933	.854	.932	54.9	82.3	64.1	418	571	452	93	54	76	W	W S W	W by S	W 23 S	2.00	5.05	4.35	...	...	Clear.	Do.	Do.
5	.921	.940	.904	62.2	85.8	64.4	472	692	534	84	58	89	S W by S	S S W	S S W	S 34 W	1.55	1.65	0.18	...	...	Do.	Do.	Cir. Str. 10.
6	.846	.744	.788	64.0	86.1	69.9	534	787	634	88	65	90	S W by W	W by S	W by S	W 28 S	1.74	5.61	0.86	...	0.023	Cir. Str. 10.	Cir. Str. 4.	Do. 8.
7	.950	.918	.902	48.8	65.0	55.1	261	449	372	71	71	84	E N E	S E	N E b E	E 34 N	16.48	5.82	3.72	...	...	Clear.	Do. 8.	Rain.
8	.714	.744	.808	54.6	74.1	60.3	418	532	468	94	64	89	N W b W	W N W	S W by S	W 11 N	3.52	0.60	3.75	...	0.500	Rain.	Do. 4.	Cr. St. 2. Aur. Br.
9	.910	.829	.786	55.5	74.8	64.4	418	617	534	91	74	89	N W	S W	S S E	S 40 W	0.12	1.55	0.12	...	Inp	Clear.	Do.	Ninb. 10.
10	.701	.504	.485	64.5	80.3	71.1	565	761	715	93	76	93	S S E	S S W	S W by S	S 27 W	0.21	3.90	4.07	...	0.266	Do.	Do. 8.	C. St. 8. Dis. thu.
11	.541	.514	.600	64.0	69.6	60.1	565	541	399	94	76	77	W	W by S	W b S	W 11 S	6.95	6.45	18.01	...	0.670	Cir. Str. 10.	Do. 6.	Str. 2.
12	.757	.662	.684	53.4	63.9	52.0	361	476	349	87	79	87	N E	N W	S	W 40 N	5.22	0.74	1.42	...	...	Clear.	Do. 4.	Cir. Str. 8.
13	.556	.498	.635	48.9	64.1	49.1	336	425	326	93	71	93	S E	N N W	N W b N	N 34 W	0.06	4.92	5.86	...	0.660	Rain.	Rain.	Do. 2.
14	.799	.772	.800	53.4	70.0	52.1	315	515	349	76	70	87	N N W	W by S	S	W 10 S	7.57	2.07	1.62	...	...	Clear.	Cir. Str. 4.	Cir. 2.
15	.563	.541	.648	50.2	66.0	50.7	361	544	349	96	85	92	S S E	S S E	W S W	S 10 E	0.08	0.75	4.20	...	0.283	Str. 2.	Rain.	Cir. Str. 4.
16	.814	.781	.844	46.3	86.3	48.1	303	305	302	93	66	86	W b S	N W	W N W	W 34 N	1.02	11.93	4.24	...	...	Clear.	Cir. Str. 4.	Do. 10.
17	.856	.793	.750	45.6	50.3	47.3	315	326	313	96	87	93	W S W	E N E	N E by E	E 34 N	1.80	0.17	0.35	...	0.283	Rain	Do. 10.	Do. 8.
18	.667	.538	.491	45.8	69.0	66.6	319	550	568	99	77	79	N E b E	N E by E	W by S	E 34 N	0.70	6.35	4.56	...	Inp	Cum. Str. 10.	Clear.	C. St. 10. Dis. thu.
19	.576	.737	.817	48.7	68.3	55.7	281	400	351	80	58	79	W by S	S W b W	S S W	W 34 S	4.21	15.60	12.18	...	...	Clear.	Cir. Str. 4.	Clear.
20	.807	.752	.822	33.6	74.2	55.4	349	485	372	81	55	84	W	W	S S W	S 34 W	6.91	0.15	1.70	...	...	Do.	Cir. Cm.	Do.
21	.858	.785	.817	42.0	63.6	50.8	263	345	326	90	59	87	S S W	W by N	W b N	W 1 N	0.41	0.41	1.31	...	...	Do.	Cir. Cm. Str. 4.	Str. 10.
22	.791	.713	.779	49.8	61.0	46.2	336	362	303	90	66	90	N E by E	E N E	E by S	E 34 N	0.01	2.21	2.71	...	...	Cir. Cm. St. 4.	Cir. Str. 4.	Clear.
23	.654	.591	.551	46.2	53.0	49.4	304	386	349	96	93	93	N by W	N N E	N W	N 34 E	3.85	0.61	5.96	...	0.133	Rain.	Rain.	Str. 4.
25	.394	.383	.501	48.0	51.6	44.6	324	326	261	93	81	86	W N W	[illegible]	W S W	[illegible] 34 N	0.29	8.85	10.00	...	0.030	Cir. Str. 8.	Cir. Str. 8.	Clr. Aur. Bor.
24	.605	.551	.452	43.0	58.0	51.0	252	346	337	85	70	87	W S W	S W	S by W	[illegible] W	8.57	9.52	6.40	...	Inp	Clear.	Do. 6.	Cir. Str. 10.
26	.536	.505	.627	49.6	66.7	52.1	312	464	349	86	72	88	S S W	W S W	S S W	S 30 W	4.05	2.45	0.17	...	Inp	Cir. Str. 8.	Do. 2.	Do. 2. Dis. thu.
27	.699	.797	.841	47.3	60.2	46.7	337	393	282	98	75	86	W S W	W	N N W	W 11 S	2.87	2.22	3.12	...	...	Do. 10.	Do. 8.	Clr. Aur. Bor.
28	.889	.771	.783	41.0	68.2	50.0	257	470	314	96	69	82	E N E	S S E	S E by S	S 23 E	1.27	3.75	3.81	...	...	Cl. Light frost	Clear.	Do.
29	.776	.756	.765	55.0	64.9	52.1	347	425	304	84	71	80	S by E	S S E	S E by S	S 11 E	3.42	23.80	6.22	...	...	Cir. Str. 6.	Cir. Str. 8.	Do.
30	.684	.526	.276	51.1	56.3	54.2	337	385	400	87	84	93	E N E	E S E	E N E	E 11 N	8.40	8.51	14.10	...	0.723	Do. 9.	Do. 10.	N. 10. R'n. D.T.

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

Barometer	Highest, the 31st day	29.982
	Lowest, the 21st day	29.400
	Monthly Range	0.582
	Monthly Mean	29.649
Thermometer	Highest, the 2nd day	97°.6
	Lowest, the 26th day	39°.4
	Monthly Range	58°.2
	Monthly Mean	63°.20

Greatest Intensity of the Sun's Rays .... 118°.4
Lowest Point of Terrestrial Radiation .... 38°.1
Amount of Evaporation 2.61
Mean of Humidity .... .834
Rain fell on 15 days, amounting to 9.913 inches—it was raining 72 hours 45 minutes, accompanied by thunder and lightning on 3 days.
Most prevalent Wind, W. N. W., 360.20 miles.
Least prevalent Wind, S., 2 miles.
Most windy day, the 26th; mean miles per hour, 9.94.
Least windy day, the 1st; mean miles per hour, 0.34.
Most winday hour, from 6 to 7, p.m., on the 25th, 20.20 miles per hour.
Total amount of miles traversed by the Wind, 2450.80; which being resolved into the Four Cardinal Points, gives, N. 621 miles; S. 242.30 miles; W. 1018.20 miles; E. 569.30 miles
There were 269 hours and 20 minutes calm during the month.
Two days cloudless during the month.
Aurora Borealis visible on three nights.
Occultation of Jupiter by the Moon, on the 19th, visible.
Meteor in S., at 7.25 p.m., on the 26th passing from *K* to *Y. Serpentis*.
The Electrical state of the Atmosphere has been marked by rather feeble Intensity.
Ozone was in large quantity.
The mean temperature of the month is 1°.64—less than that of last August. The rain exceeds 6.113 inches the rain of last August; and is the most rainy August on record.
First Frost on the 26th.

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

Barometer	Highest, the 1st day	30.122
	Lowest, the 30th day	29.276
	Monthly Mean	29.730
	Monthly Range	0.846
Thermometer	Highest, the 6th day	87°.9
	Lowest, the 1st day	34°.9
	Monthly Mean	57°.89
	Monthly Range	53°.0

Greatest Intensity of the Sun's Rays .... 103°.9
Lowest Point of Terrestrial Radiation .... 34°.2
Amount of Evaporation 2.34
Mean of Humidity .... .821
Rain fell on 14 days, amounting to 3.571 inches; it was raining 55 hours and 20 minutes—and was accompanied by thunder and lightning on 4 days.
Most prevalent Wind, W by S.
Least prevalent Wind, N E.
Most windy day, the 29th; mean miles per hour, 31.99.
Least windy day, the 3rd; mean miles per hour, 0.48.
Most windy hour, from 1 to 2, p.m., on the 19th—26.2 miles.
Total amount of miles—2799.5; resolved into the Four Cardinal Points, gives, N. 471, S. 589.5, W. 1249, E. 490.
There were 243 hours 10 minutes calm during the month.
There were 4 days perfectly cloudless.
Aurora Borealis visible at observation hour on 4 nights.
The electrical state of the atmosphere has been marked by moderate intensity.
Ozone was in moderate quantity.

POSTSCRIPT.

The Editor has to acknowledge various Works forwarded to him, from time to time, by the Publishers and others, and begs to state that all such donations are added to the Library of the Canadian Institute. These will accordingly be duly recorded, along with the other additions to the Library and Museum, purchased or presented during the Summer recess, in the Report annually submitted by the Council to the Institute, which will be printed in a subsequent number of the Journal.

This number closes the first volume of the New Series of the Canadian Journal. With the commencement of the new volume it is purposed to record in each number, a list of Books and Periodicals received; reserving to the Editing Committee the further selection of those for special notice, which shall appear to them best suited for the objects aimed at in the issue of a Periodical for circulation among the members of the Canadian Institute.

Reports of the Twenty-Sixth Meeting of the British Association for the Advancement of Science, held at Cheltenham; and of the Tenth Meeting of the American Association, held at Albany, N. Y., in August last, are unavoidably delayed till a future number, owing to the pressure on our available space, for Meteorological Tables and Index, to complete the concluding number of the volume.

ERRATA.

Page 357, line 11 from foot, for *of an unit* read *of* R_1

" 358, " 6 " " R_k " R_{k-1}

" 388, last line, for *Bryoza* read *Bryozoa.*

INDEX.

REVIEWS.

SCIENTIFIC AND LITERARY NOTES.

GEOLOGY AND MINERALOGY.

PAGE

PHYSIOLOGY AND NATURAL HISTORY.

ETHNOLOGY AND ARCHÆOLOGY.

CHEMISTRY.

LITERATURE AND FINE ARTS.

MATHEMATICS AND NATURAL PHILOSOPHY.

ENGINEERING AND ARCHITECTURE.

MISCELLANEOUS.

CANADIAN INSTITUTE, PROCEEDINGS OF.

TO THE READER.

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

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

Extract from the Annual Report of 1855.

CONTENTS.

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