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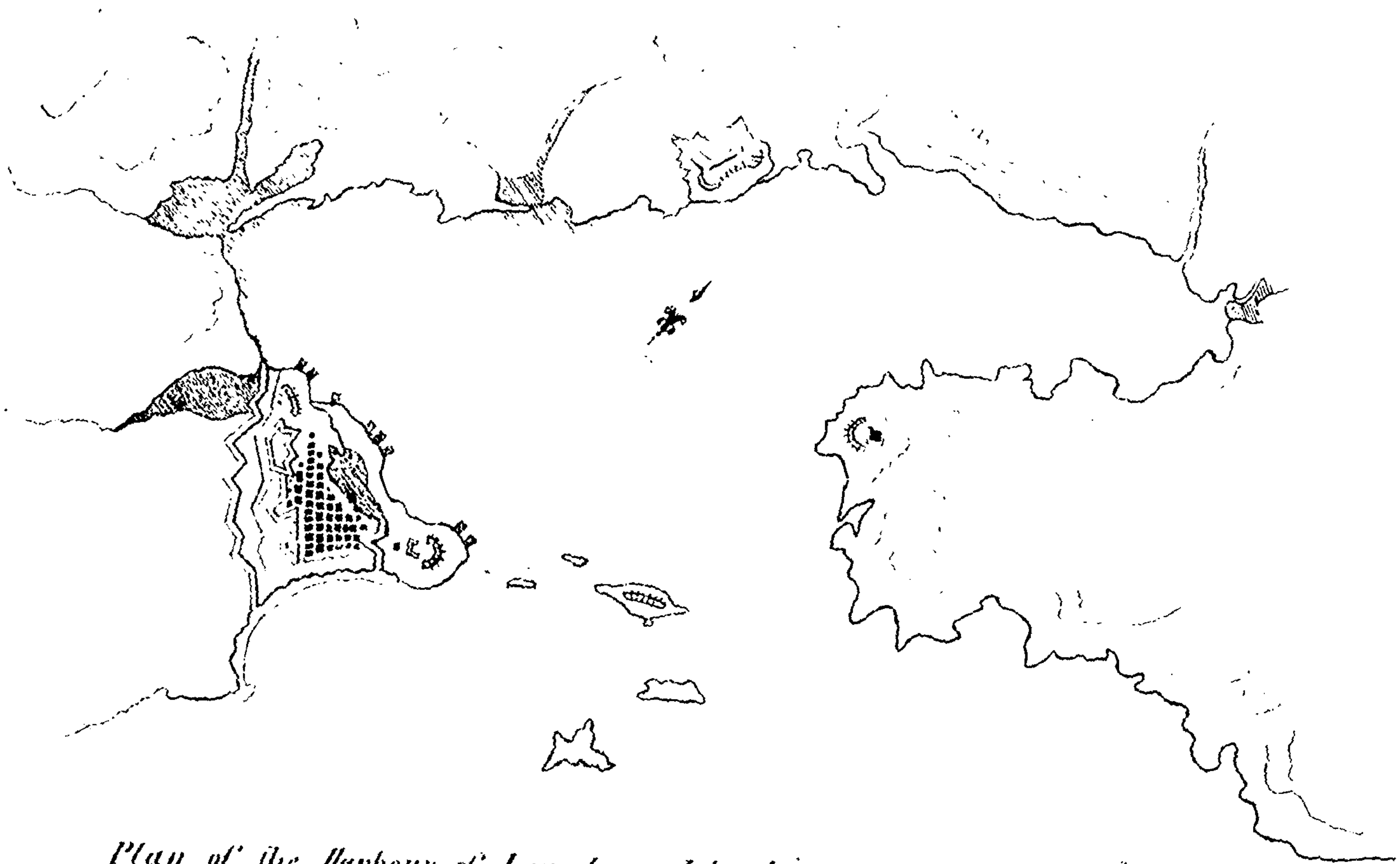


Plan of the Harbour of Louisburg Island of Cape Breton 45°54' N.L. 59°53' W.L.

S. J. Stratford

The Canadian Journal.

TORONTO, JANUARY, 1853.

INCORPORATED BY ROYAL CHARTER.

The Annual Address of the President of the Canadian Institute was delivered on Saturday, January 8th, at the Rooms of the Institute, in the old Government House. The number of members present exceeded forty. The presence of the Hon. The Chief Justice Robinson and many other distinguished and earnest well-wishers of literary and scientific progress in the Canadas, afforded a very gratifying indication of co-operation and interest in the proceedings of the Institute.

The preliminary business of the evening consisted of the revision and amendment of the Regulations and By-laws of the Institute, the election of members, &c.

The following gentlemen were elected members of the Institute:

The Reverend W. A. Adamson, D. D., Librarian Legislative Council.........................Quebec.
Charles Rahn.................................Toronto.
W. J. Fitzgerald.................................Toronto.
Samuel Spreul.................................Toronto.

The members proposed were,—

Major Lachlan.................................Montreal.
Dr. Connor.................................Toronto.
William Hawkins.................................Toronto.
Thomas Henning.................................Toronto.

The President announced the establishment of Two Prize Medals by the Council for the best Essays on the following subjects:—

1.—A Medal, value £10, for the best comprehensive essay on the Public Works of Canada, their commercial value, their relations to a general system of American Public Works, their engineering peculiarities, cost and other statistics, to be accompanied by illustrations.

2.—A Medal, value £10, for the best essay on the physical formation, climate, soil and natural productions of Canada.

Notice was given by the President that a paper on "The Mineral Springs of Canada" would be read before the Institute by Professor Croft, at their next meeting, on Saturday, January 15th.

The President's Annual Address.

The termination of the official year, gentlemen, or the commencement of a new session, is the time when it seems fitting for the President of our Society to exercise the privilege of addressing to it that commentary on its affairs,—and its actual position,—or it may be that counsel and suggestion,—which cannot be well incorporated in a Report. I think there can be no difference of opinion as to the advantage of this course, where there is any real activity in the body to respond to it, or the essential part which an annual Address may perform in sustaining the action of the Society, coming from an officer whose voice will, in general, have a weight precisely proportioned to that earnestness, activity, and ability, of which the Society is itself the exponent. On this account I have not shrunk from the responsibility of establishing the proper precedent, by venturing to address you now, notwithstanding the circumstance that less than twelve months ago you were pleased to accept me as the President's representative upon a similar occasion. Nor will I pay the Society the questionable compliment of too strongly expressing—what it would, however, be impossible for me not to feel—a sense of unfitness for the office to which you have been pleased to call me; and which, if it implied anything more than an acknowledgement—very gratifying to myself—of previous services, and of, perhaps, some advantages, from accidental circumstances, for aiding the endeavours of the Society, I should have been most reluctant to assume. I will merely beg, therefore, that you will on this occasion divest my views or advice from any other claim to authority than they may possibly derive from the manner in which they commend themselves to your own judgment.

It is not organization, gentlemen, 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. I venture to press this very obvious truth; because upon the spirit of our first complete session may probably depend much of the support which we may fairly claim from the community, and the interest which enlightened and liberal men may take in our proceedings. In our actual circumstances, we cannot altogether trust, as larger and longer established societies may do, to spontaneous efforts, but must strive to give reality to what in their cases becomes but nominal,—a claim of the society upon the active exertion of each individual member. There is an MS. preserved in the British Museum which gives a list of the members of the Royal Society at a very early date; and a sort of memorandum against the name of each, as to what might be expected of him. There are some,—and I am sorry to say Newton is one of them,—with the words "no pay" against their names. Sometimes, however, with the addition, "will contribute experiments;" there were others who were expected not only to pay, but to "give yearly one entertainment to the Society." Now, I think, it may be said that that we do not indulge these brilliant prospects of entertainments, and do expect all our members to "pay;" but still more confidently may we expect that lively general interest on their parts which will impel all from whom it may be reasonably looked, to "contribute experiments;" that is, to prepare papers upon the subjects of their several pursuits or studies, and induce those who have joined us principally with the kind and generous purpose of assisting objects which they respect, but do not pursue, to give one additional proof of their interest, by occasionally attending our weekly meetings.

It is, perhaps, too much to expect that there can be, at present, any considerable proportion of papers upon scientific subjects elicited from the Society. Not to dwell upon the fact that the production of such papers presupposes the existence of acquirements and of pursuits which we know to be the characteristics of a different state and stage of society from that existing in Upper Canada at present, and which it is our hope and aim to develope, rather than our pretension to embody, we labour under several special disadvantages. For instance, the simplicity and sameness, over great areas, of the geological formations of this peninsula,—their comparative poverty in fossils,—the absence of mountain ranges,—the limited catalogue of its mineral productions; all undoubtedly combine to deprive that delightful study of many of its attractions, and to deprive societies like ours of an allurement and stimulus to individual exertions. The same physical peculiarity limits to a certain extent, I presume, as compared with other geographical provinces of this continent,—the field of the naturalist and botanist, at least in some departments; for entomology and probably ornithology are exceptions. But we should be very wrong to infer from this that there is nothing for the cultivators even of those branches of science to learn, nothing which they may contribute to the knowledge of the world. It was a keen eye in Mr. Hunt which detected in the coarse-grained silicious sandstones of the River Ouelle, belonging to the Lower Silurian formation,—those few, scattered anomalous foreign substances,—the longest fragment about an inch and a half long and one-fourth of an inch in diameter, whose chemical constitution, revealed by his skilful analysis, sustains a supposition which even geology, habituated as it is to have its landmarks carried ever further and further back into the bosom of the eternity behind us, deems almost too extravagant for belief. These bodies consist in great part of phosphate of lime; and every thing about them, save only their startling antiquity, leads him to the belief,—shared also, there is reason to think, by geologists of great eminence,—that they are the bones of vertebrate animals, and that certain nodules of similar constitution accompanying them, are coprolites: thus actually revealing not only the existence but the carniverous character of races of the animal kingdom which have been heretofore supposed to have had no existence on our globe until a much later period. I do not, however, allude to this discovery—on which Mr. Hunt observes becoming caution, and which the distinguished director of the geological survey has not, that I am aware of, supported as yet with his own authority,—as if it were established; but refer to it simply as a recent illustration, furnished by a Canadian geologist, of what close observation, prompted by a spirit of enquiry, and sustained by sound knowledge, may detect in an apparently unpromising field. Mr. Abraham's interesting discovery of crustacean footprints in the argillaceous schist of Beauport is another case in point. We might come much nearer home. How many of us have made our daily walks in this busy neighbourhood subservient to the same study? Study Palæontology, collect fossils at Toronto! I can imagine some one to say, as if the idea were preposterous; yet one of our members, Professor Hind, has found a large proportion of those of the Hudson River group, figured in that magnificent work, the Palæontology of New York,—I believe some fifty or sixty at least, and some which are apparently undescribed there,—no further from hence than the banks of the Humber bay. At the late Provincial Fair, held in this city, was there not one thing exhibited, where we should have least expected to meet with it, which suggested to every one who saw it the happiness of a love for natural history, and the astonishing richness of the humblest section of that wide field? I allude to the curious collection of objects illustrating insect architecture, gathered by Mr. Couper, of this city, which accompanied his entomological collection. And it needed but close observation and a love of nature to find the works of instinct, varied to meet a thousand needs, in which the humble yet Divine intelligence of the Architect lived before us, where most of us, perhaps, have found only the pests of our gardens. I know that a military officer, recently in this garrison, who combined the naturalist with the sportsman, formed an extensive ornithological collection, while actually performing his duties here; and most of us have contemplated with interest and instruction the collection of birds, shot I believe entirely in this neighbourhood, which Mr. Doel has exhibited on various occasions. It cannot be said that there is not ample scope for pursuits of natural history even in this neighbourhood. It may require an Agassiz to detect in the *Lepidosteus* or gar-pike of our lakes, that remote reptilian character which distinguishes it from every known fish, and stamps it as the last and only representative of the gigantic race of fish-lizards of the secondary epoch; but we need not such confirmation of the truth which probably no one will question, that our streams, our lakes, our woods, our fields,—all, beyond a doubt,—present, in their inhabitants or their productions, a full proportion of those nice and narrow distinctions from similar objects elsewhere, which form the peculiar study of the naturalist, and are so often connected with the broadest and most important enquiries raised in the progress of science.

In venturing, then, to guard against exaggerated views of what such a society as ours can effect, by remarking that we must not expect that papers on purely scientific subjects can be frequently presented to us, at present, I had in view, chiefly, the circumstance that our constitution is avowedly practical, and, in some measure, even professional; for it was the Professional Society of Engineers and Architects from which it derives its origin; and any one who has remarked the curious descent, as some might call it, ascent

I would rather say, which the successive societies established in Toronto have made, from objects chiefly fanciful to objects essentially real, who traces the principle of association through the original Shakespear Society, the Literary and Historical Society, the Athenæum, to the Canadian Institute, will doubt that in this practical element lies our best hope of a more permanent and active existence than rewarded the establishment of the societies which have preceded us.

It has been boldly said by Tennyson, that

> We are the ancients of the earth,
> And in the morning of the times.

Assuredly these words are no where more true than here. All which time alone can bring to maturity may be wanting around us, but ought we not to find in its place the buoyancy, the life, and the aspirations of youth? Measured on the gigantic scale of centuries of science, our results may, perhaps, for a time appear diminutive enough: let them not fail, however, to receive at least from ourselves, something of that grateful acknowledgement which made heroes, and sages, and demi-gods, in times of old, of the authors of sufficiently simple discoveries. It will be well, however, if the same state of things do not betray us into a danger not unknown to similar associations: that of substituting reciprocal compliment for a well-founded estimate of our real status, and indolently lowering the standard by which the world will judge us, to that scale upon which it may be most agreeable to judge ourselves. One of the most distinguished of the men of true science in the neighbouring States has recently drawn a lively picture,—for the truth of which, however, he appealed to all his hearers,—of the degree to which, in the generation immediately succeeding the War of Independence, a species of charlatanism, deriving its countenance and support from the general ignorance of the community, intruded into the place of science, and outvoted it in every division of forces. "Our real danger," said he, in words applicable to every country in which an elevated standard of acquirement is wanting "lies now from a modified charlatanism, which makes merit in one subject an excuse for asking authority in others, or in all; and because it has made real progress in one branch of science, claims to be an arbiter in others. Sometimes this authority is thrust on men who, not having the force to enlighten those who press them as to their real claims, injure the cause which they would fain promote, by being too impressible. Merit thus moulded assumes the form of the impressing body. Whether the authority be seized or accepted it is unlawful." Thorough knowledge of subjects of science other than those by which, in a young country, men may earn their bread, is not ordinarily reconcileable with that indispensable prerequisite; but happily it is pretence, not ignorance, makes the charlatan. Avoiding exaggeration of language, and sustaining always, by the aid of a well-selected library, and ready access to contemporary scientific literature, a just and temperate view of the value, as regards the world, of those efforts which to ourselves alone are of high importance, we cannot fail to pass safely over that epoch of danger, which, in the case referred to, preceded the maturity of the national growth. I see no reason why, in a few years, a Canadian society should not rank with those of highest character on this continent. Already have our great public works created a demand for the highest science of the engineer. Railroads, with their long train of applied arts and sciences; processes of manufacture, which science first divulged, and science alone can direct, are obeying the attraction of profit, and naturalizing themselves on this new soil. With these practical sources of support, and with five or six universities or colleges, including a very numerous professional body, and one which counts among its members many names of distinguished academical rank, it is surely something beyond a provincial standing to which a society in Upper Canada may ultimately aspire. But, gratifying as we must feel the support given to us to be, we cannot say that this Institute as yet by any means unites the strength of these bodies; some of them, I believe, are not represented among us at all, and it must be a work of time to gain the confidence and interest of all. Among the endless examples furnished by the life of that illustrious man,—of whom it has been so truly said that he left no duty incomplete, as he left no honour unacquired,—there is one so appropriate to our present subject that I may be pardoned for alluding to it. Late in life did the great Duke of Wellington remember that he had still to testify his respect for those other fields of human rivalry and labour, in which the elder Herschell, Davy, Wollaston, Young,—while he was waging the battles of liberty,—were winning equally imperishable fame, and adding other conquests to the dominion, not of their country, but of their race. In his seventy-eighth year he became a Fellow of the Royal Society. A similar view of duty taken by all those to whom it equally applies would add not a little to our strength and our resources. A command of funds is much more essential to a society like the Canadian Institute than may at first sight appear. The liberal assistance granted to us by the government, to be amply justified, I trust, by our use of it, has for the present relieved us from embarrassment; but with our present very low rate of annual subscription, a considerable portion of which also returns to the member in the form of a monthly publication, a numerous list of members is almost indispensable. It has been already stated by the Council in the annual report, that we do not aim at present at forming a general library or a general museum; but we desire that at the earliest possible period, students in any ordinary subject of science, shall find here the most recent standard works on that subject, and collections illustrating it. Of the former, a selection has already been ordered; our progress with the latter rests very much with ourselves. It is much to be wished that members should bear in mind the great acceptability at the outset of almost any thing belonging to the departments of geology and natural history, and make such individual contributions as may be in their power. By separate exertions, in different quarters,—the quadrupeds and the birds,—the fishes, the insects,—the land and fresh-water shells, as well as the flora of the country, might undoubtedly be pretty completely collected in a year or two, and a great impetus, as well as a great assistance, given to future researches. It is a pleasure here to refer to the success which has attended the exertions of our sister societies at Quebec and Montreal in this respect, as calculated to give us much encouragement.

I have alluded to the Canadian Journal, and trust I may be pardoned for dwelling a moment upon the claims of that publication to our active and zealous support. The advantages of a ready medium of publication, its tendency to encourage the preparation of papers; to elicit, and to attract *as it were to itself*, by degrees, the information and knowledge which is afloat in the community, are so great that it may seem superfluous to insist upon them, but it may be scarcely less valuable, I conceive, as an index of the life that is in us; a criterion of the actual state of scientific knowledge in Upper Canada, and a permanent evidence of the widening basis, the expansive growth of those pursuits, which it is the object of this Institute to combine and strengthen. Let us hope, that while in the practical departments of the mechanic, the engineer and the architect, it witnesses the treatment of greater, more important, and more various subjects every year, as the industrial progress of the country will cause it to do; so also there may appear the necessity for such an improvement in the standard of the original and selected articles on scientific subjects, as may shew increasing strength, and a higher faculty, in that class of readers. It is greatly desirable at present that our individual endeavours be given to extend its circulation, and to put it upon a footing to yield some just remuneration for the editorial labour at present bestowed gratuitously upon it.

It is with great pleasure, Gentlemen, that I am permitted to announce that the Council has decided to offer two medals for competition in the session of 1853-4.

One medal of the value of £10, for the best comprehensive essay or paper on the Public Works of Canada, their commercial value and relations to a general system of American Public Works; their characteristics in an engineering point of view, cost and other particulars, to be illustrated by all necessary maps, plans, or drawings.

And, one medal of the value of £10, for the best essay or paper upon the physical formation, climate, soil, and natural productions of Upper Canada, to be also illustrated by all necessary maps or diagrams.

The amalgamation of the Toronto Athenæum with this Society, a subject referred to in the Annual Report of the Council, promises, I am most gratified to be enabled to state, to be speedily carried into effect. It will give us the advantage of the Library, which that institution owes in great measure to the persevering and indefatigable exertions of its most efficient Secretary, Mr. S. Thompson, and remove all appearance of rivalry or division of forces in a cause in which all should combine.

It would be doing an injustice to this Society were I to omit, on this occasion, to mention, on any false grounds of delicacy, a circumstance which cannot be regarded as unimportant, in reference to the progress of the physical sciences in Canada. I allude to the intention, officially expressed by the authorities under whom I have the honour to be employed here, of withdrawing at an early period the military detachment by which a series of observations in Magnetism and Meteorology has been maintained in this neighbourhood, since the year 1840. Naturally deeply interested in the continuance of enquiries which have absorbed the best years of my own life, and in whatever can bring credit to a country to which I am bound by very strong ties, I *cannot but hope that means may be devised* in the Colony for maintaining a Physical Observatory at Toronto, upon a scale fully adequate to the continued investigation of the numerous and interesting subjects of enquiry, which it has hitherto cultivated; and with such additions as in abler hands may make it an honour to the country. It is not for me, on the point of resuming a purely military position, to concern myself unduly in a civil and colonial question; but, neither, on the other hand, is it for me, in the office to which you have been pleased to call me, to neglect to call your attention to a question in which the public opinion will probably have its due weight, and to which the Canadian Institute, as a body, cannot be indifferent.

I have now, Gentlemen, trespassed sufficiently long upon your patience. This Society has a dignified, an honourable and a patriotic object before it; the field is wide, and ready for the harvest; if the labourers are still few, and if much of that knowledge, contingent upon a thousand advantages never as yet brought within our reach, which alone can truly appreciate or encourage their exertions, is at a low point among us, let us not doubt that it will gain ground with rapidity, and receive new impulses, and new rewards, from every endeavour we make to carry into effect the objects of our incorporation. The talent and the energies which can overcome disadvantages, can unquestionably be looked for as confidently in our body, as in any similar society. I think it might be said, are as unquestionably present—but this will be best shewn by the event. With harmony and mutual respect among ourselves; with a liberal disposition, as a body, to encourage whatever may justly claim our countenance, and as individuals to listen to whatever has a just claim to respectful attention, although, as will often happen, the subject may be of little interest, perhaps scarcely intelligible, to ourselves; we shall see the Canadian Institute more respected, because more useful, every year, and have the reward of witnessing our society, grow with the growth, and strengthen with the strength, of a country whose progress in every element of material prosperity, will bear comparison favourably with that of any other in the world.

On the Rocks of Canada: by W. E. Logan, F.R.S., and G.S., Director of the Geological Survey.

(*Communicated to the Geological Section of the British Association, at the Meeting at Ipswich in 1851, and ordered to be printed in full in the Report.*)

In the present paper it is my purpose to place before the Association, in as condensed a form as possible, one or two of the main features of the physical structure of Canada, ascertained in the progress of the geological survey now carried on in the country, under my direction, by the authority of the provincial government.

With the exception of the drift, the country is composed of rocks, none of which are newer than the carboniferous epoch. The general geographical distribution of these rocks, as far as ascertained, and as connected with the physical structure of the bordering States of the American Union, on the one hand, and the sister British Provinces on the other, is represented on the map which is displayed to view.

One of the points to which it is my wish to draw attention is the age of the copper-bearing rocks of Lakes Superior and Huron, as determined by the evidences collected on the Canadian survey; and another, the differences that exist in the structural condition of the western and eastern parts of the Province.

The rocks on the north shore of Lake Superior consist of reddish granite and syenite, which in ascending order pass into micaceous and hornblendic gneiss and allied forms. These are succeeded by chloritic and partially talcose slates, which become interstratified with obscure conglomerates, with a slaty base; and upon them rest unconformably bluish slates, with intermingled bands of chert and limestone towards the bottom, and a thick and extensive overflow of greenstone trap at the top. Reposing on these are white sandstones, which pass by an alternation of colours into red sandstones and conglomerates, often with jasper pebbles, and these are repeated after the occurrence of an uncertain amount of reddish limestone of an argillaceous quality. The sandstones and conglomerates become interstratified with amygdaloidal trap layers, and an enormous amount of volcanic overthrow divided into beds crowns the summit. The sandstones are often argillaceous, and display ripple-mark and crack casts on their surfaces, while the concentric curves of flow sometimes characterize those of the trap. Innumerable dykes cut up the sedimentary and volcanic beds; and both the dykes and the overflows are almost universally marked by a transverse columnar structure. The thickness of the whole from the base of the blue slates cannot be less than 12,000 feet; and the whole formation is intersected by copper lodes of different characters in different places, which run in directions both with and transverse to the strike.

On the north shore of Lake Huron the granite is succeeded by a formation consisting of white, often vitreous sandstone or quartz rock of great thickness, sometimes passing into a beautiful jasper conglomerate, and alternating with great beds of slate and bands of conglomerate with a slaty base, both being interstratified with thick masses of greenstone. A persistent band of limestone of about 150 feet in thickness, and interstratified with thin cherty layers, occupies a place in the series, probably somewhere about the middle. The surfaces of the sandstone often exhibit ripple-mark; and the total thickness of all the members of the formation may be about 10,000 feet. Different intrusive rocks intersect those of stratification; and, as related to one another, they display a succession of events in the history of the formation. There is of course a set of dykes,—greenstone, no doubt,—cutting the sedimentary rocks, and giving origin to the greenstone overflows. It is difficult, however, to identify these; but another set of greenstone dykes are seen cutting both the sedimentary and igneous strata; intrusive granite, sometimes occupying considerable areas, thrusts these antecedents aside, sending forth dykes of its own order, intersecting all, and reaching to considerable distances from the nuclei; and then another set of greenstone dykes, and all that previous causes had placed. Evidences of disturbances and dislocations accompany all these successive intrusions,—those connected with the granite being the most violent. But there is, in addition, another set of disturbances of still posterior date, and it is to these that is due the presence of those metalliferous veins which give the country its value as a mineral region.

In respect to the age of the Huron cupriferous formation, the evidence afforded by the facts collected by my friend and associate, Mr. Murray, (published in our Report of Progress for 1847-48,) on the Grand Manitoulin, La Cloche, Snake, Thessalon, Sulphur, and other Islands, points ranging along a line ninety miles out in front of the coast, is clear, satisfactory, and indisputably conclusive. On these Islands, the Potsdam sandstone, the Trenton limestone, the Utica slates, and the Loraine shales,—successive formations in the lowest fossiliferous group of North America, were each, in one place or another, found in exposures denuded of all vegetation, resting in uncomformable repose, in a nearly horizontal position, upon the tilted beds and undulating surface of the quartz rock and its strata: filling up valleys; overtopping mountains; and concealing every vestige of dykes and copper veins; and it would appear that some of these mountains have required the accumulation of the whole thickness of the lowest three and part of the fourth fossiliferous deposit, equal to about 700 feet, to bury their summits.

The chief difference in the copper-bearing rocks of Lakes Huron and Superior seems to be the great amount of amygdaloidal trap present among the latter, and of white quartz sandstone among the former. But on the Canadian side of Lake Superior there are considerable areas without amygdaloid, while white sandstone are present in others, as on the south side of Thunder Bay, though not in the same vast amount or the same state of vitrification as those of Huron. But, notwithstanding these differences, there are strong points of resemblance in the interstratification of igneous rocks, and the general mineralized condition of the whole, as to render their proximate equivalence highly probable; and the conclusive evidence given of the age of the Huron would thus appear to settle that of the Lake Superior rocks in the position given to them by Dr. Houghton, the late State Geologist of Michigan, as beneath the lowest known American fossiliferous deposits; and in this sequence those of Lake Huron, if not those of Superior, would appear to be contemporaneous with the Cambrian series of the British Isles.

The eastern limit of this formation on Lake Huron is in the vicinity of Colling's Inlet, opposite the eastern extremity of the Great Manitoulin Island, whence it gradually recedes inland, taking a north-eastern course; and farther down the St. Lawrence and its lakes the Lower Silurian appear to rest upon gneissoid rocks, without the intervention of the Cambrian.

If a line be drawn on the map in continuation of the Hudson River and Lake Champlain valleys to the vicinity of Portneuf, about thirty miles above Quebec, and thence in a north-eastward direction, it will divide the country into two areas; which, though nearly resembling one another in the general formations of which they are composed, yet present important differences in their structural condition. Each area belongs to a great trough of fossiliferous strata resting in Canada, with the exception of the supporting Cambrian formation of Lakes Huron and Superior, on gneissoid rocks, and containing coal measures in the centre; and the conditions, in which the two areas differ, are the general quiescence and conformable sequence of the formations from the base of the Lower Silurian upwards in the western, and the violent contortions and unconformable relations of those of the eastern. The coal measures of the eastern area are those of Rhode Island, and in a metamorphic state of Massachusetts, and those of Nova Scotia and New Brunswick. None of the productive part of the New Brunswick coal measures reaches Canada; but there comes out from beneath it, on the Canada side of the Bay Chaleur, 3000 feet of carboniferous red sandstones and conglomerates. These are succeeded by 7000 feet of Devonian sandstones. which rest upon 2000 feet of Upper Silurian rocks, consisting of limestones and slates. The base of the Upper Silurian group has been traced a distance of about 700 miles from Gaspè on the Gulf of St. Lawrence, first to Memphramagog Lake in Canada, thence to Halifax on the southern limit of Vermont, and further into Massachusetts, keeping in its outcrop at a variable distance from the coal. In the interval, between the Upper Silurian and the carboniferous formations, there can be little doubt the Devonian sandstones will display a conspicuous figure in the eastern area, as they are known to be still 2500 feet thick in the eastern portion of the western area, in which they do not die away until reaching the banks of the Mississippi. In the eastern area the Lower Silurian strata sweep round the Upper, occupying a zone of between 40 and 50 miles broad; and the lowest rock common to both, connecting the troughs on the anticlinal, in the valley of Lake Champlain, is the Trenton limestone.

On the north-western side of the western area the formations are in a general flat and quiescent condition from Lake Superior to Pennsylvania, and they succeed one another without any observed want of conformity from the base of the Lower Silurian to the summit of the carboniferous. But it has been shown by Professor Rogers, that proceeding from north-west to south-east there occurs in this state a set of successive parallel undulations which increase in intensity in the direction mentioned, and on the south-east side of the Apalachian coal-field are sufficiently violent to produce overturn dips in all the formations together, the coal inclusive. These plications with their overturn dips thus form the south eastern rim of the western area, and are distinctly traceable by the Alpalachian chain through Vermont into Canada, and through Canada to the Gulf of St. Lawrence; in this part constituting the north-western rim of the eastern area. But while in the western division there is no want of conformity from the Lower Silurian rocks to the carboniferous, and the plications there appear to be of a date subsequent to the carboniferous deposit, in the eastern there are evidences of a want of conformity between the Upper and Lower Silurian formations; and though the folds in the former do not seem quite so violent, they are in parallel directions with those in the latter. There is another and a greater want of conformity between the Devonian rocks and the carboniferous. A large portion of the carboniferous deposit of New Brunswick shows but very moderate dips, and on the shores of Bay Chaleur it lies in a quiescent condition on the tilted edges of the lower formations, sometimes resting on one and sometimes on another. Its north-western outcrop, however, or rather, I should say, the longitudinal axis of the whole coal-field from New Brunswick to Newfoundland, has a parallelism with the folds of the inferior rocks, and there are several parallel undulations in nearly the same direction on the south side of the carboniferous deposit.

The conclusion to be drawn from these facts appears to be, that some cause, producing folds in the stratification in one general direction, has been in operation from at least the cessation of the Lower Silurian epoch to the termination of the carboniferous; and it only requires the inspection of a map of Atlantic America to observe how the features of its physical geography, displayed in the configuration of its coast, in its valleys of undulations and those of transverse fracture, are almost entirely dependent on the results of this cause.

The fossiliferous rocks of both these divisions, with the exception of that part supported by the Cambrian formations of Lakes Superior and Huron, rest, along the valleys of the St. Lawrence and the Ottawa, upon a series consisting of micaceous and hornblendic gneiss, interstratified towards the south with great bands of crystalline limestone, sometimes highly charged with magnesia and associated with vast masses of magnetic iron ore, but without calcareous beds on the north. These rocks constitute a part of the low granitic ridge, which to the westward has been traced by Sir J. Richardson as extending with a north-westerly curve to the Arctic Ocean.

The Canadian rocks on the north side of this granitic ridge, as displayed toward the head of Lake Temiscamang, consist, in ascending order, of chloritic slates and conglomerates, with a slaty matrix; the volume of these is probably not less and may be much more than 1000 feet. On them rests a set of massive pale greenish-white or sea-green sandstones, the total amount of which, as determined by the height of hills which they compose in nearly horizontal layers, is between 400 and 500 feet. These are succeeded by about 300 feet of buff and whitish fossiliferous limestones, the lowest bed of which is composed of a collection of great boulders and blocks of sandstone, some of them nine feet in diameter, that were lying immediately on the strata from which they were derived when they became covered up, and in which great cracks and worn fissures are filled with the calcareous deposit that envelopes the whole. The sandstones being without discovered fossils, it is not easy to determine their age; but the limestones by their organic contents are distinctly shown to belong to the Upper Silurian epoch. The Lower Silurian deposits, unless the unfossiliferous sandstones be a member of the group, appear to be wholly wanting in the locality, and as all the forms brought from other localities on the north side of the granitic ridge by Bigsby, Richardson, and others, are, I believe, referable to Upper Silurian types, it appears not improbable that the absence of the Lower Silurian rocks may spread over an extensive area, and the south side of the ridge indicate an ancient limit to a Lower Silurian sea.

The nearest locality of the well-defined forms which inhabited this sea is at the island of Allumette, about 200 miles southward from the Upper Silurian rocks of Lake Temiscamang; there is, however, a patch of the same lower formation which is only about 100 miles southward from them, but in it the fossils are obscure. Instead of giving any remarks of my own on the fossils of the two sides of the granitic ridge, I shall append to my paper a note which my friend Mr. Salter, of the Geological Survey of the United Kingdom, has been so kind as to make on them after a careful inspection, only stating that the specimens which have been examined are but a small part of an important collection, chiefly from the eastern of the two divisions that have been alluded to, brought from Canada for comparison, and that twice as many specimens as have been brought remain in the Province from other parts, while great additions it is hoped will annually be made to them.

Louisburg, Cape Breton.

BY S. J. STRATFORD, M.R.C.S., ENG., TORONTO.

During the last summer, in a tour to our noble Eastern Provinces, fortune led my steps to explore the remains of the ancient city of Louisburg; and I was forcibly struck with the spectacle of lonely desolation which it now presents. The remains, however, of the extensive fortifications which are presented in every direction, plainly bespeak the former strength and importance of this maritime capital of La Nouvelle France. As the sudden destruction of a place so celebrated was a most unusual occurrence in the New World, I was naturally led to enquire into its history, and to collect material on the spot that should explain it; but as this, though replete with thrilling incidents, would be too extensive for the *Canadian Journal*, I must be content at present to offer but a few observations on the celebrated city, which appears to have been almost totally forgotten in Canada.

The town of Louisburg was situated upon the neck of land which jets out into the sea, westward of the islands which form the mouth of the harbour; was of an oblong figure and nearly two miles in circumference. It was fortified in a most scientific manner; while powerful batteries were built at all the most commanding points that could defend the entrance of the harbour.

The streets of the city were wide, and ran at right angles; the houses were principally constructed of wood, built upon stone foundations; but the public buildings were of more durable materials, stone or brick. The public buildings situated in the town were of an extensive character, and principally for religious purposes. There was the fine hospital of St. Jean de Dieu, to which was connected a church, dignified by the title of a Cathedral,—a really elegant and spacious structure; besides these there was an extensive nunnery; and a by no means insignificant theatre. There were several gates in the different parts of the town; and on the north-east side was a spacious quay, where they had constructed a kind of bridge, called in the French language *Les Calles*, or wharves, which projected considerably into the sea, and were extremely convenient for loading and unloading goods. At this point there was a chain boom which extended in front of the quay, within which the ships were placed, and effectually prevented them being cut out by an enemy on a sudden attack. The fortifications consisted of two bastions, called the King and Queen; and two demi-bastions, distinguished by the names of Dauphin and Princess. The city was surrounded with a rampart of stone nearly three miles in extent; from thirty to thirty-five feet high; and a ditch of eighty feet wide, with the exception of two hundred yards near the sea, which was enclosed by a dyke and a line of pickets. At this place the sea was very shallow, and numerous reefs rendered it inaccessible to shipping, while it received an additional protection from the side fire of the batteries. The bastions were mounted with eight batteries, containing embrasures for 148 pieces of cannon; and there were sixteen mortars. The centre of one of them, the King's bastion, was occupied with a stone building, with a moat on the side towards the town. This was called the citadel, though it had neither artillery or a structure suitable to receive any. Within this building were the apartments for the governor, the barracks for the soldiers, and the arsenal. Under the platform of the redoubt was a magazine, well furnished with military stores. The parish church also stood within the citadel; and beside it there was a handsome parade ground. The entrance to the town was by the west gate, over a draw-bridge, near which was the Dauphin bastion, with a circular battery mounting sixteen guns, all fourteen-pounders. Adjacent to this battery had been erected spacious casernes or bombproof barracks, the remains of which are still to be found among the ruins of the city, and form objects of great curiosity for the inspection of the tourist.

The entrance of the harbour of Louisburg was defended by a battery almost level with the water, situated upon one of the islands that form its mouth. This was called the Island Battery, and was mounted with thirty-six pieces of cannon, all of which were twenty-four pounders. There was a battery situated at a mile and a half from the town opposite the mouth of the harbour. This was a very strongly built fortress, surrounded by a ditch, and flanked by two redoubts. It was mounted by thirty pieces of cannon, twenty-eight of which were thirty-six-pounders, and two eighteen-pound carronades. The remains of this battery are still obvious at the present day; and from their extent must have contained a barrack and a considerable magazine. From the quantity of cut-stone lying about, it is clear that it was a well-built fortress; and from its position it must have completely commanded the whole harbour, as well as have greatly aided in defending its entrance. At the Light-house Point there was a third powerful battery, where, from its high and commanding situation, elevated far above the Island Battery, it commanded not only that, but the town and the western part of the harbour, and was a great defence to its mouth. There was a Circular Battery, mounted with twenty guns, situated on the beach east of the town; and forming part of the fortifications which surrounded the city, was cavilier, pierced with twelve embrasures, called by the name of Marapas, which was also intended to strengthen the defences of the harbour. All around the coast without the harbour of Louisburg, the shore is everywhere bounded by bold and rocky precipices, whose breakers for the most part defy an hostile landing; but in every nook or creek where it was possible to run in a boat, we find that the French had erected defences, the remains of which are still sufficiently obvious at the present day.

Thus strongly fortified from an attack by sea, the city of Louisburg was still vulnerable from the land side. The high land which everywhere surrounded the harbour offered a means of attack upon any one of the principal batteries, provided the opposing force could obtain possession of it: thus flanked, the city could not be permanently defended. It would seem that the French engineers, in their operations, confided greatly in the rocky and inaccessible condition of the country in the rear of Louisburg, to strengthen their defences, and thought that if they could only guard the harbour's mouth from a naval attack, that the town was secure from the apparently impenetrable character of the country. Experience, however, fully proved the fallacy of that confidence, and was the eventual cause of the destruction of their defences.

The building of these extensive fortifications, and the other public works, necessarily employed many hands, and took many years for its accomplishment; it necessarily caused the arrival of many emigrants—artificers as well as labourers; that ere these works were finished, the city of Louisburg contained quite a respectable number of inhabitants; these, with the floating population employed in very extensive fisheries, a considerable coasting trade, and a large military establishment necessary to defend these extensive fortifications, there is little doubt that Louisburg might have numbered a population of 30,000 inhabitants. That the city enclosed within the fortifications would positively have contained that amount of population there is probably a doubt; but when we survey the extent of the harbour, and observe the numerous ruins along its shore, we shall cease to be sceptical of this fact. In one place we find the evident remains of an extensive brewery; in another of a considerable tannery; while the establishments for curing fish were certainly very numerous. And if we recollect that upwards of 500 vessels were employed in the taking of fish, we shall be convinced that the hands necessary to conduct such establishments must have been very numerous; and if we add to these the careening wharves and other places for the repair of shipping, with their various artificers; we certainly think that this calculation of the number of its inhabitants could not possibly have been very much over the mark.

The trade of the city of Louisburg during all this period must have been very considerable, as all the necessaries of life had to be imported by sea. The rocky and sterile country in the immediate vicinity of Louisburg harbour, without a very high state of cultivation, was perfectly unable to produce food for such an extensive amount of population as we have indicated; while the almost total want of settlement at this period in the other parts of the Island of Cape Breton, more adapted to agriculture, could not have been able to supply the deficiency; consequently the inhabitants were obliged to look to Canada and France for their supplies. In order to supply this deficiency, agricultural establishments were formed upon Isle St. John, or Prince Edward's Island, in the Gulf of St. Lawrence, which even at this early period had attracted the attention of the French, and was fully able with but slight development to supply the military establishments of Cape Breton; and for this purpose the Island was most strenuously guarded by the French government. The mere conveyance of the necessaries of life for so large a population must have required a considerable number of vessels; but when we find that all the materials of every description employed for building had to be transported in vessels from distant parts; that the stone, the brick, the timber the lime, and even the sand, had to be conveyed either from Canada, France, or the West Indies, our surprise that so large a fleet was employed in the commerce of Louisburg must cease. The necessity to transport all these materials by sea was dependent on the deficiencies of development and want of knowledge of the country, rather than on any lack of such material in the Island of Cape Breton. Later investigation clearly proves that building materials of every description abound in the Island, and at no very great distance from the harbour of Louisburg; even had the different localities where these various materials abound been discovered, the want of proper roads on which to transport them would, in all probability, have prevented their being used.

In the simple article of sand, which invariably abounds upon the sea shore, experience proved had to be conveyed to Louisburg. The character of the mortar which is found among the ruins of the fortifications is sufficient evidence of the difficulty under which the engineers laboured for proper sand as a building material. The simple fact is, that in every instance in which the sea-shore sand was used the works speedily mouldered away and fell down, especially after they had been submitted to the action of the frost during winter. Mortar used in building is a silicate of lime; and when a large quantity of the chloride of sodium always found in the sea-shore sand is combined with it, the proper combination of silica and lime is impeded, and instead of becoming the hard durable material which characterizes proper mortar, it is friable, and easily disintegrated with the least moisture, depending in all probability on the chloride of calcium formed in the mixture. It is certain that after the engineers employed on the works of Louisburg had discovered their mistake, there existed a vast difficulty in remedying the defect, and of procuring sand free from salt. The whole Island of Cape Breton is surrounded and greatly indented by the sea; while all its inland parts were then totally inaccessible for want of roads, so that proper sand could not be procured nearer than Canada or the West Indies.

The greater part of the cut-stone with which the fortifications and other public edifices were built, had evidently from its character been imported from a distance ; but the rough material extensively employed in the erection of the fortifications was clearly obtained from the neighbouring rocks; and immense quantities of such stone may be seen lying about in every direction, evidently quarried from the surrounding rocks: this had apparently been prepared for the extension or repair of the works.

The lime-stone and brick were also brought to the place: the lime-stone apparently from the West Indies, as we found numerous pieces containing corralines lying about in several places. The lime-stone was burned in a kiln situated upon the sea beach, and must have made excellent lime. The bricks were apparently brought from France. These articles in themselves would have rendered a large amount of shipping necessary in the conveyance of such bulky material, and certainly must have constituted a considerable branch of commerce.

The advantageous position of Louisburg, placed in the midst of the most productive fisheries in the world, would naturally have added vastly to its commerce. That there were at this time very numerous establishments for curing of fish in the harbour is evident from the ruins everywhere scattered about; and when it is shown that upwards of 500 vessels, of about 150 tons, were employed in catching fish, requiring a complement of over 10,000 men, it is evident that this business must have been very extensively carried on. It is affirmed that 5,800,000 quintals, of 112lb. each, of cured cod alone, were annually exported from Louisburg; and when we come to add the herring, mackerel, and salmon, with the seal and whale oil, we shall not be supposed to exaggerate the extent and importance of the commerce carried on at this time. Six hundred square rigged vessels, and many coasting craft, were necessary to do the business which all these different wants and services required; while the imposts and other duties accruing from this commerce, brought in an annual income to the French crown of upwards of a million and a half of livres.

As a striking instance of the vast amount of commerce carried on in the city of Louisburg, we find it stated that a M. Maillet de Granville, who had left France extremely poor, at the age of sixteen, had, by industry and application to business, advanced himself in the world so as to be able to purchase the lordship of *Mount St. Louis, which cost him 80,000 livres; and that at the* taking of Louisburg he lost property to the value of one hundred and fifty millions of livres, and was thereby left perfectly destitute.

From the above detail, also, it must be clearly evident that the erection of the extensive defences of the city of Louisbourg must have been built at enormous expense to the French nation, when all the materials, all the artizans, and even all the provisions consumed had to be brought from a distance, and that, sometimes, during a period of war. It is certain that upwards of 30,000,000 of livres were expended upon these works; and after the capture of Louisburg, King Louis the Fourteenth is said to have exclaimed, that he should have expected to have found the very streets of Louisburg paved with silver, from the great and continued drain upon his treasury which the maintenance of this establishment cost him.

The city of Louisburg has twice fallen before the power of the British arms. In the first instance it was taken by Sir William Pepperall and the brave New England Colonists; and secondly by the forces under General Amherst, assisted by the gallant Wolfe; when, chiefly at the instigation of the inhabitants of the city of Halifax, the British government resolved to destroy it; but even this operation is said to have taken upwards of a year, and to have cost £10,000.

The city of Halifax has always been jealous of the splendid and capacious harbour of Louisburg, and has invariably instigated the government to prevent its redevelopment; but situated 200 miles nearer to Europe than Halifax, it is pre-eminently the spot at which all the railroads on the American continent must terminate. Suppose, for example, two steam-ships coming from the eastward, off the harbour of Louisburg, (to which point they must come as a matter of necessity,) the one landing its passengers at this point, and dispatching them by railroad; while the other goes to Halifax, then forwards her's by similar means to Petticodiac, in New Brunswick, where all the railroads must meet: those sent from Louisburg will arrive full a day in advance of those dispatched from Halifax, and not have to go full one hundred miles out of their way to arrive at it. This fact, and the certainty of being able to cross the Gut of Canso—scarcely a mile wide, with a railway train at all seasons of the year—will again restore the city of Louisburg to the importance which its peculiar and favoured position unquestionably assigns to it; for, placed at the mouth of the Gulf of St. Lawrence, and at the north-eastern extremity of this portion of the American continent, steam-vessels destined either for Canada or the United States may here call for coal—of which there is abundance in the immediate neighbourhood—or land their passengers, to proceed by rail to any part of the American continent, without going a mile ont of their way.

At a subsequent period, should it be judged worthy of consideration, I shall willingly detail the present condition of the harbour of Louisburg, *especially the ruins of the ancient city*, and point out from its favoured position its applicability, not only to be the chief railway station upon the American continent, but the point of communication for the great Atlantic magnetic telegraph; for the chief mart of the great fisheries in its neighbourhood ; and, pre-eminently, for the best location for a great *watering place for the valetudinarian, to be found upon this* continent.

Davis's Report on the Nautical Almanac.*

Our readers may not be aware that the American Nautical Almanac, established by Congress some three years since, and placed under the supervision of the Navy Department, is already so far advanced, under the able superintendence of Lieut. C. H. Davis, that a few weeks will witness the appearance of the first volume, computed for the year 1855. The ability and position of the gentlemen charged with the execution of the work, affords the best reason for expecting a publication which shall materially add to the scientific reputation of our country.

The attention of our legislators has recently been recalled to the subject by a series of most singular resolutions offered in the United States Senate by a distinguished member of that body, whose philanthropy is evidently more enlarged than his astronomy. The resolutions of inquiry, with the answers appended to each by Lieut. Davis, were as follows:—

1. *That the Secretary of the Navy be instructed to inform the Senate where, and at what observatory, the observations and calculations for the "Nautical Almanac" are made.*

This inquiry comprises several distinct interrogatories, which, with your permission, I will answer separately.

The calculations of the Nautical Almanac are made at no observatory, and have no direct connection with or dependence on the current duty of any particular observatory. The daily duties of observatories, and of offices like this of the "Nautical Almanac and Astronomical Ephemeris," are perfectly distinct from each other. The business of the observatory proper is to record events and appearances, and to make the calculations requisite to render these records immediately useful to the astronomer; it also endeavours to add to the sum of knowledge by the discovery of new facts, and the observation of new truths and phenomena, as exemplified by the frequent discovery of planets and comets, and the constant observation of those, the periods of which are still to be investigated; by the study of the nature of comets,—of the rings of Saturn,—of the comparative brightness of stars and planets, &c.

The business of the office of a "Nautical Almanac and Astronomical Ephemeris" is to *predict*, one or more years in advance, the events and phenomena, the actual occurrence of which the observatory records, and which the navigator compares, observes, and calculates, while on the otherwise pathless sea, in order to pass in safety from country to country.

The calculations of the Nautical Almanac are made principally at Cambridge, the residence of the present superintendent, where the printing of the work can be conducted most expeditiously, most economically, and, what is still more important, most accurately: and where convenient reference can be had to the best scientific libraries of the country, an indispensable aid in laying the permanent foundation of a work of this magnitude and importance.

Bnt as the superintendent of the almanac has succeeded in engaging the limited services of some distinguished mathematicians and astronomers in other parts of the Union, a portion of the computations have been made elsewhere; for example: by Professor Winlock, of Kentucky; by Mr. Sears C. Walker, of Washington; by Professor Kendall, of Philadelphia; by Professor Smith, of the Wesleyan University, at Middletown; and by Miss Mitchell, of Nantucket.

The observations used by the Nautical Almanac, that is the observations on which the fundamental laws of the astronomical prediction are based, have not been made at one observatory, but at all observatories; not at one place, but at all places of correct and well-attested observation on the globe; not at one time, but in all times of authentic history.

2. *Why the same are not made at the National Observatory at Washington?*

Whenever, in the progress of theoretical information, or in consequence of entirely new discoveries, or for the purpose of anticipating the official publication of printed volumes, it has been occasionally desirable and expedient to have recourse to an observatory, the National Observatory at Washington is the *only one* to which the superintendent of the almanac has applied for information.

The superintendent of the National Observatory has been requested, for example, to make some meridian observations of stars of comparison, which were used in the reduction of those observations of the planet Mars which have been made during the last hundred years at the Greenwich observatory; to test by immediate observations the accuracy of the elements of the new planet Iris; to furnish from the records of the observatory certain information in anticipation of the next printed volume of the "Washington Observations;" and to direct the attention of the observers towards the new planets discovered since the year 1827, concerning which astronomical history supplies, of course, no information, and concerning which all our knowledge is to be gleaned from future observation.

But it is the printed and published transactions of this and other observatories, in which the observations, &c., are given to the world in their reduced and complete and final form, that are employed in the large computations of the almanac, and not the separate observations made at the various instruments from day to day, in the prosecution of a great scientific enterprise.

3. *What expenses are necessary therefor, except the pay of the superintendent?*

The pay of computers, the cost of publication, including composition, press-work, and correction; paper, books, &c., &c.; the expense of stereotyping; the printing of auxiliary tables for computation, of blanks, of instructions, and mathematical formulas and methods.

4. *What progress has been made towards making a Nautical Almanac?*

The first volume is nearly completed, and its printing far advanced. All the main and heavy computations are done.

5. *For how long a period the calculations of the first almanac are expected to extend?*

For a period of one year; the first number of the almanac will be published in the year 1852, for the year 1855.

6. *Whether it is necessary to the perfection of the Nautical Almanac to make observations at more than one observatory; and, if so, are they made at two observatories; and, if so, at what two?*

The reply to this question is partly comprised in the reply to the first question.

If all the established observatories in Europe and elsewhere published to the world the results of their labours in the same convenient, complete, and elegant form as the observatories at Washington and Greenwich, they would not be too numerous for the wants of those astronomers who devote their attention to the improvement of the theories of planetary motion. And it is from these *published* volumes, of whatever date, that the almanac derives its useful and serviceable facts and information.

* Silliman's Journal.

The "Washington Observations" of 1846 have supplied the mean places of what are called the "fundamental stars;" and this volume, together with subsequent observations at the same instruments, not yet printed, have enabled computers to employ a more exact measure of the sun's diameter.

For this and similar reasons, it has been correctly said that the National Observatory now contributes to the general sum of the requisite materials for making an almanac of our own.

7. *Whether any persons except the superintendent have been paid for services in preparing the "National Almanac;" and if so, how many, and what compensation have they received?*

A list of the computers and other persons employed in the office of the Nautical Almanac is hereunto annexed; and also a statement of the number of persons, except the superintendent, who have been paid for services in preparing the Nautical Almanac, and the compensation they have received up to the last payment.

8. *When is it expected that a Nautical Almanac will be prepared for publication?*

The reply to No. 8 is contained in that to No. 4. It is expected that the first volume will be ready for sale and distribution in about three or four months.

9. *What improvement, if any, is it expected the American Nautical Almanac, when published, will have over the English?*

The American Nautical Almanac has made improvements upon the English in the ephemeris of the moon, and that of most of the planets. It has rejected the lunar tables of Burckhardt and Damoiseau, now pronounced obsolete; and has constructed lunar tables for its own use, which embrace the corrections of Professor Airy, deduced from the lunar observations made at the Royal Observatory, Greenwich, from 1750 to 1830, and the corrections arising from the discovery of Hansen. It is only necessary to turn to the last published volumes of the Washington or Greenwich observatory to become acquainted with the errors and irregularities that abound in the ephemeris of the moon, very often extending to one-third of a minute of arc. The determination of the longitude at sea, however, by the method known as "the lunar observation," the only method employed in the common practice of navigators, where chronometers are wanting or are untrustworthy, or require verification or examination of their rates, depends essentially or intrinsically upon the accuracy of the moon's predicted place. Now, this error of one-third of a minute of arc involves an error of ten miles in the determination of a ship's longitude at sea.

The lunar tables, prepared in the office of the Nautical Almanac, reduce the average errors in the moon's place, as derived from the obsolete tables, and given in the British Astronomical Ephemeris, to one-third of their amount; and a distinguished gentleman of Philadelphia, Mr. Miers Fisher Longstreth, has since published an improvement of the lunar formula, which has probably reduced this remaining error by two-thirds. Mr. Longstreth's corrections have been embodied in the new tables of the almanac, and thus, owing to the genius and labours of Pierce, Longstreth, and other distinguished astronomers, the almanac has it now in its power to predict the moon's place in the heavens with a degree of precision far surpassing anything heretofore attained elsewhere. And the proof of this is at hand. Whilst the lunar tables were in the course of preparation, the Department, in a letter dated August 5, 1850, authorized the superintendent of the Nautical Almanac to publish his predictions and elements of the total eclipse of the following year, July 28, 1851, for the express purpose of testing the accuracy of the new tables, and of acquiring the means of other improvements; and on the 25th of August, 1850, the superintendent, by permission of the Department, communicated the predictions of his office to the American Association for the Advancement of Science, at that time in session at New Haven; he, at the same time, announced to the mathematical and physical section of that body, the preparation of the new lunar tables, and submitted to its criticism and approval the objects in view, and the mode in which they were to be accomplished. His communication is contained in the printed proceedings of the Association at that meeting.

The event proved highly satisfactory, by showing conclusively the superiority of the lunar tables now in use in the office of the American almanac.

For the prediction at Cambridge the British almanac was in error eighty-five seconds, and the American almanac only twenty seconds.

At Washington, the British almanac was in error for the beginning of the eclipse seventy-eight seconds, and for the end sixty-two seconds. The American almanac was in error for the beginning only thirteen seconds, and for the end only one second and a half.

The observations were made by Mr. Sears C. Walker, at Cambridge, and by Professor Hubbard and Mr. Fergusson (and communicated by Lieut. Maury) at Washington. Where the eclipse was total, and where, for this and other reasons, the test was more rigid and conclusive, the result was still more gratifying and decisive as to the superiority of our own lunar tables. The same tables of the moon are used in the French and Berlin almanacs as in the British; the errors, therefore, are the same. The errors exposed in this eclipse may give rise to an error of from fifteen to twenty miles in the determination of the longitude at sea by means of lunar distances, and to an uncertainty of twice that amount. The possibility of such an error, arising from this source, is removed in the American ephemeris.

It may be mentioned, among the benefits conferred by these lunar tables, that they bring into practical availability a large number of "moon culminations," as they are technically called, observed by the astronomers of the coast survey on the western coast of the United States, which have been hitherto lost. These observations are made on the land for the nice and accurate determination of geographical longitudes, and in that now difficult and extensive field of labour are of the highest importance: owing, however, to the imperfections in the tables, by means of which the place of the moon in her orbit is computed, no other observed "moon culminations" can be usefully applied than those which have been correspondingly observed elsewhere. That is, these "moon culminations," to be available, must be observed at the same date at two different places. In consequence of this necessity, some six hundred or more of the observations made in California and Oregon, to be found in the books of the coast survey, have been laid aside "for want of moon's places more reliable than the British Nautical Almanac can give us."—[Letter of A. D. Bache, superintendent United States Coast Survey, to the superintendent of the Nautical Almanac, Nov. 20, 1851.]

It was said that the ephemeris of the planets has been improved. The ephemeris of the planet Mercury will be derived, for the first time, from the new and elegant theory of M. Le Verrier.

In preparing the ephemeris of Venus, with that of Mars, the correctness of Lindenau's elements of the orbits of these planets, deduced from the Greenwich planetary observations from 1750 to 1830, by Mr. Hugh Breen, have been for the first time introduced. But some labour has been bestowed in combining the rough groupings of Mr. Breen in such a manner as to carry forward the corrections uninterruptedly; all his results have also been discussed anew, according to the method of least squares, and the work is left in such a form that the observations of all observatories, particularly those of Washington and Greenwich, on account of the complete form in which they are given to the world, can be used from year to year, for the continued improvement of the elements of the planets. The perfection of the places of these planets is the more important and valuable that they are used very constantly in lunar distances by the navigator, and their errors are highly magnified at the time they are best seen and most useful, by the greater relative change in their distances from the earth than in those of the other planets employed in this way.

In preparing the ephemeris of Jupiter and that of Saturn, as well as in those of the preceding planets, all the errors and alterations pointed out by Professor Airy in the introduction to the Greenwich Planetary Reductions, have been corrected and adopted and the tables of Bouvard and Lindenau have been entirely remodelled and reconstructed for the convenience of computation. But it is well known to astronomers that the theory of Jupiter and Saturn demands a thorough revision; and their combination presents a case of peculiar difficulty, which has been ably treated by Professor Hansen. To prepare Hansen's theory for use in practical computation, is a work of time. It will be entered upon immediately, and will probably be completed in the course of two years.

In the case of Uranus, there are no tables which can be relied upon. Professor Pierce's theory, combined with the researches of LeVerrier, will, for the first time, form the basis of the new ephemeris of Uranus.

With regard to the new planet Neptune, the world has already accepted with grateful acknowledgments the labours which American astronomers have conferred upon it with illustrious success. The computation of the tables of the perturbations of Neptune, by Professor Pierce, and the computation of the elliptic elements of Neptune, by Mr. Sears C. Walker, have resulted in the preparation of an ephemeris, by the last named gentleman, which admits of no sensible correction.

The ephemeris of the fixed stars has also been improved by the introduction of the latest and most approved constants of precision, nutation, and aberration.

The general list of occultations has been very much extended, in order to make it especially useful to geographers in general, the boundary and other surveyors of the government in the interior, to the coast survey of the United States on both oceans, and the explorers of unknown parts of the continent.

Other changes regarded as improvements might be recited. The astronomical part of the ephemeris has been adapted to the meridian of Washington; siderial dates have been introduced; what is believed to be a more correct obliquity of the ecliptic has been adopted; and more convenient forms and a better typographical execution are kept in view. A work comprising such a multiplicity of details may admit of many similar amendments.

To the above it should be added, that an entirely new reduction has been made of the early Greenwich observations of Mars, by Bradley, Bliss, and Maskelyne, preparatory to a new theory and to new tables of this planet.

A new method, with new tables, of clearing lunar distances will be given in the first number of the almanac, in which improvements are presented leading to the correction of errors of ten, fifteen, or twenty minutes in the longitude, common to the methods at present in use; which errors may, in rare cases, amount to a whole degree.

There are two other signal advantages to be derived from the publication of the Nautical Almanac, the mention of which should not be omitted: they concern the navigator, surveyor, astronomer and geographer.

One of these is a more complete, full, and accurate table of latitudes and longitudes, particularly of American latitudes and longitudes, than is now anywhere to be found.

These positions also embrace in their number the most conspicuous towns and trigonometrical stations, with their magnetic and astronomical bearings, along both sea coasts, and as far in the interior as the operations of the coast survey extend. When, therefore, the American surveyor or astronomer of a boundary commission opens the almanac for the requisite astronomical data of his observations, he may find also such terrestrial data as will answer for the proper basis of his field work, and at the same time as the standard of accuracy to his own independent computations. To meet his wants, some additional constants will be occasionally inserted,—as height of station above the sea, mean barometric pressure, variation of the needle, &c. And as a separate list of the latitudes and longitudes of the principal observatories of this country and in every quarter of the globe is a customary part of the almanac, so the stationary astronomer will, in turn, find his purposes served. An assistant is employed in verifying the positions in the world generally, given in the best European lists; and a suitable selection will be made from the determinations of the offices of hydrography, topography, and the coast survey, to enrich the American table with the best and most numerous list of American geographical positions extant.

Similar tables are published in the French almanac; but no such tables, with the exception of the observatories, are given in the British. This, therefore, is regarded as another improvement in the American almanac upon the latter.

The other signal advantage spoken of, relates to the subject of the tides. The conduct of a general system of tidal observations, their reduction, and their scientific discussion, by which is evolved the rules for the prediction of the tides, are all the property of the hydrographical and astronomical departments of the coast survey. But it is the province of the Nautical Almanac to present the results of these various labours in a manner suited to answer the practical demands of navigation and engineering.

It will not perhaps be irrelevant to cite a single case under the general problem of the tides. In order to be able to give rules practically useful to the pilot, engineer and seaman, for applying to the ordinary tides, corrections depending on the moon's varying distance and declination, it is necessary to know to what meridian passage, or southing of the moon the tide is due; or, what the distance is from the land of the general tide wave that causes the local tide which the observer is actually registering; or, in fine, what is the age of the tide when it arrives at any particular part of our coast. This knowledge is the result of the careful study of a large number of observations made at various points. The age of the tide at London differs from that at Key West; and that of Key West again from that of New York, or Hampton Roads.

Our exclusive dependence upon European authority for that knowledge of our coasts which no European authority can, from the nature of the case, supply, has been a disadvantage and a reproach. Both the disadvantage and the reproach the American Nautical Almanac will help to remove by making use, as it has been authorized to do, of the materials in the records of the coast survey, for furnishing a tide table founded on the actual observations of tides in our own northern and southern harbours, and their subsequent reduction and discussion in the office of that institution.

One consequence of the announcement of the preparation of the American Nautical Almanac, may be noticed here. It has reduced the price of the British Almanac by one-half, that is from 5s. to 2s. 6d.

The Counter effect of a restoration of the British monopoly in the American market will probably be a return to the former price.

10. *Is it expected that any errors of former astronomers or observers, are to be corrected, or any new means suggested by which more precision is to be given to astronomical science?*

This inquiry is, for the most part, answered in the reply to the preceding question.

11. *After the first Nautical Almanac is published, will the succeeding numbers probably cost as much, or more than the first?*

After the first volume of the Nautical Almanac is published, it is estimated that the sum of $19,400 will be the probable cost of the succeeding volumes; and this sum is not more than sufficient to allow the first class computors, who must be gentlemen of liberal education and of special attainments in the science of astronomy, the lowest salary paid for similar services in other offices of the Government. The annual estimate for the British Almanac is between sixteen and seventeen thousand dollars; but, generally speaking, intellectual labor commands a higher compensation in this country than in Great Britain.

A portion of the appropriation will be returned into the treasury every year when the sale of the book commences. The cost of the first number includes the expense of the various works of preparation already detailed. These preparatory productions are permanently useful; they are the instruments to be employed in the computation of all future numbers. If the American Almanac should be continued uninterruptedly for as long a period as the British has existed, the cost of preparation, thus distributed, would amount to about two hundred and twenty-two dollars a number.

12. *Will the same time be necessary for the second and subsequent numbers, respectively as for the first?*

The succeeding numbers of the Almanac will appear annually, three years in advance of the year for which they are computed, according to the custom in England, France and Germany. The time spent in the computation of each number will be one year.

Finally, in reply to this resolution in general, let it be said that the *Nautical Almanac and Astronomical Ephemeris* is not a work of insignificant value, or of trifling labour. It has been viewed by the Department, and is considered by American astronomers and mathematicians as a work of consummate utility and of real national importance, resembling in this respect the *Nautical Almanac and Astronomical Ephemeris* of Great Britain, the *Connaissance des Temps* of France, and the *Astronomical Annual* of Prussia.

On one hand, it is the text-book of the navigator. It informs him of his place on the ocean, where there are no other guides than the sun and stars. It is his intellectual rudder and compass; without it no ship-master leaves the shores of the United States. When he loses sight of the last light-house or head-land, he turns to that for his further directions.

On the other hand, it is the *vade mecum* of the astronomer, whether stationary or travelling. He learns from in the fixed observatory how his instruments must be set that he may see any particular body, and what is the precise moment for observation: and in the moveable observatory he turns to its pages to ascertain how, on any given day, he can best determine his latitude and longitude, the astronomical bearings of his stations, and the rate and error of his chronometer. Thus, as the tables of the Almanac owe their origin to the labours of their observations, so, they repay the obligation by affording the most ready and complete facilities by which those labours are, at the present time safely and expeditiously conducted.

The Ancient Miners of Lake Superior; by C. Whittlesy.*

(Concluded.)

If copper utensils had been common among the Indians, they would have been preserved, and handed down to our times, or at least to the times of the Jesuits; for, before then, they had no iron or steel, and no metal but copper. If they had the ingenuity and skill, which has been claimed for them in providing themselves with implements, they would have manufactured something like an axe, as the Aztecs did, and would never have lost the use of it. As the Jesuits mention only stone axes, and say, that the Indians had neither hatchets or kettles, I conclude that "Loons Foot" is mistaken, when he asserts that they had copper axes. I will now give some reasons for ascribing the working of these ancient mines to the *Aztecs* or "mound builders."

The character of the mining works, is that of a people, having about the same advancement and intelligence as is exhibited in the construction of the earth-works and fortifications that are visible throughout the west. There is in neither, any evidence that they had iron or steel, or the art of hardening copper, as the Egyptians had. In the mounds, and in contact with the skeletons that were interred at their base, are found copper ornaments, axes, and tools, of great variety and in great numbers. They are all fully described in the work of *Squier* and *Davis*, to which I have referred.

The copper is apparently *cold wrought*, and does not show that it has been melted. It must, therefore, have been found by the mound-builders in its native state, and there are no mines in North America, known at this time, from which native metal can be had, except those of Lake Superior.

There is a peculiarity about this copper, not known in any other mines, which serves still farther to identify the locality from whence the Aztecs procured theirs. The silver which it contains, is also in its native state, in particles, blotches and masses of pure white, studding the surface of the native copper.

Copper has been found in the mounds, in which specks of silver are plainly visible. Dr. Locke, of Cincinnati, has a rough sheet of it, taken from an ancient work at Colerain, Hamilton Co., O., where there is a spot of native silver, of the size of a small pea. This shows conclusively, not only that it came from Lake Superior, but that it has not been melted.

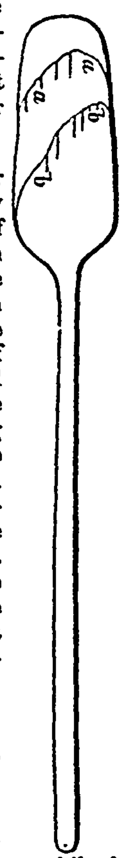
In the old works of the "Minnesotah" location, near the forks of the Ontonogon River, here was found, at the depth of 18 feet, a mass of copper, weighing 11,588 pounds, which had been taken out of the vein by the ancients. It had been raised a few feet along the slope of the vein by means of wedges and of *cob-work*, made of logs, laid up in the form of the body of a small log house. I had a piece of one of these logs, which was cut from a black oak tree about six inches in diameter, showing distinctly, the marks of a narrow axe, $1\frac{3}{4}$ inch wide, and very sharp. The character of the cut or stroke, made by the axe, struck me at once, as such as the copper axes would make, that I had seen in Ohio, which were taken from the mounds.

Although, the timber beneath the mass of copper, in the old Minnesotah works, was very soft and tender, by reason of its age,

* Annals of Science—Cleveland.

it had not rotted from exposure to the atmosphere, having been always covered by water. The timber was of a dark color, and shrank very much on drying; but the marks of the instrument by which it was cut off, were as plain and as perfect as they were on the logs and stumps recently cut in the vicinity. Directly over the mass, and over the timber which supported it, there stood, on the rubbish that covered the mass, about 12 feet in depth, a hemlock tree, that had recently been cut down, on the stump of which I counted (290) two hundred and ninety annual rings, or layers of growth. Other older and larger trees had come to maturity, fallen, and rotted away on the same ground.

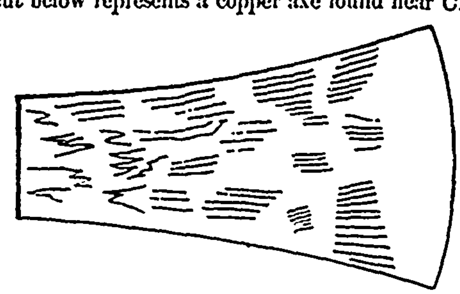
I have another piece of timber which I take to be white cedar, that I procured from an extensive ancient rock excavation in the side of a mountain, forming an artificial cave, about four (4) miles south-east of Eagle Harbor, on section 17, T. 58, N.R., 30 west. It was presented to me by Dr. Blake, the Agent of the Company, who was engaged in re-opening the mine, and who found among the rubbish, a wooden shovel, a part of a wooden bowl, that had been used to bail water, and troughs of cedar bark for carrying off the water.



This shrunken and withered wooden "bat" or *shovel*, is more decayed than most of those found by Dr. Blake, because it was a part of the time out of water. Some others that I saw were less rotten, in fact, were merely water soaked, and showed the marks of the knife or other shaving tool by which the handle was fashioned. They generally resemble an Indian paddle, in size and form, but some of them are worn unequally as though they were used side wise. The one I have was taken from the loose materials thrown out from the cave so long since that the trees, of the usual size and kinds, were growing upon the "burrow," or spoil bank. A birch about (2,) two feet in diameter, stood immediately over this shovel, the lower roots of the tree scarcely reaching to it, through the ancient rubbish. The marginal cut represents in outline, one of these shovels, length three-and-a-half feet, *a a*, form of one after use, from the Aztec cave, four miles south-east of Eagle Harbor; *b b*, form of the one I have, showing it had been used for scraping sidewise.

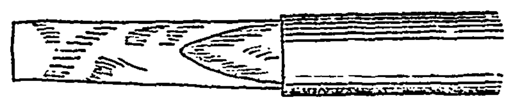
They have been found at the Copper Falls mine, and all of them are made of white cedar, which is abundant on Lake Superior.

The end of the stick or skid has the marks of a tool like a narrow axe, but not as broad or as perfect as those on the Minnesotah specimen which I was obliged to leave at the Ontonogon River, and which has been lost. The outline cut below represents a copper axe found near Chillicothe,

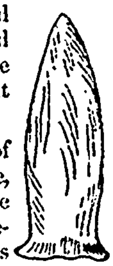


weighing two pounds five ounces, four-tenths of an inch thick, and seven inches long.

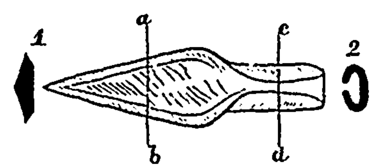
The cuts on the piece I now have are made with a duller tool, and apparently, having a curved edge like an adze. An axe or adze, of that kind, has been found in one of the mounds in Ross county, Ohio, It is figured and described by Mr. Squier, and also two other kinds of axes, and the mode of fastening a handle or helve to them, on pages 197–8–9 of the "Contributions." As yet no such axes have been found on Lake Superior. The only implements found there, which are made of copper, and which are from the rubbish of the old works at a depth of five to fifteen feet below the present surface, are figured below.



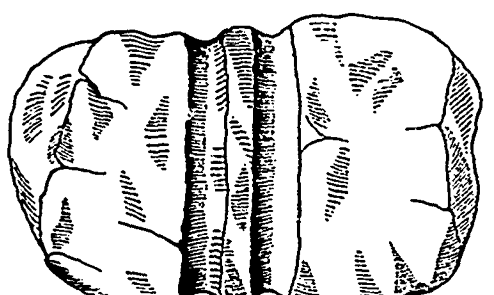
One is a chisel, an inch wide, with a bevel edge and a socket to receive a wooden handle, and is five inches long. Another is a "gad," or wedge, such as quarry men now use, and is four inches long, both of which are figured and described in the report of the Geologists, for the year 1850, and are from the Minnesotah ancient workings.



The third is a spear-head, in the possession of S. W. Hill, Esquire, of the Copper Falls mine, four and a half inches in length, which had the remains of a handle in it when found. It is represented below, the section through the line *a b* is shown at 1, and the section across the shank *c d*, is shown at 2.

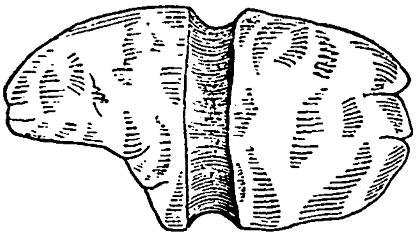


The "gad" is the only implement of metal, as yet known, which was then used in mining. The rock was excavated principally by the use of *fire*, by means of which the mass was softened, and fractured. The main implement made use of to break up the wall rock and vein stone, after it was calcined, was a *stone maul* or "hammer," shown in this cut which represents



a maul with double grooves, weighing 39½ pounds, it is twelve inches long, five and a half inches wide, and four inches thick.

These broken and cast-away mauls are seen in great numbers among the rubbish of all the old works, weighing from two to thirty-six pounds. They were handled, in all probability, by putting a withe around the middle at the groove. The wall rock that is left standing on each side of the vein appears to have been bruised and worn away by incessant pounding with these mauls. One from the Copper Falls mine, broken by use and having but a single groove, is in the possession of Mr. S. W. Hill, and is here figured in outline, as viewed edgewise:—



No distinct marks of a metal tool have been seen in these works. The "gad" must have been used as at this day, by driving it into the cracks and fissures of the rock, to break out fragments. Other mining tools will probably be found, such as picks, or something answering the purpose of them.

The traces of fire and heat are frequently visible in the remains of charcoal and ashes, far down in the wrought veins, and on pieces of blackened rocks, among the rubbish.

There are mines of copper now wrought by fire, at Rammelsburg, in Germany, and which have been in operation for a great length of time, many hundred feet beneath the surface.

There are, also, in the county of Munster, in Ireland, on the Lakes of Killarney, mines of copper, supposed to have been *wrought by the Danes, which have shafts 300 feet deep, and* which were wrought by the agency of fire. In the same mines are found hammers or mauls of stone, the same as those of Lake Superior, with grooves around the middle.

It is, therefore, not impossible to work very extensive mines without the use of powder, or even without the use of any instrument of iron or other metal.

The Danes may have had iron tools, for there are marks of wedges visible on the sides of their shafts; but they knew nothing of the mode by blasting, for powder had not been discovered at that time.

The civilization and general state of advancement of the Danes must have been similar to that of the mound builders, if we may be allowed to judge by the monuments they have left behind them.

There has not been observed on Lake Superior any remains that indicate the existence of cities, or permanent houses of earth or stone. Mr. Hill is of the opinion that he has seen two "mounds" or tumuli, near the Ontonogon, that are artificial and ancient. These are the only known works resembling those of Ohio, except the gravel pits about the Portage Lake. There is nothing to show that the country was permanently inhabited by the ancient miners; and as their works were open cuts, and not galleries, it must have been almost, if not quite, impracticable to work them in the winters of that latitude.

No *graves* or human remains have been found here that can be referred to the era of the copper workings. Neither are there any evidences that there were furnaces or places where copper was *refined* or *melted*, or where it was crushed in the rock and afterwards separated by washing, as we do now.

It seems most probable that the people did *not reside* in the country, but came in the summer from a milder climate, bringing their provisions with them, and taking away, on their return in the fall, the metal they had raised.

In that case the numbers who would die in this healthy region would be small; and no large towns would be built, or permanent habitations, such as would be likely to survive to our times.

It is thus by analogies and by proofs that we may connect the ancient copper-miners of Lake Superior with the "mound-builders" and the Aztecs.

It is a question of some interest how much *time* has elapsed since these mines were worked, and also since the Aztecs abandoned the valley of the Mississippi. I think there is some evidence showing that the two regions were deserted by them about the same time; and this strengthens the presumption that all was the work of one people.

The timber which remains in the ancient diggings of Lake Superior is in a better state of preservation than that found in the mounds; but not more so than would naturally result from the coldness of the climate, the greater durability of the timber itself, and the fact that much of the timber of the mines is and has been continually covered with water.

In the Grave-creek mound, and in others, the crib-work or enclosures of the Aztec skeletons are of wood, and it is found to be very rotten; but these are in all cases above the level of the soil, the earth which surrounds them is dry and artificially raised, and into which the atmosphere penetrates.

Although some of the cedar and pine timber from the old *copper mines is still comparatively sound, like this piece taken* from a pit on the Copper Falls location, eighteen feet below the surface; all the well-preserved pieces were from wet places or under water. The trees from which the mound-builders constructed their burial vaults are less lasting than the northern timber, if both kinds were placed in the same circumstances.

Timber may be preserved under water and constantly wet earth many thousand years. I have in my possession many pieces of cedar from the "stratified drift" or "diluvial deposits" on which this city is built, that must have been buried many thousand years before man was placed upon the earth; and these specimens are as solid as the old oaken crib-work taken from the Minnesotah mines. They are even more solid than this ancient cedar shovel, taken from the Eagle Harbour location, and presented to me by Dr. Blake, and which was sometimes not covered with water. The ancient cedar trees beneath our town were from twelve to twenty feet from the surface, and were always either wet or moist. All circumstances considered, the time indicated by the timber-remains of Lake Superior is as great as by that taken from the mounds, and both may have been left there two thousand years ago.

There is a very sure guide that may be followed in determining the *shortest space of time* since the mines and the mounds were abandoned, and that is the age of the growing timber which stands upon them. There are living trees now flourishing on these ruins which are more than three hundred years old.

On the same spot there are the decayed trunks of a preceding generation or generations of trees that have arrived at maturity and fallen down from old age. It is also a matter of common observation, that where land has been cleared and remained a long time in cultivation, if it is abandoned, a different *kind* of *timber* from that which was cut away first springs up and has its day. It is only by a slow progress of encroachment that the ancient and surrounding forest trees regain their dominion over the soil; and thus it is only after generations have passed away that the new growth is crowded out and disappears. On the ancient earth-works, and on the ancient mining-pits of the North, the same kind of timber is seen as that which occupies the adjacent forest.

This carries us back through a period of at least 600, and probably of 1000 years, as the *limit* within which this country has *not been* occupied either by the old copper-diggers or the race of the mounds. We have historical evidence from the Spaniards that North America was occupied by the Aborigines three hundred and sixty, and from the Icelanders eight hundred and fifty one years ago. If they came as emigrants from Mongolian tribes of Asia, a long period must have elapsed after their arrival in order to allow of such an increase of their numbers.

The natural increase of civilized nations is much greater than of barbarous ones; and in the former case it does not exceed 100 per cent. in 40 years. The Mongolians may have passed freely from Asia to America, as the "Esquimaux" or Eskimo do now in their "kinks," made of skins; but there is no apparent reason for an emigration more rapid than the surplus population would demand. Upon the whole, it seems that it must be since the Aztecs left, and the Indians assumed the middle States of the West, from 1500 to 2000 years.

A long period must have elapsed between the first appearance of the Aztecs upon our soil and their exodus to the South, during which the copper mines were wrought, the mounds, earth-works, and fortifications built, and the rich lands of the Western States cultivated. If we add one thousand years for their occupation of the Northern States, it does not carry us back beyond the foundation of Rome [753 years B.C.]; and when Rome was built the ruins of Pæstum were so ancient that no one knew, from history or tradition, the people who erected those fallen structures.

Cleveland, August, 1852.

Extracts from Exhibition Lectures.

IRON SMELTING.—Let us select the smelting of iron as an example of the teachings of Chemistry. If practice, unaided by Science, be sufficient for the prosecution of manufactures, this venerable art must be thoroughly matured, and Science could scarcely expect to be of much use to it in its present state. But while we find much to admire in the triumphs of practical Experience, there is yet great room for the improvement of this art. The cheapness of iron ore, and of the coal used in its smelting, has been so great, that, regardless of their capital importance to this country, we, like careless spendthrifts, use them without thought of the future.

The mode of smelting iron consists in mixing the ore with lime and coal, the former producing a slag or glass with the impurities of the ore, while the coal reduces the oxide of iron to its metallic state. Much heat is required in the process of smelting, but the cold air blown in, as the blast, lowers the temperature, and compels the addition of fuel, as a compensation for this reduction. Science pointed to this loss, and now the air is heated before being introduced to the furnace. The quantity of coal is wonderfully economized by this application of Science; for, instead of seven tons of coal per ton of iron, three tons now suffice, and the amount produced in the same time is increased nearly sixty per cent. Assuredly this was a great step in advance. Could Science do more?

Professor Bunsen, in an inquiry in which I was glad to afford him aid, has shown that she can. We examined the furnaces, in each portion of the burning mass, so as fully to expose the operations in every part of the blazing structure. This seemingly impossible dissection was accomplished by the simplest means. The furnaces are charged from the top, and the materials gradually descend to the bottom; with the upper charge a long graduated tube was allowed to descend, and the gases streaming from ascertained depths were collected and analyzed. Their composition betrayed with perfect accuracy the nature of the actions at each portion of the furnace; and the astonishing fact was elicited that, in spite of the saving produced by the hot blast, no less than 81½ per cent. of fuel is actually lost, only 18½ per cent. being realized. If, in round numbers, we suppose that four fifths of the fuel be thus wasted, no less than 5,400,000 tons are every year thrown uselessly into the atmosphere, this being nearly one-seventh of the whole coal annually raised in the United Kingdom. This enormous amount of fuel escapes in the form of combustible gases, capable of being collected and economized; yet, in spite of these well-ascertained facts, there are scarcely half-a-dozen furnaces in the United Kingdom where this economy is realized by the utilization of the waste gases of the furnace.

Large quantities of ammonia are annually lost in iron-smelting, which might readily be collected. Ammonia is constantly increasing in value, and each furnace produces and wastes at the least 1 cwt. of its principal salt daily, equivalent to a considerable money loss. With the low price of iron, this subsidiary product is worthy of attention. As I write, a Welsh smelter has visited me, to say that he has adopted this suggestion with advantageous results. I might adduce other improvements introduced by Chemistry in the smelting process; but these will suffice to show you that she has added to human power by increasing production, while she has also economized both the time and the materials employed.

TEXTILE FABRICS.—Without the aid of Chemistry, it would have been impossible for textile fabrics to have attained their present development. The bleaching of cotton and linen was not much practised in England until about a century since; before that time they were sent to Holland, where the operation of bleaching consisted in steeping them in potash for a few days, afterwards for a week in buttermilk, and then exposing them for several months on a meadow to the influence of the sun and moisture. A great improvement was made in Scotland by substituting sulphuric acid for sour milk; and the immediate effect was to reduce the time from eight to four months. In 1785, a French Chemist suggested the use of chlorine as a means of hastening the process; and in the last year of the eighteenth century a compound of this gas with lime was introduced by Tennant of Glasgow. The development of the cotton manufacture now became immense. By a happy adaptation of other chemical processes, in conjunction with the bleaching power of chlorine, the time required for the whitening of cotton and linen fabrics was at once reduced from months to hours, while the miles of outstretched calico, defacing the verdure of country districts, disappeared, the whole operation being carried on within the small space of an ordinary factory. You may imagine what an impulse this gave to a trade so important to us. The bleaching of calico now consists of a chemical operation of great precision; that of silk and wool has not yet been so thoroughly comprehended by Science, and consequently has not derived so many advantages from its application.

A greater acquaintance with the theory of bleaching has led to a better understanding of the very ancient practice of washing. The washing of domestic linen is by no means an operation too insignificant for the attention of the Chemist. A dozen shirts may cost 3*l.* 12*s.*, this being the united interest of the producer, cotton-spinner, and shirt-maker. These shirts will last three years, with care; and supposing three to be washed each week, the cost of washing—that is, the washerwoman's interest in the dozen shirts—amounts to 7*l.* 16*s.*, or more than double that of the cotton-spinner. In fact, the cost of washing is about one-twelfth the income of a family of moderate means. Taking rich and poor together, and estimating the cost of washing at no more than 3d. per head weekly, the annual charge of washing to the metropolis alone is 1,535,050l., which is equal to about one-twenty fifth of the whole capital invested in the cotton manufactures of the United Kingdom. Hard water usually contains lime; and in washing that earth unites with the fatty acid of soap, producing an insoluble body of no use as a detergent. For every 100 gallons of Thames water, 30 oz. of soap are thus wasted, before a detergent lather is formed. In personal ablution we economize this excessive waste by the uncomfortable practice, universally followed in London, of taking about an ounce of water into the hands, and converting it into a lather, the water in the basin being only employed to rinse this off, instead of aiding in the detergence. But in washing linen this plan cannot be followed, every particle of the lime being removed before the soap becomes useful; this, as a matter of economy, is frequently accomplished by carbonate of soda, as being cheaper than soap. The amount of soap and soda salt thus wasted in the metropolis has been stated to be equal to the gross water rental. Hard water, besides wasting soap, produces a greater tear and wear of clothes.

All these facts are well known to manufacturers; and hence the care with which a water is selected before the seat of a manufactory is determined. Why, then, should we not attend to our domestic manufactures, considered trifling only because they are carried on with a great division of labour, unseen in its aggregate? Yet these domestic manufactures are of more importance, economically, than those carried on in large and imposing factories.

I wish I had time to refer, with sufficient detail, to the discovery of Mercer, who has shown that the immersion of cotton in soda or in sulphuric acid causes an equal contraction of the fibres, thus producing the mechanical effect of a loom. If a very fine calico, containing as much as 180 picks to the inch, be thus treated, it contracts to calico of 260 picks to the inch—a fineness not yet attained by any mechanical contrivance. This calico, in addition to its acquired fineness, has also assumed powers which enable it to receive colours superior to those assumed by ordinary calico. Before leaving this important discovery of Mercer, I should allude to one other by the same chemist. The French calico-printers employ mousselines-de-laine consisting altogether of wool; while in England we use a much cheaper fabric, consisting of wool and cotton. The colours on this mixture are, however, extremely meagre when compared with the former; but Mercer has shown that the mixed fabric acquires the properties of the other when it is treated with a bath of chloride of lime. This, one of the greatest discoveries ever made in calico-printing, has been of great value to this country.

I cannot, however, allude to all the triumphs of Chemistry in calico-printing, an art which has grown with the growth of Chemistry, and strengthened with its strength. The knowledge of mordants and of colours, and the other results of chemical discoveries, are of every-day occurrence. Let us take one of the last examples. Lapis lazuli, long celebrated for its beautiful blue, almost ranked among the precious stones, and was sold at a price which put it quite out of the reach of the calico-printer. But chemists, ascertaining its composition by analysis, soon learned how to make it by synthesis. Artificial ultramarine is now manuf[illegible]red at three or four shillings per pound. But when it was n[illegible], how was it to be fixed on cloth? From its insolubility its fix[illegible]on was a real difficulty. Chemists suggested that the ultramarine might be mixed with albumen, which, being coagulated with heat, would retain the colour on the cloth to which it was applied. Whole barrels of the dried white of eggs are now to be seen at calico-print works. Yet this is an expensive process. Could common cheese not be substituted for the white of eggs? Cheese is soluble in ammonia; and the ultramarine, being mixed with this solution, is retained by the cheese, when the ammonia evaporates. Now, therefore, the ultramarine is fastened on by cheese, made from the buttermilk of Scotland, and sold under the name of lactarine.

Stannate of soda is a salt largely used by calico printers. The usual mode of preparing it was, (1), tin was reduced from its ore; (2), this tin was dissolved in muriatic acid; (3), it was oxidized by nitric acid or chlorine; (4), the oxide thus formed was precipitated and redissolved by soda, this bulky, aqueous solution being furnished to calico-printers. Mercer simplified the process, and obtained it in the solid state by two operations: (1), the tin was obtained as before; (2), this tin was fused with a mixture of nitrate of soda and caustic soda, the former oxidizing it, and the latter forming stannate of soda with the oxide thus formed. Young showed in the exhibition a still further simplification. The common ore of tin is an oxide: why then was it necessary to reduce it to the metallic state merely to oxidize it again? He therefore fused the ore at once with soda, the impurities remaining undissolved; and the salt was made by one operation. I quote this instance as a remarkable example of the tendency of Chemistry to simplify processes of manufacture.

I might refer to the important discoveries of yellow and red prussiate of potash, the formers of Prussian blue; but this would only be to cite one out of innumerable appliances. I prefer, therefore, to finish this part of the subject, by alluding to the resists and discharges used in calico-printing. In order to preserve white patterns in the process of dyeing, the nations of the East, whence calico-printing originated, still employ the most laborious mechanical devices, each white spot being covered with sealing-wax, or by being tied up and protected from the dye. By the aid of chemistry, we either discharge the colour on the cloth, or we put upon it bodies which resist the action of the mordants and prevent the colour attaching to that particular part. Acids made from the lees of wine (tartaric acid) and from the lemon (citric acid) are now largely used in these operations, and hence come the beautiful patterns we enjoy in our dresses. It was found that, even when the whites were thus obtained, they became soiled in washing off the excess of mordants from the other parts of the cloth; and the only mode of preventing this was, to treat the cloth with a bath of cowdung. Large dairies were consequently necessary adjuncts of a calico-print work. Chemistry has shown that the action of the manure is due to its phosphates; and a mixture of phosphate of soda, phosphate of lime, and size, is now substituted for the filthy baths formerly indispensable. I could spend hours in discoursing to you on the triumphs of Chemistry in the dyeing of textile fabrics, whether of cotton, wool, and silk, or their mixtures; but I must content myself with these few isolated examples, and pass on to other subjects.

LEATHER.—The manufacture of leather has been less advanced by the application of Chemical Science than any other of the arts. If Simon, the tanner of Joppa, had been able to send leather to the Exhibition, no doubt he would have carried off a medal for leather as good, and made exactly by the same process, as that of our most eminent manufacturers of the present day. And yet the science of leather production is better understood now than then; but so many physical conditions are involved in the production of good leather, that scientific processes have been unable to satisfy them all. The hides, steeped in an infusion of oak bark, absorb tannin and are converted into leather. Good sole leather takes about a year to tan, and even calf-skins consume a month in the operation. Chemists have certainly indicated substitutes for bark, containing a greater amount of tannin; and these, as for instance terra japonica, cutch, catechu, and dividivi, produce their effects in half the time, but the leather is said not to be so durable. With sumach light skins may be tanned in twenty-four hours, and with the aid of alum even in one hour; but the resulting manufactures are not preferred to the old processes. Atmospheric and hydrostatic pressure have been used to hasten the absorption; the refined laws of Endosmis and Exosmosis have been called in to accelerate the process; heavy rollers have squeezed the solution through the pores; but all these methods have at the best but a doubtful success. Leather-manufacturers meet men of science by the well-founded assertion that the resulting leather is too porous, too hard or too soft, or not sufficiently durable; and they revert to their old traditional modes of preparation. I allude to these failures the more especially to show that there is a wide chasm between the chemist's laboratory and the workshop,—a chasm which has to be bridged over by the united aid of the philosopher and the manufacturer. One without the other does not suffice; but both, working together, may achieve great results. Yet, in bridging over this chasm, they must act on a common plan. If the manufacturer build his half without understanding the principles of construction employed by the other, the sides of the bridge may indeed meet, but they are not constructed to receive the binding influence of the keystone, and the arch must give way and tumble down.

Having thus shown the comparative failure of Chemistry in revolutionizing this important manufacture, let me take one or two instances from it to prove that, in the details of the working, it has been of use in economizing time and labour. and in affording new uses to comparatively valueless objects. In removing the hair from the hides, previous to tanning, it was customary to shave it with a knife. This process was tedious and imperfect, and the following simple one is now used. Lime-water dissolves the bulbous root of the hair, when the hides are immersed in it for some time, and the hair may then be readily removed by a blunt instrument. By this simple process one man can remove the hair from a hundred kid-skins in an hour. Still the immersion requires several weeks, while the addition of red orpiment to the lime, as practised by the sheep-skin manufacturers of France, reduces the time to a few hours.

When goat-skins are tanned for morocco leather it is necessary, in order to adapt them for dyeing, to remove the lime absorbed by the last operation. A solution of *album græcum* cleanses the pores effectually, leaving them so spongelike that air can readily be forced through them. Hence the process of tanning is rendered much easier. being in fact completed within twenty-four hours; while the leather is rendered fit to assume the colours so characteristic of morocco. About fifty persons are employed in London to collect the sweepings of dog-kennels for this purpose, and many more in applying them; and I am informed, by Mr. Bevington, that the sum annually paid to the collectors and workmen employed in using this apparently worthless substance, is not less than 5000*l.* in the metropolis alone.

The currier shaves leather to render it of equal thickness, and the shavings were treated as waste, scarcely fit for the manure-heap; but Chemistry has shown that they contain much nitrogen, which renders them well adapted for the formation of the beautiful colour known as Prussian blue.

Soap.—Soap is probably not older than the Christian era, for the soap of the Old Testament seems to have been merely alkali. Profane history, previous to Christ, does not allude to soap; and in all the detailed descriptions of the bath and of washing, it is never mentioned. Pliny describes its manufacture, but ascribes to it as singular a use as that given to the potato by Gerard, who, in his "Herbal," assures us that it "is a plant from America, which is an excellent thing for making sweet sauces, and also to be eaten with sops and wines;" so Pliny, in regard to soap states, that its main purpose was to dye the hair yellow, and that men used it for this purpose much more than women. Gradually its use became more extensive, and its manufacture considerable. Soap generally consists of a fatty acid, combined with the alkali soda. This soda was imported from Spain under the name of barilla, itself the ashes of plants grown near the sea. As these plants derived their soda from the sea, near which they flourished, Chemistry—though singularly enough in the person of Napoleon Bonaparte—suggested that it might be artificially made from sea salt. A process for this was perfected, and soda derived from salt has now replaced barilla. From 1829 to 1834 the average annual import of barilla was 252,000 cwt.; it is now almost nothing. But besides this substitution, the cheapness and comparative purity of the soap, and consequently of soda, is enormously increased, and probably exceeds ten times the largest quantity of barilla ever imported in one year into this country. Its cheapness and excellence have also had a prodigious effect on the manufacture of glass.

Chemistry has thus produced great economy and increasing power of production to the manufacturers of soap, by furnishing them with soda prepared directly and artificially from salt, instead of through the organism of plants. This, however, is only one of the benefits conferred on this manufacture by Chemical Science. The fiscal regulations of foreign countries rendered their tallow and fats expensive to British industry. Russia, with almost a monopoly of tallow and linseed oil, thought it good policy to sell them at high prices. But Chemistry pointed out that vegetables, as well as animals, produce similar fats. The fat of beef and mutton exists in cocoa beans; human fat in olive-oil; that of butter in palm-oil; and horse fat and train-oil are in many oily seeds. Was it, then, necessary to submit to the high prices of Russian tallow? Now, palm and cocoa-nut oil largely replace the fat of the Russian oxen and sheep, although the cheap importation of similar fats from Australia and South America has rendered the substitution less necessary.

CORRESPONDENCE.

Natural History Society of Montreal.

We have great pleasure in giving insertion to the accompanying communication from Major Lachlan, vindicating the Natural History Society of Montreal, from imputations which he considers to have been cast upon it by our introductory remarks to this Journal, page 2. That the gallant President misunderstood the tenor of the passage he refers to, will be evident to any one who dispassionately considers it; far from any disrespect being intended by our enquiry, the contrary is expressly stated. His own Address to that Society, in March, 1852, commented in much stronger terms than a stranger would venture to do, upon its "non-success," and on the spirit of indifference which appeared to have fallen upon it. Such a fact in the previous experience of a Canadian Society, was too important to be left out of view, in considering the probable prospects of the Canadian Institute; but we really thought we had alluded to it in terms to which the most sensitive could attach no offence. We are, however, too well aware of the ardent support which the gallant Major has given for many years, to every proposal having in view the development of scientific pursuits in Canada, to be surprised that such an allusion to a society presided over at present by himself, should meet with a warm response: and too well pleased to have the character and condition of our brethren in the Lower Province, placed in a favorable light before our readers, to feel the smallest hesitation in making the fullest *amende* for any thing unjust in our remark. In fact, the expression that neither the Natural History Society of Montreal, or the Literary and Historical Society of Quebec, have practically exercised any influence in Upper Canada, does appear to be somewhat too strong: the former by its prizes and medals open for competition to all the Provinces; the latter by its valuable historical and scientific publications, has, doubtless, to a limited extent, influenced the cultivation of literary and scientific pursuits in this Province. Honor to whom honor is due. Our remark had reference principally to that practical encouragement which such pursuits can derive from the action of a local body. In conclusion, let not the friends of science and literature in Lower Canada, admit the supposition that any ungenerous spirit of rivalry actuates those who are supporting the same cause here; or that the latter seek to exalt themselves at the expense of the former. A little healthy emulation, will promote perhaps, the life of both parties; but let, at least, the jealousy of Scientific Societies be for Canada, alone—and East and West, combine to promote her good, and bring honor to her name.

To the Editor of the Canadian Journal:

MONTREAL, 31st Dec., 1852.

SIR,—My attention having lately been called to a remark in the introduction to the first number of your Journal, coupled with a paragraph in the more widely circulated valuable Almanac of your Publisher, on the present state of the Natural History Society, I trust I may, as its President, be permitted to occupy a small space in your columns, while I endeavour to vindicate that Association from any prejudicial effects likely to arise from a partial mistake made in the one, and an ungenerous and undeserved insinuation in the other.

In the very appropriate introductory remarks alluded to, you very justly draw public attention to the comparatively little progress as yet made in Canada, in the pursuit and cultivation of the Physical Sciences, and to their having by no means attained that place which might have been looked for at this stage of our history. I regret to be compelled to admit the humiliating fact; but I am not quite satisfied with the manner in which you refer to the only two instances noticed by you: and I am disposed to think that you might have commenced with examples nearer home—it being well known that signal failures have taken place in the good City of Toronto,—where, with a united, and, as it were, homogeneous British population, better things might have been expected. For instance, without going further,—though there are even later instances—you might have named "*The Literary and Philosophical Society of Upper Canada,*" attempted to be set on foot, some 21 years ago, under the patronage of Sir John Colborne, for the promotion and study of Natural and Civil History, Natural Philosophy and the Fine Arts, but which fell to the ground in spite of all the efforts of such men as Dr. Dunlop, Mr. Charles Fothergill, Dr. Rees, and others. But you were content to single out the two Societies in *Lower Canada* alone, and without bearing in mind that curse of Canada, "the war of races," which seems doomed to forbid all generous amalgation of *mind* or *matter*, for many years to come, state as follows:—"It is true that two Societies, directed more or less to this object have existed in Lower Canada for more than twenty years, (a circumstance rather creditable to it, be it remembered.) the Literary and Historical Society at Quebec, founded in 1824, and the Natural History Society of Montreal, founded in 1827; but *we have the highest authority for inferring that the latter, at least, has not yet realized the expectations of its zealous founder;* nor can the last report of the authorities of the former be deemed entirely satisfactory. Neither have practically exercised any influence in Upper Canada."

Now, sir, permit me to remark, that though every candid observer must allow that neither of these Associations has come up to the mark which might have been expected, both of them have, in spite of all local obstacles, undoubtedly "exercised some influence" in Canada at large; the one in its Historical Researches, and various interesting Papers connected with the Natural History of the country; and the other in having—besides other important though silent influence,—having indefatigably forced upon the Legislature the valuable Geological Survey of the Province now so successfully in progress under your *Institute's* distinguished President, *Mr. Logan.* Nay, I will even venture to add, in despite of "the high authority" on which you rely that the Natural History Society, with all its short-comings, has in one *main* respect "realized the expectation of its zealous founders," to a very creditable degree, in having accumulated a *Museum* of no mean pretensions, besides a very respectable little Library of about 1,000 volumes; and that I verily believe—and I say so, free from any local bias, being a thorough Upper Canadian—that but for their anxiety to accomplish that object, and the heavy debt unavoidably incurred in the purchase of a mansion suited to such purposes, it might have long ere this borne literary fruits that would not have been discreditable to it; and that, at all events, there is now a spirit of revival among its local members, on whom alone,—unlike your society—the whole pecuniary burthen falls,—which, if well seconded by their numerous corresponding associates, and properly encouraged by the public, will not only *not* "be evanescent," but ere long lead to very satisfactory results.

The paragraph in the Almanac to which I allude, is as follows:—"*Natural History Society of Montreal.*—Established about 25 years ago, for the developement of the Natural History of the Province, and its subsequent application to economic purposes. It is supported by a Legislative grant, and the contributions of members. The late Rev. J. Somerville, bequeathed the handsome sum of £1000 to it, on condition that the interest should be devoted annually to the payment of a series of lectures on some subjects of Natural History. *The Society has pocketed the £1000; but the requirement has not been too exactly fulfilled.* The Society, however, is located in their own building, in Little St. James Street, and presents for examination, a Museum, whether of Zoological, Mineralogical, or Geological specimens, second to few on this continent. The Zoological Department is particularly rich, comprising almost every species met with in this Province. The Society seems lately to have acquired a fresh impetus. We only hope that it may not prove evanescent."

Now, Sir, allow me to observe that there appears an unkindly, if not hostile feeling lurking in part of this observation, which it would have been more creditable to the informant to have checked. I allude to the expression that the Society had pocketed the £1000 left by the late Mr. Somerville, &c., whereas the fact is, that in the express *words* of the will, and not as stated above, the bequeath was made "*towards the founding of a Lectureship on Natural History;*" and that though the money has been temporally borrowed, to pay off part of the debt incurred in the purchase of the commodious mansion now *nominally* owned by the *Society*, but, *in fact*, belonging to the *public*, that was done on the thorough understanding among the members that, until repaid, a course of gratuitous lectures should be annually delivered by them and their friends;—and that this has ever since been the case; and that *I am even disposed to believe that Mr. Scobie's informant was one of the main promoters of that arrangement.* I may further add, that had Parliament been lately as liberal to the Natural History Society as to various other Institutions in Lower, and even Upper Canada, it would have the sooner been enabled to carry out the Somerville Bequest to the very letter, without attempting to pocket a single farthing of the money.

Cordially wishing the Canadian Institute every possible success in the noble course which it has chalked ont for itself,

I remain your obedient servant,

R. LACHLAN.

Editorial Notices.

We have pleasure in acknowledging the receipt of a small box, containing some fragments of limestone, and a small packet of an exceedingly pure and beautiful specimen of burned lime. We have not as yet, received any communication from the donor. The specimen of lime is remarkable for its purity. We should be extremely obliged to the anonymous contributor if he would favour us with the name of the locality where the specimens were procured: at the same time we thank him for his interesting contribution to the museum of limestones which it is the desire of the Council of the Canadian Institute to form and describe.

Mr. Edward Van Cortlandt's notice of an Indian Burying Ground will appear in out next number.

At the weekly meeting of the Canadian Institute, on Saturday, January 8th, it was resolved,—"That it be an instruction to the Council to take steps to bring under the consideration of the Provincial Legislature the intention of the Imperial authorities to withdraw the military detachment in charge of the Toronto Magnetic Observatory; and to suggest the continuance of the observations under Provincial authority." In compliance with the above resolution, the Council of the Institute prepared a draft of a petition to the Governor-General in Council, which was submitted to a very numerously attended meeting of members of the Institute, on Saturday, January 15th, and appproved of.

The attendance of members at the weekly meeting of the Institute, on Saturday, January 15th, was remarkably good, as stated in the preceding notice. A very interesting paper on the "Mineral Springs of Canada" was read by Professor Croft. We hope to have the opportunity of introducing Professor Croft's paper into the February number of this Journal. A considerable number of candidates for admission into the Institute were proposed. Their election will be confirmed on Saturday next. This large weekly increase in the number of members is a very gratifying indication of the progress which the Institute is making in the favour of the public. At the close of the proceedings, the President announced the subject of a paper to be read before the Institute at their next meeting, on Saturday, January 22nd, to be "Notes on the Geology of Toronto," by Professor Hind.

REVIEWS.

The Canadian Agriculturalist, and Transactions of the Board of Agriculture of Upper Canada.—W. McDougall, *Toronto.*

The first annual Report of the Board of Agriculture for Upper Canada is found on the first page of the January number of this very useful publication. The Board recommended a few modifications in the Agricultural Statute passed last Session of Parliament, such as the rendering each County belonging to United Counties "distinct and independent for agricultural purposes under the said act whenever desired." They further suggest that the sum of £17 10s. required to be raised by Township Societies before they can legally organize and receive parliamentary aid, might be advantageously reduced to £10. In relation to an Experimental Farm the Report states as follows :—

"The objects which the Board recommend in establishing an Experimental Farm on the University Ground may be thus briefly stated :— First, to afford the Professor of Agriculture a ready means of giving practical illustration and effect to his class lectures in the University ; Second, to import from abroad new and improved kinds of seeds, plants and implements, chiefly with a view of testing, by experiments carefully conducted on the farm, their adaptation to the climate, soil, wants and markets of this country, and in all cases of a favourable result, to distribute such productions on easy terms throughout the Province. An occasional importation of improved breeds of animals, the offspring being sold and distributed through the Province, would be an efficient means of advancing this very important department of husbandry, and would tend to increase materially the wealth and progress of the country. It is believed that in thus connecting the science and practice of Agriculture in their various bearings on each other, in our Provincial University, it will be made more subservient to the public good.

The Board are desirous that these fifty or sixty acres for experimental and illustrative purposes, should not be mistaken for a Model Farm, which should consist of a larger area, and which would consequently involve a much greater outlay and risk. Whether Model Farms, strictly so called, are adapted to the present wants of this young country, fairly admits of a question. But something should at once be done to connect the leading facts and principles of Agriculture with the routine of instruction given in all the schools and colleges of the Province ; and if small portions of land could be set apart for such purposes, the instruction would prove far more practical and efficient.

The Board will feel much pleasure should the plan of an experimental farm on an inexpensive scale meet the approval of the Legislature, so that they may feel authorized in taking final steps for the carrying out of the same. The principal difficulty lies in the necessary outlay for the commencement. A grant of £500 would enable them to do so with every prospect of success ; and it is believed that the ordinary amount of funds placed at their disposal, would after the necessary preliminary expenditure had been made, nearly or quite meet all exigencies hereafter.",

The correspondence of the January number of the Agriculturist is more than usually voluminous. We notice some views of doubtful stability advanced which we do not wish to pass altogether unnoticed. We allude in the present instance to a communication headed 'Agriculture and Coal Fields of Ohio viewed in reference to Canada.' We would suggest a friendly caution to the enterprising writer against causing the indulgence of the expectation that workable coal measures will be found in Upper Canada. We are not disposed to agree with him in the result of his deductions from an experiment with phosphorescent wood, or in the supposition that the same degree of heat necessary to drive off carbonic acid from common lime will 'destroy' the phosphoric acid of phosphate of lime.

The selected articles are very good. One on butter making is well worthy of attentive perusal and study. The Horticultural department contains much useful and interesting matter.

The Genessee Farmer for January, 1853.—Daniel Lee, *Rochester, N. Y.*

The January number of this periodical is well supplied with excellent wood-cuts and useful information. The 'Farm as a Manufactory' is to be discussed in subsequent numbers of the *Farmer*. The subject is one of great interest and importance, and if properly handled will exercise a very beneficial influence.

The writer of 'British and American Agriculture' is rather hard upon English labourers, and scarcely institutes a fair comparison between "a smart well fed Yankee and an English labourer who lives *on nothing but beer.*" The Horticultural Department is well sustained, and contains much applicable information and advice.

SCIENTIFIC INTELLIGENCE.

Geology.

Abridgement of a Description of a Brown Coal Deposit in Brandon, Vermont, with an attempt to determine the Geological Age of the principal Hematite Ore Beds in the United States. By Edward Hitchcock, D.D., LL.D., President of Amherst College, and Professor of Geology.—Silliman's Journal.

In the autumn of 1851, Professor Shedd, of Burlington, presented me with a few specimens of beautifully preserved fruits from Brandon, Vermont. They were converted into Brown Coal, and retained exactly their original shape and markings. Early in the spring of 1852 I visited Brandon, and found that the fruits were obtained from a bed of Brown Coal, connected with the white clays and brown hematite of that place. I perceived at once that an interesting field was open before me ; and ever since I have been endeavouring to explore it. Great difficulties presented themselves ; and I have resorted to several gentlemen, both in this country and in Europe, for aid. Their opinion has yet been obtained only in part. But there are several points of much interest to American geology cleared up by what I have already ascertained. I have concluded, therefore, to give a brief account of this case ; hoping hereafter to make additions to it.

I would here acknowledge my deep indebtedness to John Howe, jr., the proprietor of this deposit of iron, clay, and brown coal. Not only did he do all in his power to aid my investigations upon the spot last spring, but since then he has sent me, free of expense, numerous specimens of the fruits and the coal ; especially at one time two barrels of the coal containing the fruits, and at another time a gigantic mass of lignite,—the trunk of a large tree, in fact,—which is now deposited in the cabinet of Amherst College.

I shall first give a description of the topography and geological associations of this carbonaceous deposit ; next an account of the lignites and fossil fruits ; and, finally, deduce from the facts some geological inferences of importance.

I. *Topography and Geological Associations.*

Geologists are aware that along the west base of the Green and Hoosac Mountains, from Canada to New York, occur numerous beds of brown compact and fibrous hematite iron ore. That in Brandon lies between two and three miles east of the village. Passing easterly from the village the surface rises slightly and exhibits clay, drift, and limestone rock in place. According to my measurements with the aneroid barometer, Brandon village is 465 feet above the ocean, and the iron mine 520 feet above the same. A short distance east of the mine the Green Mountains rise rapidly.

At this spot we find the following varieties of substances in juxtaposition :—

1. Beautiful kaolin and clays coloured yellow by ochre, rose-colour by manganese, (?) and dark by carbon.
2. Brown hematite and yellow ochre.
3. Ores of manganese.
4. Brown coal.
5. Beds of gravel connected with the clays.
6. Drift, overlying the whole.
7. Yellowish limestone, underlying the whole.

The position of the clays it is difficult to determine exactly, as there seems to have been a good deal of disturbance of the strata, perhaps only the result of slides. The iron is generally found beneath the clay, as is also the manganese. The coal in a few places shows itself at the surface. In one spot a shaft has been carried through it, only a few feet below the surface, and the same has been done to the same bed nearly 100 feet below the surface. In both places it is about twenty feet thick. I found it to be the conviction of the miners that this mass of coal forms a square column of that thickness, descending almost perpendicularly into the earth, in the midst of the clay. My own impression was, that it is a portion of an extensive bed, having a dip very large towards the north-west; perhaps separated from other portions of the bed by some disturbance of the strata. But I found great difficulty in tracing out its exact position.

It ought to be mentioned that no unstratified or igneous rocks are known to exist in the vicinity of these deposits; nor do they exhibit any marks of the metamorphic action of heat.

II. *Coal, Lignite, and Fossil Fruits.*

The greater part of the carbon of this deposit is in a condition intermediate between that of peat and bituminous coal. It is of a deep brown colour, and nearly every trace of organic structure, save in the lignite and the fruits, is obliterated. Disseminated through it are numerous angular veins, mostly of white quartz, rarely exceeding a pea in size. It burns with great facility with a moderate draught, and emits a bright yellow flame, but without bituminous odour. After the flame has subsided, the ignited coals consume away, leaving, of course, a quantity of ashes. It is employed to great advantage in driving the steam-engine at the works; and I should think it might be used advantageously for fuel in a region where wood is scarce, which is not the case at Brandon.

Interspersed through the carbonaceous mass above described, occur numerous masses of lignite. In all cases which have fallen under my observation, they are broken portions of the stems or branches of shrubs and trees, varying in size from that of a few lines to a foot and a half in diameter. They all appear to me to have been drift-wood. The largest mass which I have seen, and to which I have already referred as sent me by Mr. Howe, resembles exceedingly a battered piece of flood-wood; which led Mr. Howe humourously to inscribe upon the box in which it was sent, "*A piece of flood-wood from Noah's Ark.*"

This lignite in all cases retains and exhibits upon a fresh fracture its organic structure; yet generally it is quite brittle, and when broken across the fibres it has the aspect of very compact coal, which admits of a good polish. In some specimens the original toughness of the wood is not quite lost, and the aspect of the wood remains.

The large mass of which I have already spoken as now in the cabinet of Amherst College, is four feet long and sixteen inches in its largest diameter. It is considerably flattened, but seems to have been so originally. In the peaty matter that adheres to it I noticed several specimens of fruit, and more than one species.

With perhaps one or two exceptions, all the lignite of this deposit belongs to the exogenous or dicotyledonous class of plants. In general the texture is close, and some of the wood is very fine-grained and heavy. The bark is often quite distinct. I have been inclined to refer some of the wood to the maple; yet probably a good deal of it is coniferous; but my microscope examinations on this point have not been as satisfactory as I could wish. I do not think much of the wood belongs to the pine tribe now common to this latitude. I have placed specimens in the hands of several distinguished vegetable physiologists, and had hoped ere this to learn their opinion; but they have not yet given it.

The only other fossil fruits that I have known to be found in our country are a few from the tertiary strata at Richmond, Va. In respect to these, Professor Jeffries Wyman has kindly furnished me with the following description :—

"In my examinations at Richmond I have frequently found lignite, occasionally fruits; but as I was more anxious for bones, I gave them but little attention. I have identified a species of Carya (walnut), which was so pronounced by Mr. Teschemacher, Prof. Agassiz, and Dr. Gray. I have also found one species of pine cone, in company with pine lignite. The latter was interesting, as having changed, while lying on my table, from the condition of rotten wood, soft enough to yield to the tip of the finger, into lignite of the usual hardness, and having the coal-like fracture. This, however, is no uncommon occurrence, and is said to be well known to geologists. The piece of wood just referred to had been bored by the teredo. The above are the only instances about which I would speak with any confidence. I have, also, from the same locality, a large mass of fossil resin. The vegetable fossils there found, with the teeth of Phyllodus, Cetacea, reptiles, sharks, &c., show a close resemblance of the Richmond formations to the London clay. I have in preparation a short notice in which the animal fossils of the two are to be compared.

CONCLUSIONS.

Although the specific character of the Brandon fossils are thus imperfectly known, the facts detailed will warrant several inferences of importance in American geology.

I. *The Brandon deposit belongs to a tertiary formation.* The following are the proofs :—

1. It lies below the drift, and for the most part is not consolidated. Its position as to the drift is seen at the openings made near the carbonaceous deposit; and the degree of induration,—or rather, in general, the want of induration,—corresponds to that of most tertiary deposits.

2. It contains all the important varieties of rock found in tertiary deposits. We have here white and variegated clays, water-worn beds of sand and gravel, beds of carbonaceous matter not bituminous, and deposits of iron and manganese.

II. *The carbonaceous matter in this deposit is strikingly analogous to that of the brown coal formation in Europe.*

1. The lignite has the deep brown colour and coal-like fracture of the brown coal deposits that have not been affected by the proximity of igneous rocks, as is the case at Meisner in Hesse. Yet the woody texture usually remains distinct.

2. While this coal is distinguished from peat by burning with a bright flame, it does not give off a bituminous odour, and thus it differs from bituminous coal.

3. The degree of carbonization of the fruits corresponds to that in the brown coal formation, as a comparison of specimens shows.

4. The sand and clays, associated with the brown coal of the Rhine valley, occur also at Brandon.

III. *The fruits and lignite of this deposit appear to have been transported by water, and probably the accumulation took place in an ancient estuary.*

1. No example has occurred in which these fruits have been found in clusters, or attached to the branches on which they grew or to their envelops; nor have I found more than a single imperfect example of a leaf.

2. The lignite is in broken and usually bruised masses, as if battered by contact with one another when floating down stream.

3. The numerous places in other parts of the United States where an analogous deposit occurs, as will be shown below, render it probable that this was formed in an ocean rather than a lake.

IV. *The Brandon deposit is the type of a tertiary formation hitherto unrecognized as such, extending from Canada to Alabama.*

This formation is identified by the following characters :—

1. The most prominent and well-known substance in this formation, on account of its economical importance, is brown hematite. In the geological surveys of Vermont, Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, and North and South Carolina, this ore is described by Adams, Shepard, Percival, Mather, Henry D. and William R. Rogers, Olmsted, and Tuomey. Throughout this whole distance of 2000 miles, there is a striking resemblance in the character of the ore. It is compact, fibrous, and stalactitical; and much of it is in a state of ochre.

2. It is always more or less enveloped in clay of various colours.

3. It is almost invariably found lying upon or near a certain sort of limestone, or its associated and interstratified mica slate. This limestone is usually highly crystalline, and when disintegrated it shows a large proportion of iron in its composition; and the general opinion of the geologist just named is, that the iron originated from it. Indeed, Prof. Adams, in his first report on the Vermont survey, has described a true vein of iron ochre in the limestone, which I have also examined. I have

likewise some reason to suppose that Foss's bed of hematite in Dover, N.Y., may once have constituted a bed in mica slate.

In all the Northern States, the beds of this ore occur along the western base of high mountains; and from the description of the gentleman above named I understand this to be the case in the middle and Southern States. Prof. Henry D. Rogers imputes this fact to the southern direction of the currents in the great ocean by whose waters the iron and the clay were deposited, and to the greater depression of the valley on its south-eastern side. Prof. Rogers is the only geologist I believe who speaks decidedly of the deposition of this ore from the ocean. By this supposition he comes so near representing this formation as tertiary, that it would have needed only a bed of carbonaceous matter, such as occurs at Brandon, to have brought him upon that ground. Not improbably, now that the Brandon bed is known, similar ones may be found associated with the ore of other localities: for how long has it remained unnoticed at Brandon!

Thus does the discovery of the Brandon brown coal deposit enable us to add to American geology a tertiary formation nearly 1200 miles long, which may appropriately be placed upon our maps.

V. *This deposit probably belongs to the Pliocene, or Newer Tertiary.*

1. So far as we know, it lies immediately beneath the drift.

2. It is destitute of any consolidated beds, save the nodules of hematite, which is not true of any of our miocene or eocene deposits.

3. The brown coal of continental Europe, to which ours corresponds closely in appearance, belongs to the newer tertiary.

I confess that these arguments are not sufficient to remove all doubts from my mind as to the part of the tertiary group to which this formation should be referred. All geologists, however, I think, will say that it has marked peculiarities, which distinguish it from all the tertiary deposits of our country hitherto described; and we may at least say, that the presumption is strongly in favour of its being pliocene. It is rather remarkable, if it was an oceanic deposit, that no marine remains have been found in it. I believe, however, that this is very much the case in Germany; though, unfortunately, the papers of Horner, Von Dechan, and others, on the brown coal are not within my reach.

Photographic Landscapes on Paper.

32, Harley Street, Dec. 7.

Allow me to request your insertion in the *Athenæum* of the annexed communication, on the subject of Photography, in the form of a letter to myself from my brother-in-law, Mr. John Stewart, resident at Pau; who has been singularly successful in his application of that art to the depiction of natural scenery,—and whose representations of the superb combinations of rock, mountain, forest and water which abound in the picturesque region of the Pyrenees, are among the most exquisite in their finish, and artistic in their general effect, of any specimens of that art which I have yet seen. The extreme simplicity of the process employed by him for the preparation of the paper, its uniformity, and the certainty attained in the production of its results, seem to render it well worthy of being generally known to travellers. It need hardly be mentioned that the "air-pump" employed may be one of so simple a construction as to add very little to either the weight, bulk, or expense of the apparatus required for the practice of this art. The obtaining of a *very perfect* vacuum, for the imbibition of the paper, being a matter of little moment,—a single barrel (worked by a cross-handle by direct pull and push,) furnished with a flexible connecting pipe, and constructed so as to be capable of being clamped on the edge of a table, would satisfy every condition.

I remain, &c., J. F. W. HERSCHEL.

Pau, Pyrenees.

My Dear Herschel,—Thanks to the valuable indications of Prof. Regnault, of the *Institut*, I have been enabled to produce, what appear to me, most satisfactory results in *Photographic Landscapes on Paper*. In this remote corner (so deficient also in resources for experiment) I feel that I am but very partially acquainted with the results obtained and the progress making in the great centres, Paris and London; but I think that, in detailing the simple process and manipulation I now adopt, indications of some value, and suggestive of further improvement to fellow-labourers in the art may be found; and if you are of the same opinion, you will perhaps facilitate the communication of these details to our photographers at home.

The following observations are confined to negative paper processes, divisible into two—the *wet* and the *dry*. The solutions I employ for both these processes are identical, and are as follows:—

Solution of Iodide of Potassium, of the strength of 5 parts of iodide to 100 of pure water.

Solution of Aceto-Nitrate of Silver, in the following proportions: 15 parts of nitrate of silver; 20 glacial acetic acid; 150 of distilled water.

Solution of Gallic Acid, for developing, a saturated solution.

Solution of Hyposulphite of Soda: of the strength of 1 part hypo. of soda, to from 6 to 8 parts water.

The solutions employed are thus reduced to their simplest possible expression, for it will be observed that in iodizing I employ neither rice-water, sugar of milk, fluorine, cyanogen, nor free iodine, &c., &c.; but a simple solution of iodide of potassium (the *strength* of this solution is a question of considerable importance, not yet, I think, sufficiently investigated.)

For both the wet and the dry processes I iodize my paper as follows:—In a tray containing the above solution I plunge, one by one, as many sheets of paper (twenty, thirty, fifty, &c.,) as are likely to be required for some time. This is done in two or three minutes. I then roll up loosely the whole bundle of sheets, while in the bath; and picking up the roll by the ends, drop it into a cylindrical glass vessel with a foot to it, and pour the solution therein, enough to cover the roll completely (in case it should float up above the surface of the solution, a little piece of glass may be pushed down to rest across the roll of paper and prevent its rising.) The vessel with the roll of paper is placed under the receiver of an air pump and the air exhausted; this is accomplished in a very few minutes, and the paper may then be left five or six minutes in the vacuum. Should the glass be too high (the paper being in large sheets) to be inserted under a pneumatic pump receiver, a stiff lid lined with India rubber, with a valve in the centre communicating by a tube with a common direct-action air-pump may be employed with equal success. After the paper is thus soaked *in vacuo* it is removed, and the roll dropped back into the tray with the solution, and then sheet by sheet picked off and hung up to dry, when, as with all other iodized paper, it will keep for an indefinite time.

I cannot say that I fully understand the rationale of the action of the air-pump, but several valuable advantages are obtained by its use:—1st. The paper is thoroughly iodized, and with an *equality* throughout that no amount of soaking procures, for no two sheets of paper are alike, or even one, perfect throughout in texture; and air bulbs are impossible. 2nd. The operation is accomplished in a quarter of an hour, which generally employs one, two, or more hours. 3rd. To this do I chiefly attribute the fact that my paper is never solarized even in the brightest sun; and that it will bear whatever amount of exposure is necessary for the deepest and most impenetrable shadows in the view, without injury to the bright lights.

Wet Process.—To begin with the *wet* process. Having prepared the above solution of aceto-nitrate of silver, float a sheet of the iodized paper upon the surface of this sensitive bath, leaving it there for about ten minutes. During this interval, having placed the glass or slate of your slider quite level, dip a sheet of *thick* clean white printing (unsized) paper in water, and lay it on the glass or slate as a wet lining to receive the sensitive sheet. An expert manipulator may then, removing the sensitive sheet from the bath, extend it [sensitive side uppermost] on this wet paper lining, without allowing any air globules to intervene. But it is difficult, and a very simple and most effectual mode of avoiding air globules, particularly in handling very large sheets, is as follows:—Pour a thin layer of water [just sufficient not to flow over the sides] upon the lining paper, after you have extended it on your glass or slate, and then lay down your sensitive paper gently and by degrees, and floating as it were on this layer of water; and when extended, taking the glass and papers between the finger and thumb, by an upper corner, to prevent their slipping, tilt it gently to allow the interposed water to flow off by the bottom, which will leave the two sheets of paper adhering perfectly and closely, without the slightest chance of air-bubbles;—it may then be left for a minute or two, standing upright in the same position, to allow every drop of water to escape; so that when laid flat again or placed in the slider none may return back and stain the paper. Of course, the sensitive side of the sheet is thus left exposed to the uninterrupted action of the lens, no protecting plate of glass being interposed,—and even in this dry and warm climate I find the humidity and the attendant sensitiveness fully preserved for a couple of hours.

To develope views thus taken, the ordinary saturated solution of gallic acid is employed, never requiring the addition of nitrate of silver; thus preserving the perfect purity and varied modulation of the tints. The fixing is accomplished as usual with hyposulphite of soda, and the negative finally waxed.

Dry Process.—In preparing sheets for use when *dry* for travelling, &c., I have discarded the use of *previously waxed* paper,—thus getting rid of a troublesome operation,—and proceed as follows: Taking a sheet of my iodized paper, in place of floating it (as for the wet process) on the sensitive bath, I plunge it fairly into the bath, where it is left to soak for five or six minutes; then removing it wash it for about twenty minutes in a bath, or even two, of distilled water, to remove the excess of nitrate of silver, and then hang it up to dry (in lieu of drying it with blotting paper). Paper thus prepared possesses a greater degree of sensitiveness than waxed paper; and preserves its sensitiveness, not so long as waxed paper, but sufficiently long for all practical purposes, say thirty hours, and even more. The English manufactured paper is far superior for this purpose to the French. To develope these views, a few drops of the solution of nitrate of silver are required in the gallic acid bath. They are then finally fixed and waxed as usual.

These processes appear to me to be reduced to nearly as great a degree of simplicity as possible. I am never troubled with stains or spots, and there is a regularity and certainty in the results that are very satisfactory. You will have observed, too, how perfectly the aerial perspective and gradation of tints are preserved, as also how well the deepest shadows are penetrated and developed, speaking, in fact, as they do, to the eye itself in nature. In exposing for landscape, I throw aside all consideration of the bright lights, and limit the time with reference entirely to the dark and feebly-lighted parts of the view. With a 3¼-inch lens the time of exposure has thus varied from ten minutes to an hour and a half, and the action appears to me never to have ceased.

The influence of the air-pump in this appears to me very sensible, and deserving of further examination and extension. I purpose not only iodizing, but rendering the paper sensitive with the action of the air-pump, by perhaps suspending the sheet after immersion in the nitrate bath under the receiver of the air-pump for a few minutes before exposure in the camera, or by some other manœuvre having the same object in view.

I should add, that I have chiefly employed Canson's French paper in iodizing with the aid of the pump. Few of the English manufactured papers are sufficiently tenacious in their sizing to resist the action of the pump, but they may easily be made so; and were, in short, the English paper, so far superior in quality to the French, only better sized,—that is with glue less easily soluble, even though more *impure*, there is scarcely any limit to the beauty of the views that might be produced.

There are more minor details that might be given; but I fear repeating many a "twice-told tale," acquainted so little as I am with what is doing: the preceding, however, may have some interest, and whatever is of value is entirely due to our friend M. Regnault, ever so generously ready as well as able to aid and encourage one's efforts.

Ever yours, JOHN STEWART.

Chemistry and Physics.

1. *On the motion of Fluids from the Positive to the Negative Pole of the closed Galvanic Circuit.*—Wiedemann has communicated to the Prussian Academy of Sciences, a memoir on the mechanical action of the voltaic circuit which is of essential interest and importance. The apparatus employed consisted of a porous earthenware cell, closed at the bottom and terminated above by a glass bell firmly cemented to the upper edge of the cylinder. Into the tubulure of the bell a vertical glass tube was fitted, from which a horizontal tube proceeded so as to permit the fluid raised to flow over into an appropriately placed vessel. A wire serving as the negative pole of a battery passed down through the glass bell into the interior of the porous cylinder, where it terminated in a plate of platinum or copper. Outside the porous cylinder another plate of platinum was placed and connected with the positive pole of the battery. The whole stood in a large glass vessel, which, as well as the interior porous cylinder, was filled with water. The intensity of the current was measured by a galvanometer. As soon as the circuit was closed, the liquid rose in the porous cylinder and flowed out from the horizontal tube into a weighed vessel. The results obtained by means of this apparatus were as follows:—

(1.) The quantity of fluid which flows out in equal times is directly proportional to the intensity of the current.

(2.) Under otherwise equal conditions, the quantities of fluid flowing out are independent of the magnitude of the conducting porous surface.

To avoid any uncertainty arising from the laws of the flow of liquids through small orifices, Wiedemann measured the intensity of the mechanical action of the current by determining the height of a column of mercury which would hold the transferring force in equilibrium. For this purpose a graduated tube or manometer filled with mercury was attached to the extremity of the horizontal tube above mentioned: with different currents and porous surfaces of different extent, the mercury in the manometer rose to different heights. By the measurements of these heights the following results were obtained:—

(3.) The height to which a galvanic current causes a fluid to rise, is directly proportional to the intensity of the current and inversely proportional to the extent of the free porous surface.

The mechanical action of a galvanic current may also be referred to its simplest principles by the following proposition:—

(4.) The force with which an electric tension, present upon both sides of a section of any given fluid, urges the fluid from the positive to the negative side, is equivalent to a hydrostatic pressure which is directly proportional to that tension.

In this manner therefore we obtain a simple measure of electric tension and its mechanical action in terms of atmospheric pressure and consequently of gravity.

The above laws hold good only for fluids of the same nature. When different fluids are subjected to the action of the currents, the mechanical action is greatest upon those which oppose the greatest resistance to its passage. The requisite data are still wanting to determine the precise connection between the mechanical action and the resistance, but observations made with solutions of sulphate of copper of different degrees of concentration, appear to show that the quantities of fluid transferred in equal times by currents of equal intensity, are nearly proportional to the squares of the resistances.—*Monatsbericht der K P. Akademie der Wissenschaften, March,* 1852, 151.

Spots on the Sun.—The number of spots seen in 1826 was 118; from this there was an increase to 161 in 1827 and 225 in 1828, and then a decrease to 33 in 1833. The number again increased, and was 333 in 1837, 282 in 1838, and 34 in 1843. Again it increased and after five years in 1848, it was 330, since which there has again been a decrease. Moreover at the time of minimum the spots are much smaller than at the maximum. In 1841 the largest was hardly 4′ broad. While in 1848 three groups were 8½′ across, and one spot appeared for seven or eight consecutive rotations.

M. Gautier observes that he has remarked a singular connection between this decennial period in the spots, and a decennial period in the variations of the magnetic needle recently pointed out by Dr. Lamont of Munich. According to this astronomer, since August, 1840, the mean annual amplitude of the diurnal variation of magnetic declination between 8 A. M. and 1 P. M. augments regularly for *five* years and then diminishes for five years. The epoch of the *minimum* of this amplitude corresponds to the middle of the year 1843, and that of the *maximum* to the middle of 1848. He has also found, from the Gottingen observations a *maximum* in 1837, corresponding with the above observations on the spots.

The results of Dr. Lamont have been confirmed by M. Reslhuber at the Observatory of Kremsmunster in Austria. Thus in 1843, the annual mean diurnal variations of declination and intensity have been respectively 6′ 28″·6 and + 0·00088; and in 1844 they were 6′ 14″·9 and + 0·00138. In 1848, they were 10′ 55″·4 and + 0·00273; in 1849, 10′ 39″.5 and and 0·00230.

M. Schwabe has deduced from eight observations with regard to the period of rotation of the sun, 25·07 days as the shortest, 25,75 as the longest: the mean of his results gives 25·507. He remarks that some of the spots have a brownish red colour; one was examined with glasses of different colours, to avoid any source of error, its north side was reddish-brown, more red than brown. The next day it had much changed and the border had the usual gray colour.

M. Rodolphe Wolf, of Berne, has been registering the spots since 1847; and he concludes that the number through a year so varies, that if a curve be drawn to express the variation, this curve has undulations, the more regular of which correspond each to a period of about 27½ days, or the period of the sun's rotation with relation to the earth. As bearing on this subject, the author states that M. Buijs Ballot of Utrecht, has concluded from thermometric observations at Haarlem, Zwanenbourg and Dantzig, (see Pogg. Ann., 1851, Dec.,) that during a number of years, at each period of 27·7 days there is at these places a small elevation of temperature and at the intermediate period a diminution.

On the Freezing of Vegetables.—In connection with an abstract of Prof. J. LeConte's paper On the Freezing of Vegetables, (Silliman's Journal, vol. xiii., 84,) published in the Bibliothèque Universelle for June, 1852, the following note is inserted by M. A. de Candolle, showing that the action of freezing on vegetation for some years has not been altogether misunderstood by botanists. "In 1838, I published in the Bulletin de la Classe d'Agriculture de Genève (No. 121, p. 171,) in an article on the intense cold of January, 1838, the following remarks—after first alluding to the observations of Pictet and Maurice who found the temperature of the centre of a chesnut tree below zero, and also the experiments of M. Ch. Coindet, who after a prolonged cold had extracted from the middle of a large tree, small crystals of ice:—'These trees are however not dead. I have myself, after a cold but little intense, seen crystals of ice in the interior of the buds of several trees which have not suffered from it. Young branches, the buds of many trees, and the leaves of the plants of our country are in winter often penetrated beyond doubt with a cold several degrees below zero (centigrade); and although the viscous liquids of the slender tubes congeal with difficulty, it must frequently happen that congelation takes place, without the plant or the organ perishing. Thus cold does not kill vegetation by a mechanical action proceeding from the congelation of the liquid as some naturalists pretend. We must recognize rather a physiological action; that the vitality of the tissue is destroyed by a certain degree of cold followed by a certain degree of heat, according to the peculiar nature of each plant. The vegetable and animal kingdom, according to this view, will act alike. In the same manner as the gangrene that sets in after the thawing of a frozen part causes the death of an animal tissue, so the change or putrefaction which follows a rapid thawing will be the principal cause of the death of the vegetable tissue. Is is well known in practice how to manage the transitions of temperature to preserve the organs of vegetables.'

Since 1838, until my connection with the Academy of Geneva ceased, I stated in my annual lectures that cold may act in two ways on vegetation:—either *physically*, by the contraction or congelation of the liquids, which often does not kill them; and *physiologically*, by an action upon the tissues and upon vegetable life, which the laws of physics do not account for. The most striking example of this last, is the immediate death of hot-house plants when exposed to a temperature of 1 + or + 2° C., which causes no congelation. The action of the same degree of temperature is very different on two allied species, and sometimes on two varieties of the same species."

Shooting Stars.—M. Coulvier Gravier reports (*Comptes Rendus Acad. Sci.*, Aug. 16, 1852) that according to his observations at Paris from June 18 to Aug. 13, 1852, the average hourly number of shooting stars seen (by one observer?) at midnight was in the first half of July about 8, from the 16th to the 21st, 11; from the 22d to 27th. 21; from Aug. 2d to 6th, 38; on the 10th, 63; on the 11th, 50; on the 12th and 13th, 45.

Monthly Meteorological Register, at Her Majesty's Magnetical Observatory, Toronto, Canada West.—December, 1852.

Latitude 43 *deg.* 39.4 *min. North. Longitude,* 79 *deg.* 21 *min. West. Elevation above Lake Ontario:* 108 *feet*

Magnet.	Day.	Barom. at tem. of 32 deg. 6 A.M.	2 P.M.	10 P.M.	MEAN.	Temperature of the air. 6A.M.	2P.M.	10P.M.	M'N.	Tension of Vapour. 6A.M.	2P.M.	10P.M.	M'N
						°	°						
c	1	29.967	29.953	29.924	29.949	31.6	42 4	33 4	35 50	0.147	0.187	0.157	0.167
bd	2	.957	.943	.908	.933	28 4	44 6	32.7	34.78	.139	.206	.151	.167
c	3	.812	.713	.596	.696	33 3	44.6	44 9	40 57	.169	.217	.264	.215
b	4	.379	.298	.312	.336	42 4	44.1	37.3	41.02	.244	.265	.210	.237
c	5	.397	.445			40 8	43.7			.246	.244		
c	6	.529	.355	.326	.404	40.6	43.7	47.4	43.57	.238	.256	.290	.256
c	7	.369	.126	.004	.165	45.6	51 0	47.0	47.65	.274	.341	.281	.296
c	8	.271	.457	.567	.450	39.9	40 5	37 1	38.92	.228	.159	.158	.179
be	9	.499	.384	.460	.457	37.8	39 6	34 1	36.55	.189	.186	.169	.179
	10	591	.577	.579	.577	27.8	41.3	32.7	33 55	.135	.179	.161	.153
	11	.480	.388	.466	.449	31.9	37.0	31.6	33.33	.160	.159	.124	.144
	12	.579	.640			26.2	34.4			.126	.131		
cd	13	590	.599	.802	.674	25 6	31.9	26.3	28.35	.118	.164	.108	.132
c	14	.986	30 010	.958	.936	21.1	31.5	30.9	27.43	.105	.172	.137	.125
b	15	.974	30.050	30.034	30.024	23 7	33 4	26 2	27.47	.107	.150	.120	.126
a	16	.928	29.605	29.249	29.555	34.5	34.4	38 4	36.07	.161	.173	.208	.186
c	17	.019	29.096	.218	.123	38.4	30 2	17.2	27.43	.204	.145	.092	.134
c	18	.282	.479	.744	.537	20 8	28.8	26.9	25.95	.093	.106	.105	.107
b	19	.652	.224			24.4	34 5			.113	.172		
b	20	.342	.470	.580	.471	32 8	28.7	18.6	25 57	.124	.118	.088	.109
c	21	.728	.886	.994	.882	14 0	18 5	17 9	16.72	.078	.063	.076	.074
a	22	30.112	30 188	30.187	30.168	20 5	25.2	26.9	24.17	.086	.081	.099	.089
cd	23	29.900	29.564	29 495	29.633	29.1	33.3	35.9	33.00	.147	.185	.197	.178
c	24	.270	.215	.456	.347	40.2	43.7	36.6	39 00	.224	.232	.175	.204
cd	25	.656	.692	.408	.584	31.6	31.7	33.0	32.33	.149	.148	.166	.157
a	26	.448	.611			26 6	29.4			.123	.122		
c	27	.930	.564	.220	.543	20.8	33.1	35 5	30 83	.097	.148	.193	.153
e	28	28.966	29.190	29 567	29.276	39.7	30.2	28.7	32.02	.234	.117	.113	.149
ec	29	29 676	.750	.817	.757	26.9	28.4	26.9	27.28	.109	.127	.125	.122
a	30	.685	.584	.670	.641	27.3	33.1	26 4	28.73	.119	.171	.130	.134
a	31	.682	.498	.421	.519	25.2	23.4	22 6	23.42	.125	.122	.112	.119
	M	29.614	29 579	29.591	29 5978	30.83	35.16	31 60	32 27	0.156	0.170	0.156	0.15

Day.	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	M'N	Wind. 6 A.M.	2 P.M.	10 P.M.	Rain in Inch.	S'nw in Inch.
1	82	70	82	80	SW b W	S b W	S W b S	- -	- -
2	89	71	82	83	S W b S	S S W	N E b E	- -	- -
3	89	75	90	85	N N E	N E b E	E N E	1.020	- -
4	91	93	95	93	E b N	E N E	N b E	0.060	- -
5	94	87			W N W	W b S	W S W	Inap	- -
6	95	91	90	92	S b E	E b S	S S W	Inap	- -
7	90	93	88	90	S W b S	E N E	S S E	0.460	- -
8	93	63	71	75	S W	W S W	SW b W	- -	- -
9	84	77	86	83	E N E	E S E	E S E	- -	- -
10	88	70	87	80	SW b W	SW b W	Calm	- -	- -
11	90	72	70	76	N	N b W	W	- -	- -
12	87	65			W b N	W S W	SW. b W	- -	0.1
13	80	92	75	83	W	N	N W b W	- -	0.5
14	89	97	79	81	NW b N	S b E	S E b E	- -	- -
15	81	80	83	82	S	S b W	S b W	- -	- -
16	80	88	91	88	E b S	E S E	E b S	0.745	0.2
17	88	85	92	85	S W	W S W	W S W	- -	0 5
18	81	67	71	75	W S W	W	W b N	- -	Inap
19	84	86			W S W	S W b W	W b S	- -	- -
20	67	74	83	78	N W	N N W	N	- -	0.3
21	89	59	74	76	N b W	NN W	Calm.	- -	- -
22	75	55	66	67	Calm	S W b S	S E	- -	- -
23	92	98	94	95	E S E	E S E	E	0.600	Inap
24	91	83	81	86	NE b N	W b S	W S W	0.010	- -
25	84	83	88	86	N W b W	Calm.	E b S	- -	6.5
26	83	75			N W b N	W S W	W S W	- -	- -
27	93	78	96	88	N W	E b S	E b S	1.100	1.0
28	97	70	71	79	S b E	W S W	W b S	- -	Inap
29	74	80	85	81	S W	W b S	W S W	- -	0.5
30	79	91	88	83	W S W	S b W	E N E	Inap	2.0
31	91	94	89	92	NE b E	N E b E	N b E	- -	8.0
M	86	80	83	83	Ml's 5 60	Ml's 8.10	Ml's 6 47	3 995	20 1

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

North.	West.	South.	East.
1096.30	2228.30	1370.34	1516.54

Mean velocity of the wind - - 6.54 miles per hour.
Maximum velocity - - - - - 21.3 ml's per h'r, from 1 to 2 p m. on 28th.
Most windy day - - - - - 17th: Mean velocity, 14.14 miles per hour.
Least windy day - - - - - 10th: Mean velocity, 2.77 ditto.
Most windy hour - - - - - noon: Mean velocity, 8.37 ditto.
Least windy hour - - - - - 9, p.m. Mean velocity, 5.26 ditto.
Mean diurnal variation - - - 3 11 miles.

The column headed "Magnet" is an attempt to distinguish the character of each day, as regards the frequency or extent of the fluctuations of the Magnetic declination, indicated by the self-registering instruments at Toronto. The classification is, to some extent, arbitrary, and may require future modification, but has been found tolerably definite as far as applied. It is as follows:—

(*a*) A marked absence of Magnetical disturbance.
(*b*) Unimportant movements, not to be called disturbance.
(*c*) Marked disturbance—whether shewn by frequency or amount of deviation from the normal curve—but of no great importance.
(*d*) A greater degree of disturbance—but not of long continuance.
(*e*) Considerable disturbance—lasting more or less the whole day.
(*f*) A Magnetical disturbance of the first class.

This is the mildest December since 1831, (the earliest date of observations at Toronto.)

The day is reckoned from noon to noon. If two letters are placed, the first applies to the earlier, the latter to the later part of the trace. Although the Declination is particularly referred to, it rarely happens that the same terms are not applicable to the changes of the Horizontal Force also.

Highest Barometer - - 30.210, at 4 P. M., on 22d } **Monthly range:**
Lowest Barometer - - 28.966, at 6 A.M., on 28th } **1.244 inches.**

Highest observed Temp. - 51.0, at 2 P. M., on 7th } Monthly range:
Lowest regist'd Temp. - 13.2, at A.M., on 21st } 37.8
Mean Highest observed Temperature - - 36.54 } Mean daily range:
Mean Registered Minimum - - - - - 26.58 } 9.96
Greatest daily range - - - - - 22.2 from 6 A.M., to 10 P.M., on 17th.
Warmest day - - 7th - - - Mean Temperature - 47.65 } Difference:
Coldest day - - - 21st - - - Mean Temperature - 16.72 } 30.93

The "Means" are derived from six observations daily, viz., at 6 and 8, A. M., and 2, 4, 10 and 12, P. M.

Comparative Table for December.

Ye'r	Temperature. Mean.	Max.	Min.	Range.	Rain. D'ys	Inches.	Snow. Dy's	Inch.	Wind. Mean Velocity.
	°	°	— °	°					
1840	24 28	41 0	4 4	45 4	3	inapp.	18	not regis'd	Miles.
1841	29 67	45.5	2. 4	43 1	7	6 600	5		--
1842	25.33	40.3	3. 8	36 5	3	0.880	17		--
1843	30 59	41.1	2. 7	38 4	6	1.040	8	8.1	--
1844	28.78	48.9	— 0. 8	49 7	6	imperfect	6	4 2	--
1845	21.49	37 6	— 2. 7	40.3	2	inapp.	12	4 7	--
1846	27.72	49 2	3. 7	45.5	5	1 215	9	6 0	--
1847	30.58	50.0	6. 6	43 4	7	1.185	3	6.8	4 55
1848	29 63	49.1	0. 6	48.5	7	2.750	7	16 5	5.44
1849	26.92	41.3	— 9. 7	46.5	5	0 840	12	9.6	6.23
1850	22 55	48 3	— 5. 2	58.0	2	0 190	18	29 5	7 40
1851	21 59	43 8	—10. 5	54.3	6	1.073	15	10.7	7 37
1852	32.27	51.0	13. 9	37.1	7	3 995	10	20 1	6.54
M'n	27.03	45.16	0 03	45.13	5.1	1.648	11.2	11.6	6.25

Notice of a Binocular Microscope.

BY J. L. RIDDELL.*

I devised last year, and have lately constructed and used, a combination of glass prisms, to render both eyes simultaneously serviceable in microscopic observation.

Behind the objective, and as near thereto as practicable, the light is equally divided, and bent at right angles, and made to travel in opposite directions, by means of two rectangular prisms, which are in contact by their edges somewhat ground away. The reflected rays are received at a proper distance for binocular vision upon two other rectangular prisms, and again bent at right angles; being thus either completely inverted, for an inverted microscope; or restored to their first direction for the direct microscope. These outer prisms may be cemented to the inner by Canada balsam, or left free to admit of adjustment to suit different observers. Prisms of other form, with due arrangement, may be substituted.

I find the method is applicable with equal advantage to every grade of good lens, from Spencer's best sixteenth to a common three inch magnifier, with or without oculars or erecting eye-pieces, and with a great enhancement of penetrating and defining power. It gives the observer perfectly correct views in length, breadth, and *depth*, whatever power he may employ. Objects are seen holding their true relative positions and wearing their real shapes. A curious exception must be made. In viewing opake solid bodies, with one piece to each eye, depression appears as elevation, and elevation as depression, forming a singular illusion. For instance, a metal spherule appears as a glass ball silvered on the under side; and a crystal of galena, like an empty box. By the additional use of erecting eye-pieces, the images all become normal and natural. Match drawings of any solid object, made from each eye-piece, by the aid of the camera lucida, when properly placed in the common stereoscope, appear to stand out in natural relief. These, if engraved and printed in the proper position with respect to each other, might find an appropriate place in books on the arts and sciences.

In constructing binocular eye-glasses, I use for lightness and economy four pieces of common looking glass instead of prisms.

With these instruments the microscopic dissecting-knife can be exactly guided. The watchmaker and artist can work under the binocular eye-glass with certainty and satisfaction. In looking at microscopic animal tissues, the single eye may perhaps behold a confused amorphous or nebulous mass, which the pair of eyes instantly shapes into delicate superimposed membranes, with intervening spaces, the thickness of which can be correctly estimated. Blood corpuscles, usually seen as flat disks, loom out as oblate spheroids. In brief, the whole microscopic world, as thus displayed, acquires a tenfold greater interest, in every phase exhibiting, in a new light, beauty and symmetry indescribable.

MISCELLANEOUS INTELLIGENCE.

Ontario, Simcoe, and Huron Union Railroad.

The Directors of the Ontario, Simcoe, and Huron Railroad, accompanied by the Chief Engineer, made an excursion over the road on the 5th instant. So much has been said disadvantageous to the character of this road, that we have much satisfaction in being enabled to state that the road is in excellent order, and that the distance of thirty miles now completed, going northward, was run in one hour; and that on a portion of the road a speed of forty-five miles per hour was attained.

In the vicinity of Newmarket the Directors inspected some heavy works now in progress, and which have been undertaken with a view to the reduction of some objectionable curves made in the original location. When these works are completed,—as they will be early in April,—the grading and bridging will be completed to Barrie; and as the timber for the superstructure is distributed over the line, the laying of the track will then be rapidly proceeded with; and it is expected the road will be opened as far as Barrie early in June.

OBITUARY.

Died, November 11th, at the age of about, 63 or 64 Gideon Algernon Mantell, L.L.D., F.R.S. The renowned geologist, Dr. Mantell, imbibed at an early period of his life a taste for natural history pursuits, and having fixed his residence, as a medical practitioner, at Lewes, was led to devote himself with great natural enthusiasm to the investigation of the fossils of the Chalk and of the Wealden of Sussex. In 1812-15 Dr. Mantell commenced forming at Lewes, the magnificent collection of 1300 specimens of fossil bones, which is now in the British museum; and in 1822 appeared his "Fossils of the South Downs," a large quarto work, with forty plates, engraved by Mrs. Mantell, from drawings by the author. Another work was published by him about the same time, entitled "The Fossils of Tilgate Forest," and compared with the geological literature of the period in which they were written, they are meritorious productions.

In 1825, Dr. Mantell was elected a Fellow of the Royal Society, and he has contributed some important papers to its "Philosophical Transactions." For his memoir "On the Iguanodon," he had the honour in 1849 to receive the Royal Medal. He was also an active member of the Geological Society, and in 1835 was presented with the Wollaston Medal and Fund, in consideration of his discoveries in fossil comparative anatomy generally. From Lewes, Dr. Mantell removed about this time to Brighton, and his collection being materially added to, was purchased by the Trustees of the British Museum for £5000. Upon this he removed to the neighbourhood of London. Dr. Mantell took great delight in imparting to others a knowledge of his favourite science; he was fluent and eloquent in speech, full of poetry, and extremely agreeable in manners to all who manifested an admiration of his genius. He now turned his attention to the more popular and attractive works for which his name will be chiefly remembered. "Wonders of Geology," "Medals of Creation," "Geological Excursions round the Isle of Wight," and an enlarged edition of his "Thoughts on a Pebble," all of which are profusely illustrated, and have passed through several editions. His latest work was a hand-book to the organic remains in the British Museum, entitled, "Petrifactions and their Teachings." To these may be added, "Thoughts on Animalcules," and a "Pictorial Atlas of Fossil Remains," selected from Parkinson's and Arlis's palæontological illustrations; and among his early productions a handsome quarto narrative, with portraits of the "Visit of William the 1st and Queen Adelaide to the Ancient Borough of Lewes," which included some original poetry. Dr. Mantell was a most attractive lecturer, filling the listening ears of his audience with seductive imagery, and leaving them in amazement with his exhaustless catalogue of wonders.

THE CANADIAN JOURNAL

Will be published Monthly, and furnished to Subscribers for 15s. per annum, in advance. To Members of the Canadian Institute the *Journal* will be transmitted without charge.

Persons desirous of being admitted into the Institute, as Members, are requested to communicate with the Secretary. The Entrance Fee (including one year's subscription.) is One Pound Currency.

There are three classes of persons who may with propriety join the Institute. First—Those who by their attainments, researches, or discoveries, can promote its objects by their union of labour, the weight of their support, and the aid of their experience. Second—Those who may reasonably expect to derive some share of instruction from the publication of its proceedings by the *Journal;* and an acquaintance with the improvement in Art and the rapid progress of Science in all countries,—a marked feature of the present generation. Third—Those who, although they may neither have time nor opportunity of contributing much information, may yet have an ardent desire to countenance a laudable and, to say the least, a patriotic undertaking,—a wish to encourage a Society where men of all shades of religion or politics may meet on the same friendly grounds: nothing more being required of the Members of the CANADIAN INSTITUTE than the means, the opportunity, or the disposition to promote those pursuits which are calculated to refine and exalt a people.

All communications relating to the CANADIAN INSTITUTE to be addressed to the Secretary. All communications connected with the *Journal* to be addressed to the Editor. Remittances on account of the *Journal* received by the Treasurer of the CANADIAN INSTITUTE, Toronto.

* University of La., New Orleans, Oct. 1, 1852.—*Sill. Jour.*