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The Canadian Journal.

TORONTO, SEPTEMBER, 1853.

Variations in the Level of the Lakes.

The recent extraordinary rise in the waters of the Great Lakes has assumed an importance in relation to navigation, boundaries of property, and the preservation of property situated upon their shores, which throws into the shade all considerations of the phenomenon as a purely scientific question. It will be interesting to enquire whether the present remarkable rise is due to causes which do not at present appear, or whether it is the result of extraordinary rainfall, followed by an unusually small degree of evaporation. Other phenomena of a less general description, yet also influencing the level of the Lakes in different localities, demand attention. We think that the fluctuations in the water level of our inland seas may be conveniently divided into three groups:—

1. Variations in the general level of the waters of the Lakes.
2. Sudden local variations.
3. Influx and efflux of the mouths of rivers and harbours.

We propose to enumerate some of the changes which have been observed in the levels of Lakes Erie and Ontario before proceeding to enquire into the causes which have occasioned them. It is well known that these changes have produced very remarkable effects upon the coast wherever the drift clays or the softer shales form the lake boundaries, and even where the coast is in the form of a sloping beach.

We glean the following notices from Hall's Geology of the 4th District of New York:—

"Twenty-five and thirty years ago the beach of Lake Erie was a travelled highway beyond Buffalo, but at this time it would be quite impossible to travel along the same."

"From the united testimony of persons residing along the margins of all the Lakes, and from other demonstrative proofs, it appears that for many years previous to 1838, all the Lakes had been rising; that about this period they attained their maximum, and have since been subsiding."

"Mr. Hiram Burton, who resided at the mouth of Slippery-Rock Creek for twenty-three years, informed me (Mr. Hall,) in 1840 that the water of Lake Erie was then four feet higher than when he came to that place; that in 1838 it was still higher, but he had made no accurate measurements."

"Mr. Higgins, Topographer to the Geological Survey of Michigan, has given the rise of the Lakes as five feet three inches from 1819 to 1838; he regards it as probable that the minimum period continues for a considerable length of time, while the maximum continues only for a single year."

Several of the Lake shore or beach roads on the North side of Lake Ontario have disappeared in numerous localities, within the memory of living residents. The old Lake Shore Road, from Toronto to Hamilton, is in parts quite washed away, and we were informed by a resident, a mile or so to the west of the Humber, that a road existed about seven years ago below the present old road. The shore is flat at the place just alluded to, and the destruction of the first and second roads may be attributed to the effects of South-Easterly winds upon a high level of the waters of the Lake. A storm from the South East would place the new Plank Road in considerable jeopardy. A very favourable illustration of some of the results to be anticipated by high lake levels in conjunction with prolonged storms, exists now at the Peninsula opposite the Toronto City Hall, where a wide gap was formed during the Spring of the present year by the waves of the Lake washing away sand, shingle and pebbles to the depth of several feet. The Canal thus formed is at present about 160 feet wide and 4 feet deep. Its width and depth, and even its position are constantly varying with each high wind from the East, South or South West. Similar occurrences have been frequently observed to take place in the narrow stripe between Ashbridge's Bay and the Lake on the same Peninsula; and at the present moment, and about the same place, a sand and gravel ridge not less than three feet above the present high level of the Lake, is to be found occupying the spot where open communications existed between the Bay and the Lake during a part of last winter and the winter of 1849. We may learn from these occurrences the probable fate of the Canal opposite the City Hall. The effects of high lake levels upon the precipitous clay cliffs which form a very large portion of the coast lines of Lakes Erie and Ontario, are interesting both in their relation to property and to the future probable condition of the Lakes, as well as to their past history. An average of a yard a year would be a very moderate allowance for the encroachments of the waters upon the land, occasioned by the washing away of the cliffs which form the coast. We have lately witnessed the entire removal of many acres of land, on which large trees were growing, by the encroachment of the waters of Lake Simcoe on its eastern shores. Instances might be multiplied to shew that the annual march of the waters *inland* is a very curious item in the physical history of the Great Lakes, and one to which we are inclined to ascribe far greater importance in many relations than appears at the first view of this phenomenon.

We now proceed to give such results as we have been able to collect from the different observers who have interested themselves in the rise and fall of the waters of the Great Lakes. The following table shows the mean depth, the least depth, the greatest depth, the monthly fluctuation, and the greatest fluctuation during twenty-four hours, which we have reduced from the measurements made at Port Colborne, Welland Canal, Lake Erie, during the years 1850, 1851 and 1852. The influence of winds, and probably of local variations in the atmospheric pressure, will become apparent upon examination of the column which gives the greatest fluctuations during twenty-four hours.

TABLE *of the Variations in the Level of Lake Erie, at Port Colborne, during the years* 1850, 1851, *and* 1852:

MONTH.	Mean Depth.	Least Depth.	Greatest Depth.	Monthly Fluctuation.	Greatest Fluctuation in 24 hours.
	feet.	feet.	feet.	feet.	feet.
1850—April	12.25	11.5	12.83	1.33	0.91
May	12.32	11.83	12.83	1.00	0.56
June	12.05	11.75	12.50	0.75	0.50
July	12.16	11.75	12.83	1.08	0.75
August	11.98	11.25	12.75	1.50	0.91
September	11.82	10.66	12.41	1.75	1.33
October	11.74	11.08	13.16	2.08	1.87
November	11.45	10.75	12.33	1.58	0.75
December	11.70	9.83	14.83	5.00	4.33
1851—January	12.12	11.08	15.16	4.08	4.00
February	11.85	9.79	12.16	2.37	1.41
March	12.28	11.33	13.16	1.83	0.83
April	12.3	10.8	13.4	2.6	2.25
May	12.9	12.1	16.4	4.3	3.9
June	13.18	12.58	13.84	1.26	.75
July	13.23	12.5	14.25	1.75	1.35
August	13.	12.08	13.5	1.42	1.17
September	12.57	11.17	14.25	3.08	1.75
October	12.73	12.08	14.03	2.00	1.6
November	12.6	11.17	14.25	3.08	1.75
December	12.74	11.83	14.6	2.77	1.66
1852—January	12.2	9.75	13.92	4.37	1.5
February	11.8	10.9	12.5	1.6	1.08
March	12.1	11.17	13.66	2.49	1.66
April	12.8	9.83	14.16	4.33	3.16
May	13.6	13.00	16.33	3.33	2.5
June	13.8	12.9	15.00	2.3	1.08
July	13.5	12.16	14.9	2.73	2.75
August	13.35	13.3	13.5	.5	.5

The lowest monthly mean depth of the waters of Lake Erie, on the sill of the lock at Port Colborne, during the interval between April, 1850, and August, 1852, a period of 32 months, appears to have been 11.45 feet, which occurred in November, 1850. The highest observed mean was in July, 1852, when the depth appears to have been 13.55 feet, giving a difference of 2.1 feet.

The least depth recorded occurred in January, 1852—9.75 feet; the greatest depth in May 1851, and in May 1852, when the height of the water was indicated by 16.33 feet, affording a difference of 6½ feet, which was due, without question, to the prevalence of westerly winds. To the same influence we may ascribe the remarkable monthly fluctuations, and to a great extent, the fluctuations during twenty-four hours. The greatest monthly fluctuation recorded is 5 feet; the greatest daily fluctuation is 4⅓ feet. It is a matter of some uncertainty whether the daily fluctuations are due to the influences of winds alone; it appears probable that local variations in atmospheric pressure may have something to do with this phenomenon. The situation of Port Colborne, at one extremity of Lake Erie, is most favourable for the influence of westerly winds, whose effects upon the coast of Buffalo and other neighbouring localities are well known. The westerly winds are among the most frequent and powerful which affect Lake Erie, and they occasionally produce very disastrous results at the eastern extremity of the Lake.

The levels of Lake Ontario, at Port Dalhousie, are given below, for the years 1851 and 1852; they do not indicate the extraordinary fluctuations which distinguish the water-levels of Lake Erie. The sheltered situation of Port Dalhousie sufficiently explains this difference.

TABLE *of the Variations in the Level of Lake Ontario, at Port Dalhousie, during the years* 1851 *and* 1852:

MONTH.	Mean Depth.		Least Depth.		Greatest Depth.		Greatest Monthly Fluctuation.		Greatest Fluctuation in 24 hours.	
1851.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
January	11	8	11	8	11	9	0	1	0	1
February	11	10	11	9	12	0	0	3	0	1
March	12	5	12	1	12	7	0	6	0	2
April	12	10	12	7	13	2	0	7	0	2
May	13	3	13	2	13	3	0	1	0	1
June	13	4	13	3	13	5	0	2	0	0
July	13	2	13	1	13	4	0	3	0	1
August	----	----	----	----	----	----	----	----	----	----
September	12	10	12	8	13	0	0	4	0	1
October	12	5	12	3	12	7	0	4	0	1
November	12	3	12	3	12	4	0	1	0	1
December	12	2	12	2	12	3	0	1	0	1
Mean yearly difference	1	8	----	----	----	----	----	----	----	----
1852.										
January	12	2	12	2	12	2	----	----	----	----
February	12	2½	12	1	12	4	0	3	0	1
March	12	7	12	4	12	9	0	5	0	1
April	13	1	12	10	13	6	0	8	0	2
May	14	3½	13	6	14	4	0	10	0	2
June	14	6½	14	4	14	7	0	3	0	1
July	14	5	14	4	14	6	0	2	0	1
Mean yearly difference	2	3½	----	----	----	----	----	----	----	----

The Lock-Master (Mr. Geo. Thompson) at the Burlington Bay Canal, in his Report to the Secretary of the Board of Works on the subject of the rise and fall of the Lakes, remarks:—

"As far back as 1836 we had exactly the same high water as we have had this season. I do not remember, in the interval of 16 years, of ever the water being so high; the mean of the rise of each year in that interval may, I think, be stated pretty correctly at from 22 to 28 inches; this season it has risen to 3 feet 6½ inches above the low water mark that I took in 1848. It had not been as low for several years, and has not been as low since, but it must be remembered that it did not fall to that mark last winter by 6 inches; deducting that from 3 ft. 6½ inches, we have a dead rise of 36½ inches for this season. In March of this year the water was very near up to its old standard, which was rather singular; it rose rapidly until about the middle of May; curiosity induced me to measure it, when I found it 3 feet above the low water mark of 1848. I kept measuring it at intervals as follows:—

May 26th, 3 feet 2	inches above the low water mark of '48.					
June 8th, 3	"	3½	"	"	"	"
" 15th, 3	"	4	"	"	"	"
" 21st, 3	"	6	"	"	"	"
" 25th. 3	"	6½	"	"	"	"

It stood at this until the beginning of August. On the 4th it had fallen 2 inches; on the 15th 6 inches. September 1st, it had fallen 12 inches; 9th, it had fallen 4 inches; on the 22nd, 9 inches; 12th, 14 inches. It will continue falling till November, and sometimes well on in December; it will then remain stationary till a short time before the breaking up of the ice."

In answer to an enquiry we made some short time since of Mr. Geo. Thompson respecting the height of the Lakes this year, we were informed—

"That the water here on the 7th June, was 8 inches higher than in 1852, making it full 4 feet 2 inches higher than in 1848. It began to fall on the 13th of June; on the 19th it had fallen 2½ inches; on the 11th July 5 inches; on the 21st 6 inches; on the 29th 7½ inches; on the 4th August 9 inches; and to-day 10½ inches nearly;—it is, consequently, about 2½ inches below the years 1836 and 1852—at present. Its usual time for commencing to fall is from the 1st to the 10th July, whereas it had fallen 1 inch on the 13th June."

Observations made at the Queen's Wharf, Toronto, under the direction of CAPTAIN LEFROY, R.A.

1849.				1852.			
March 14th,	1	0		May 10th,	9	4½	
" 21th,	1	1½		" 15th,	3	5½	
" 26th,	1	3		" 18th,	3	7	
" "	1	4		" 20th,	3	7½	
April 4th,	1	6		" 29th,	3	8	
" 9th,	1	8		June 3rd,	3	8	
" 10th,	1	10		" 7th,	3	7	
" 30th,	1	11		" 12th,	3	11	
May 2nd,	1	11		" 14th,	4	0½	
" 6th,	2	3		" 29th,	3	11	
" 7th,	2	1		" 30th,	4	1	Highest.
" 14th,	1	11		July 5th,	3	11	
" 21st,	2	2		" 13th,	4	0	
" "	2	4		" 21st,	3	10	
July 3rd,	2	5		Aug. 19th,	3	5	
August 5th,	1	11		Sept. 6th,	3	2	
" 15th,	1	8		" 30th,	2	10	
Sept. 20th,	1	6		Nov. 18th,	2	6	
Oct. 25th,	0	3	Lowest.	" 24th,	2	7	
Nov. 31st,	1	9		Dec. 17th,	2	9	Wind.
Dec. 20th,	1	1					

These have always been taken on calm days, with one or two exceptions.

Mr. Dade recorded that, on July 1st, 1836, the water in perfect calm stood within 3 feet of the top of the Queen's Wharf. If so, it stood eight inches higher than it did on June 30, 1852, and about the same height as in June 1st, 1853.

Observations made at Gorrie's Wharf by MR. G. A. STEWART.

Month of June.				Month of July.				Month of August			
Day.	Hour.	Height of Water.	Direction of Wind.	Day.	Hour.	Height of Water.	Direction of Wind.	Day.	Hour.	Height of Water.	Direction of Wind.
1	9½ A.M.	4.73	E	2	3 P.M.	4.50	E	1	4 P.M.	3.99	E
"	2 P.M.	4.72	E	4	9½ A.M.	4.50	S W	2	12 noon.	4.00	
2	9 A.M.	4.68	E	5	10 A.M.	4.46	S W	3	5 P.M.	4.00	E
"	1½ P.M.	4.63	E	6	9½ A.M.	4.37	S W	5	12 noon.	3.95	
3	9½ A.M.	4.68	S W	7	12 noon.	4.40	S	7	4 P.M.	3.96	
4	10 A.M.	4.61	S E	16	12 noon.	4.15	S	8	4 P.M.	3.93	
6	9½ A.M.	4.68	S E	18	11 A.M.	4.25	S	10	4 P.M.	3.90	
7	9½ A.M.	4.60	W	20	12½ P.M.	4.17	W	12	12 noon.	3.86	
11	9½ A.M.	4.66	E	25	9 A.M.	4.13	S W	15	12 noon.	3.85	S E
16	11 A.M.	4.70	Calm.	27	12 noon.	4.05	S	16	12 noon.	3.81	S E
17	10½ A.M.	4.62	S W	30	11 A.M.	4.00	S E	18	11 A.M.	3.80	
20	9¾ A.M.	4.59	S W					20	4 P.M.	3.82	
23	9¾ A.M.	4.60	S W					23	10 A.M.	3.60	
21	12 noon.	4.55	W					25	9 A.M.	3.60	
25	9½ A.M.	4.43	N W					27	12 noon.	3.60	
28	9½ A.M.	4.50	E					29	12 noon.	3.40	
30	9 A.M.	4.54	S W					31	22 P.M.	3.40	

These observations are taken from a scale established at Gorrie's Wharf. The zero of which scale is left below the sill of the South West door of the Custom House, and corresponds with the scale on the Queen's Wharf, established by Capt. Lefroy.

We reserve for the next number of the Journal other data connected with the variations of the level of the lakes, as well as the discussion of the inferences which may be drawn from them. Meanwhile, we call *attention to the following interesting* paper, by Colonel Jackson, which has been widely circulated in manuscript, (in 1847,) but which has not yet, as far as we are aware, appeared in any accessible publication. It is addressed to the Royal Geographical Society.

On the Seiches of Lakes, by Col. J. R. Jackson, F. R. G. S., St. Petersburgh.

The Lake Leman, or of Geneva, has been long remarkable for a phenomenon known by the name of *Seiches*, and which has been considered peculiar to this lake: it consists of a kind of ebb and flow of the waters of the lake, in certain parts, without wind or any other apparent cause. While the phenomenon lasts, the waters are seen to rise and fall several times in the course of a few hours. These oscillations, more or less considerable, sometimes attain the height of 5 feet, though the general maximum seldom exceeds 2 feet: in the greater number of cases, the rise is confined to a few inches, the minimum being 0.

The *Seiches* of the Lake of Geneva, were observed in the beginning of the last century, by Fatio de Duilliers, who has given a description of them in a Memoire inserted in the 2nd volume of Spon's "Histoire de Geneve." Shortly after Professor Jallabert made mention of them in the "Memoires de l'Academie des Sciences." And more lately Mr. Serre in the "Journal des Savans;" Professor Bertrand, in an academical dissertation, not printed; as also de Saussure in the 1st Volume of his "Voyage aux Alps," have successively described this singular phenomenon.

Nothing, however, having been explained in a satisfactory manner, I wrote, some months since, to a learned Professor of Geneva, on the subject, proposing questions, the answers to which I hoped might throw some light on the nature of a fact which I apprehended to be by no means peculiar to the lake of Geneva, and I have reason to congratulate myself that the result of this step has been the publication of an able and detailed memoir on the subject by Professor Vaucher, which memoir had been written many years before, and which, in all probability, would never have been printed, but at the instigation of Professor Maurice, to whom I had written, and who, with that readiness which distinguishes the real lover of science, interested himself immediately in the subject.

From Professor Vaucher's memoir, a 4-to of 60 pages, written in French, so far back as the years 1803-4 it appears:—

1stly, That the Seiches of the Lake of Geneva are much more frequent than is generally imagined.

2ndly, That they happen at all seasons of the year and at all hours of the day; but that they are, generally speaking, most frequent in the Spring and in the Autumn.

3rdly, That the state of the atmosphere seems to have a decided influence, it being remarked, that in proportion as that state is less changeable, so are the Seiches less frequent, and *vice versa*. The Seiches have always been "*considerable*" (query as to frequency or magnitude?) when the atmosphere has been loaded with heavy clouds, or when the weather, in other respects severe, has threatened to be stormy, and when the barometer has sunk.

4thly, That although the seiches are more frequent in the Spring and in the Autumn, they are, however, more "*considerable*" (rise higher) in the summer, and in particular towards the close of that season. The highest that have been observed happened in the month of September.

5thly, The minimum of the Seiches has no precise term, their maximum seems to be 5 feet.

6thly, That although the duration of the *Seiches is very* variable, its greatest extent seems not to exceed 20 or 25 minutes, but usually lasts a much shorter time.

7thly, That the Seiches are not peculiar to the Lake of Geneva, Mr. Vaucher having observed them on the Lakes of Zurich, of Annecy and of Constance.

It appears unquestionable that the phenomenon of the Seiches is due to an unequal pressure of the atmosphere on different parts of the Lake at the same time, that is, to the simultaneous effect of columns of air of different weight or different elasticity, arising from temporary variations of temperature or from mechanical causes; and if such be in fact the case, all lakes of a certain extent, and even inland seas, must be subject to the same influence, and therefore present the same phenomenon; and I have little doubt but that correct observations will verify this presumption.

Moreover, the effect of unequal atmospheric pressure, in producing inequality in the level of the surface of large masses of water, once established as a positive fact, will throw much light upon several subjects interesting to physical geography, particularly upon that of currents, as affected by sea and land breezes, irregular winds, sudden changes of temperature, the configuration and aspect of coasts as regards the Sun, and the consequent periodical influence of reverberated heat on the density of the circumjacent air. It is, therefore, upon these considerations that I am desirous of calling to the subject the attention of such persons, as from the habitual nature of their occupations, or their studies, or their love of science, are best enabled to add to our knowledge regarding it; and in the hopes that some of the members of our Society, or that, at their instigation, others who may be in the vicinity of lakes in any part of the world, will take up the subject, I shall venture to offer what I conceive to be the best method of operating.

1st, Several points must be chosen on the lake, some in its narrower and some in its wider parts, as well as at the mouth of its most considerable *affluent*, and at the immediate egress of its main outlet. If the surface of the lake be observed to incline towards the outlet from any distance, a station should be established at the commencement of this slope, as well as at the immediate egress.

2ndly, These points once chosen, a squared pole must be driven, having marked upon it, in white upon a black, or in black upon a white ground, feet, inches, and lines, for at least five feet above and as many below, the general water level. To this pole must be added a float, surrounded by a rod to act as an indicator, which rod must slide easily in brackets fastened to the pole. Round the pole and rising above the water, an inclosure of about 2 or 3 feet diameter must be established of hurdles or planks, in such wise, that while the water within has free communication with that which is without the enclosures, so as to rise and fall with it, the former may be kept calm and secured from all influence of winds and waves.

3rdly, These stations being established, two observers at least, and more if possible, must commence their observations at an hour agreed upon, having first compared their watches. If *each* observer could at the same time be furnished with a barometer, thermometer, and hygrometer, the general results of their observations would be so much the more satisfactory; but one instrument of each kind is indispensable. In the former case, each observer will note the indications of his own instrument.

4thly, Care must therefore be taken to note down at the beginning, during, and at the close of the observations, the indications of the several instruments, together with the general state of the weather and the direction of the wind, if there be any, though it is most advisable *to observe before* and after wind.

5thly, The change of level of the water must be noted sometimes every minute; at others every ten minutes—every half hour—or every hour. The observations should be sometimes made at sunrise, three hours after his ascension, at noon, at 3 in the afternoon and at sunset, as also after, if convenient, in order to see how far the hour exercises an influence on the phenomenon. It would likewise be well to observe if the moon has any influence, and, for this purpose, observations should be made at the new and full moons and at the quadratures.

6thly, On an outline sketch plan of the lake must be marked the different stations, numbered or lettered, indicating the distance of each station from each other. This is necessary in order that the observer may be assured whether the rise or fall observed simultaneously at two or more stations are distinct and independent, though simultaneous effects, or dependent and corresponding oscillations.

7thly, For each series of observation, a table, in the following form, should be arranged:

OBSERVATIONS *on the Seiches of Lake* ______________

made by ______________________ Date ____________

TIME OF DAY.		STATION A.	STATION B.	&c	REMARKS.
HOUR.	MIN.				
9	0	r or f.* ft in li.	r. or f. ft. in li.		
	10				
	20				
	&c.				

Moreover, in order that nothing may be omitted which can be supposed to exercise any influence, the topographical structure of the basin, and particularly the aspect, height, condition, and nature of the hills in the immediate vicinity of the lake, if there be any; or, otherwise, their absence must be carefully noted.

It were needless to add, that the more numerous the observations, the better; and the more that may be made simultaneously, the more satisfactory will be the result.

I will not presume so far to question the sagacity of the Society, as to enumerate all the advantages that are likely to accrue from observations of the kind just stated, they will be, I doubt not, as evident to all, as they are to myself, and it is from this conviction, that I venture to call the attention of my colleagues to the subject.

Schutter, as may be seen in the "Memoirs de l'Academie des Sciences de Stockholm" for 1804, explains the irregular rise and fall of the Baltic on the same principle as de Saussure and Vaucher explain the Seiches of the lake of Geneva. I hope to be one day enabled to add further observations in support of the general prevalence of the phenomenon.

I have lately written to a most eminent philosopher, the

* R. or F. for *rise* or *fall*, as it may be. All that is required is *relative* rise and fall, the height at which the water may be found on commencing the operation will always be 0. In the column of remarks will be consigned the indications of the barometer, &c.

present boast of Sweden, begging of him to institute observations (similar to those here proposed) upon the great lakes of his country; I have also written to the United States, on the same, and circulars have been addressed, officially, to the Engineer Officers stationed at the several great lakes of Russia, as far as the Baikal, for the same purpose. If, as I trust, we shall by these means obtain a mass of well-authenticated information, we shall have one fact more to add to our knowledge of the earth, and one fact often leads to many. I sincerely hope the Royal Geographical Society will not consider the subject unworthy their notice.

To the above I may add that self-registering indicators would be very desirable, because the phenomenon is one which happens only occasionally, and that suddenly, giving no previous warning. These indicators would show what had taken place in the absence of the observer, and if, after a time, the phenomenon was observed to be more frequent than is supposed, or to happen at stated times, then the observers might, so to say, lie in wait for them, and notice all the facts of the case.

T. JACKSON.

The Narcotics we Indulge In.*

In ministering fully to his natural wants, man passes through three successive stages. First, the necessities of his material existence are provided for; next, his cares are assuaged and for the time banished; and lastly, his employments, intellectual and animal, are multiplied, and for the time exalted. Beef and bread represent the means by which, in every country, the first end is attained; fermented liquors help us to the second; and the third we reach by the aid of narcotics.

When we examine, in a chemical sense, the animal and vegetable productions which in a thousand varied forms, among various nations, take the place of the beef and pudding of the Englishman in supplying the first necessities of our nature, we are struck with the remarkable general similarity which prevails among them naturally, or which they are made to assume by the artifices of cookery, before they are conveyed into the stomach. And we exclaim, in irrepressible wonder, "by what universal instinct is it that under so many varied conditions of climate and of natural vegetation, the experience of man has led him everywhere so nicely to adjust the chemical constitution of the staple forms of his diet to the chemical wants of his living body?" Nor is the lightening of care less widely and extensively attained. Savage and civilised tribes, near and remote—the houseless barbarian wanderer, the settled peasant, and the skilled citizen—all have found, without intercommunion, through some common and instinctive process, the art of preparing fermented drinks, and of procuring for themselves the enjoyments and miseries of intoxication. The juice of the cocoa-nut tree yields its *toddy* wherever this valuable palm can be made to grow. Another palm affords a fermented wine on the Andean slopes of Chili—the sugar palm intoxicates in the Indian Archipelago, and among the Moluccas and Phillippines—while the best palm wine of all is prepared from the sap of the oil-palms of the African coast. In Mexico the American aloe *(Agave Americana,)* gave its much-loved *pulque*, and probably also its ardent brandy, long before Cortez invaded the ancient monarchy of the Aztecs. Fruits supply the cider, the perry, and the wine, of many civilized regions—barley and the cereal grains the beer and brandy of others; while the milk of their breeding mares supplies at will to the wandering Tartar, either a mild exhilarating drink, or an ardently intoxicating spirit. And to our wonder at the wide prevalence of this taste, and our surprise at the success with which, in so many different ways, mankind has been able to gratify it, the chemist adds a new wonder and surprise when he tells us, that, as in the case of his food, so in preparing his intoxicating drinks, man has everywhere come to the same result. His fermented liquors, wherever and from whatever substances prepared, all contain the same exciting alcohol, producing everywhere upon every human being, the same *exhilerating effects* !

It is somewhat different as regards the next stage of human wants—the exalted stage which we arrive at by the aid of narcotics. Of these narcotics it is remarkable that almost every country or tribe has its own—either aboriginal or imported—so that the universal instinct has led somehow or other to the universal supply of this want also.

The aborigines of Central America rolled up the Tobacco leaf, and dreamed away their lives in smoky reveries, ages before Columbus was born, or the colonists of Sir Walter Raleigh brought it within the chaste precincts of the Elizabethan court. The cocoa leaf, now the comfort and strength of the Peruvian muletero, was chewed as *he* does it, in far remote times, and among the same mountains, by the Indian natives whose blood he inherits. The use of opium and hemp, and the betel nut, among eastern Asiatics, mounts up to the times of most fabulous antiquity, as probably does that of the pepper tribe in the South Sea Islands and the Indian Archipelago; while in northern Europe the hop, and in Tartary the narcotic fungus, have been in use from time immemorial. In all these countries the wished for end has been attained, as in the case of intoxicating drinks, by different means; but the precise effect upon the system, by the use of each substance, has not, in this case been the same. On the contrary, tobacco, and cocoa, and opium, and hemp, and the hop, and *Cocculus indicus*, and the toadstool, each exercises an influence upon the human frame, which is peculiar to itself, and which in many respects is full of interest, and deserving of profound study. These differences we so far know to arise from the active substance they severally contain being chemically different.

I. Tobacco.—Of all the narcotics we have mentioned, tobacco is in use over the largest area, and by the greatest number of people. Opium comes next to it; and the hemp plant occupies the third place.

The tobacco plant is indigenous to tropical America, whence it was introduced into Spain and France in the beginning of the sixteenth century by the Spaniards, and into England half a century later (1586) by Sir Francis Drake. Since that time, both the use and the cultivation of the plant have spread over a large portion of the globe. Besides the different parts of America, including Canada, New Brunswick, the United States, Mexico, the Western coast, the Spanish main, Brazil, Cuba, St. Domingo, Trinidad, &c., it has spread in the East into Turkey, Persia, India, China, Australia, the Phillipine Islands, and Japan. It has been raised with success also in nearly every country of Europe; while in Africa it is cultivated in Egypt, Algeria, in the Canaries, on the Western coast, and at the Cape of Good Hope. It is, indeed, among narcotics, what the potato is among food-plants—the most extensively cultivated, the most hardy, and the most tolerant of changes in temperature, altitude, and general climate.

We need scarcely remark, that the use of the plant has become not less universal than its cultivation In America it is met with everywhere, and the consumption is enormous. In Europe, from the plains of sunny Castile to the frozen Archangel, the pipe and the cigar are a common solace among all ranks and conditions. In vain was the use of it prohibited in Russia, and the knout threatened for the first offence, and death for the second. In vain Pope Urban VIII. thundered out his bull against it. In vain our own James I. wrote his "Counterblaste to Tobacco." Op-

* Abridged from Blackwood—August 1853.

position only excited more general attention to the plant, awakened curiosity regarding it, and promoted its consumption.

So in the East—the priests and sultans of Turkey and Persia, declared smoking a sin against their holy religion, yet nevertheless the Turks and Persians became the greatest smokers in the world. In Turkey the pipe is perpetually in the mouth; in India all classes and both sexes smoke; in China the practice is so universal that "*every female, from the age of eight or nine years, wears as an appendage to her dress a small silken pocket, to hold tobacco and a pipe.*" It is even argued by Pallas that the extensive prevalence of the practice in Asia, and especially in China, proves the use of tobacco for smoking to be more ancient than the discovery of the New World. "Amongst the Chinese," he says, "and amongst the Mongol tribes who had the most intercourse with them, the custom of smoking is so general, so frequent, and has become so indispensable a luxury; the tobacco purse affixed to their belt so necessary an article of dress; the form of the pipes, from which the Dutch seem to have taken the model of theirs, so original; and, lastly, the preparation of the yellow leaves, which are merely rubbed to pieces and then put in to the pipe, so peculiar—that they could not possibly derive all this from America by way of Europe, especially as India, where the practice of smoking is not so general, intervenes between Persia and China."*

Leaving this question of its origin, the reader will not be surprised, when he considers how widely the practice of smoking prevails, that the total produce of tobacco grown on the face of the globe has been calculated by Mr. Crawford to amount to the enormous quantity of two millions of tons. The comparative magnitude of this quantity will strike the reader more forcibly, when we state that the whole of the wheat consumed by the inhabitants of Great Britain—estimating it at a quarter a-head, or in round numbers at twenty millions of quarters—weighs only four and one-third millions of tons; so that the tobacco yearly raised for the gratification of this one form of narcotic appetite weighs as much as the wheat consumed by ten millions of Englishmen. And reckoning it at only double the market value of wheat, or two pence and a fraction per pound, it is worth in money as much as all the wheat eaten in Great Britain.

The largest producers, and probably the largest consumers, of tobacco, are the United States of America. The annual production, at the last two decennial periods of their census returns, was estimated at

1840	- - -	219,163,319 lb.
1850	- - -	199,752,646 "

being about one-twentieth part of the whole supposed produce of the globe.

One of the remarkable circumstances connected with the history of tobacco, is, the rapidity with which its consumption and growth have increased, in almost every country, since the discovery of America. In 1662, the quantity raised in Virginia—the chief producer of tobacco on the American shores of the Atlantic—was only 60,000 lb.; and the quantity exported from that colony in 1689, only 120,000 lb. In two hundred and thirty years the produce has risen to nearly twice as many millions. And the extension of its use in our own country may be inferred from the facts that, in the above year of 1689, the total importation was 120,000 lb. of Virginian tobacco, part of which was probably re-exported; while, in 1852, the quantity entered for home consumption amounted to

28,558,753 lb.

being something over a pound per head of the whole population; and to this must be added the large quantity of contraband tobacco, which the heavy duty of three shillings per pound tempts the smuggler to introduce. The whole duty levied on the above quantity in 1852, was £4,560,741, which is equal to a poll-tax of 3s. a-head.

Tobacco, as every child among us now knows, is used for smoking, for chewing, and for snuffing. The second of these practices is, in many respects, the most disgusting, and is now rarely seen in this country, except among seafaring men. On shipboard, smoking is always dangerous, and often forbidden; while snuffing is expensive and inconvenient; so that, if the weed must be used, the practice of chewing it can alone be resorted to.

For the smoker and chewer it is prepared in various forms, and sold under different names. The dried leaves, coarsely broken, are sold as canaster or knaster. When moistened, compressed, and cut into fine threads, they form cut or shag tobacco. Moistened with molasses or with syrup, and pressed into cakes, they are called cavendish and negrohead, and are used indifferently either for chewing or smoking. Moistened in the same way, and beaten until they are soft, and then twisted into a thick string, they form the pigtail or twist of the chewer. Cigars are formed of the dried leaves, deprived of their midribs, and rolled up into a spindle. When cut straight, or truncated at each end, as is the custom at Manilla, they are distinguished as *cheroots.*

For the snuff-taker, the dried leaves are sprinkled with water laid in heaps, and allowed to ferment. They are then dried again, reduced to powder, and baked or roasted. The dry snuffs, like the Scotch and Irish, are usually prepared from the midribs—the rappees, or moist snuffs, from the soft part of the leaves. The latter are also variously scented, to suit the taste of the customer.

Extensively as it is used, it is surprising how very few can state distinctly the effects which tobacco produces—can explain the kind of pleasure the use of it gives them—why they began, and for what reason they continue the indulgence. In truth, few have thought of these points—have cared to analyse their sensations when under the narcotic influence of tobacco—or, if they have analysed them, would care to tell truly what kind of relief it is which they seek in the use of it. "In habitual smokers," says Dr. Pereira, "the practice, when employed moderately, provokes thirst, increases the secretion of saliva, and produces a remarkably soothing and tranquilising effect on the mind, which has made it so much admired and adopted by all classes of society, and by all nations, civilised and barbarous." Taken in excess in any form, and especially by persons unaccustomed to it, it produces nausea, vomiting, in some cases purging, universal trembling, staggering, convulsive movements, paralysis, torpor, and death. Cases are on record of persons killing themselves by smoking seventeen or eighteen pipes at a sitting. With some constitutions it never agrees; but both our author and Dr. Christison of Edinburgh agree that "no well-ascertained ill effects have been shown to result from the habitual practice of smoking." The effects of chewing are of a similar kind. Those of snuffing are only less in degree; and the influence which tobacco exercises in the mouth, in promoting the flow of saliva, &c., manifests itself when used as snuff in producing sneezing, and in increasing the discharge of mucus from the nose. The excessive use of snuff, however, blunts the sense of smell, alters the tone of voice, and occasionally produces dyspepsia and loss of appetite. In rarer cases it ultimately induces apoplexy and delirium.

But it is the soothing and tranquilising effect it has on the mind for which tobacco is chiefly indulged in. And amid the teasing paltry cares, as well as the more poignant griefs of life, what a blessing that a mere material soother and tranquiliser can be found, accessible alike to all—to the desolate and the outcast,

* M'Culloch's Commercial Dictionary, edit. 1847, p. 1314.

equally with him who is rich in a happy home and the felicity of sympathising friends! Is there any one so sunk in happiness himself, as to wonder that millions of the world-chafed should flee to it for solace? Yet the question still remains which is to bring out the peculiar characteristic of tobacco. We may take for granted that it acts in some way upon the nervous system; but what is the special effect of tobacco on the brain and nerves, to which the pleasing reverie it produces is to be ascribed? "The pleasure of the reverie consequent on the indulgence of the pipe consists," according to Dr. Madden, "in a temporary annihilation of thought. People really cease to think when they have been long smoking. 'I have asked Turks repeatedly what they have been thinking of during their long smoking reveries, and they replied, 'Of nothing.' I could not remind them of a single idea having occupied their minds; and in the consideration of the Turkish character there is no more curious circumstance connected with their moral condition. The opinion of Locke, that the soul of a waking man is never without thought, because it is the condition of being awake, is, in my mind, contradicted by the waking somnambulism, if I may so express myself, of a Moslem."*

We conceive that Dr. Madden might find in England, in Germany, and in Holland, many good smokers, who would make excellent Moslems in his sense, and who at the close of long tobacco reveries are utterly unconscious and innocent of a single thought. Yet we restrict our faith in his opinion to the simple belief, that tobacco with the haze such as its smoke creates, tends to soften down and assuage the intensity of all inner thoughts or external impressions which affect the feelings, and thus to create a still and peaceful repose—such a quiet rest as one fancies might be found in the hazy distance of Turner's landscapes. We deny that, in Europeans in general, smoking puts an end to intellectual exertion. In moderation, our own experience is, that it sharpens and strengthens it; and we doubt very much if those learned Teutonic Professors, who smoke all day, whose studies are perpetually obscured by the fumes of the weed, and who are even said to smoke during sleep, would willingly, or with good temper, concede that the heavy tomes which in yearly thousands appear at the Leipsic book fair, have all been written after their authors had "really ceased to think." Still it is probably true, and may be received as the characteristic of tobacco among narcotics, that its major and first effect is to assuage, and allay, and soothe the system in general; its minor, and second, or after effect, to excite and invigorate, and, at the same time, give steadiness and fixity to the powers of thought.

The active substances, or chemical ingredients of tobacco, or tobacco smoke, by which these effects upon the system are produced, are three in number. The *first* is a volatile oil, of which about two grains can be obtained from a pound of leaves, by distilling them with water. This oil, or fat, "is solid, has the odour of tobacco, and a bitter taste. It excites in the tongue and throat a sensation similar to that of tobacco smoke; and, when swallowed, gives rise to giddiness, nausea, and an inclination to vomit." Small as the quantity is, therefore, which is present in the leaf, this substance must be regarded as one of the ingredients upon which the effects of tobacco depend.

The *second* is a volatile *alkali*, as it is called by chemists, which is also obtained by a form of distillation. The substance is liquid, has the odour of tobacco, an acrid, burning taste, and is possessed of narcotic and highly poisonous qualities. In this latter quality it is scarcely inferior to Prussic acid. The proportion of this substance contained in the leaf varies from 3 to 8 per cent., so that he who smokes a hundred grains of tobacco *may* draw into his mouth from three to eight grains of one of the most subtle of all known poisons. It will not be doubted, therefore, that some of the effects of tobacco are to be ascribed to this peculiar substance.

The third is an oil—an empyreumatic oil it is called—which does not exist ready *formed in the natural leaf, but is* produced along with other substances during the burning. This is supposed to be "the juice of cursed hebenon," described by Shakespeare as a *distilment*. It is acrid, disagreeable to the taste, narcotic, and so poisonous that a single drop on the tongue of a cat causes immediate convulsions, and in two minutes death.

Of these three active ingredients contained in tobacco smoke, the Turkish and Indian pipes, in which the smoke is made to pass slowly through water, arrest a large proportion, and therefore convey the air to the mouth in a milder form. The reservoir of the German meerschaums retains the grosser portions of the oils, &c., produced by burning; and the long stem of the Russian pipe has a similar effect. The Dutch and English pipes retain less; while the cigar, especially when smoked to the end, discharges everything into the mouth of the smoker, and, when he retains the saliva, gives him the benefit of the united action of all the three narcotic substances together. It is not surprising, therefore, that those who have been accustomed to smoke cigars, especially such as are made of strong tobacco, should find any other pipe both tame and tasteless, except the short black *cutty*, which has lately come into favour again among inveterate smokers.

The chewer of tobacco, it will be understood from the above description of its active ingredients, is not exposed to the effects of the oil which is produced during the burning. The natural oil and the volatile alkali are the substances which act upon him. The taker of snuff is in the same condition. But *his* drug is still milder than that of the chewer, inasmuch as the artificial drying or roasting to which the tobacco is subjected in the preparation of snuff, drives off a portion of the natural volatile oil, and a large part of the volatile alkali, and thus renders it considerably less active than the natural leaf.

In all the properties by which tobacco is characterised, the produce of different countries and districts is found to exhibit very sensible differences. At least eight or ten species, and numerous varieties, of the plant are cultivated; and the leaf of each of these, even where they are all grown in the same locality, is found to exhibit sensible peculiarities. To these, climate and soil add each its special effects; while the periods of growth at which the leaves are gathered, and the way in which they are dried or cured, exercise a well-known influence on the quality of the crop. To these causes of diversity is owing, for the most part, the unlike estimation in which Virginian, Cuban, Brazilian, Peruvian, East Indian, Persian and Turkish tobaccos are held in the market.

The chemist explains all the known and well-marked diversities of quality and flavour in the unadulterated leaf, by showing that each recognised variety of tobacco contains the active ingredients of the leaf in a peculiar form or proportion; and it is interesting to find science in his hands first rendering satisfactory reasons for the decisions of taste. Thus, he has shown that the natural volatile oil does not exist in the green leaf, but is formed during the drying, and hence the reason why the mode of curing affects the strength and quality of the dried leaf. He has also shown that the proportion of the poisonous alkali (nicotin) is smallest (2 per cent.) in the best Havannah, and largest (7 per cent.) in the Virginian tobacco, and hence a natural and sound reason for the preference given to the former by the smokers of cigars.

*Madden. Travels in Turkey, vol. i. p. 16.

As to the lesser niceties of flavour, this probably depends upon other odoriferous ingredients not so active in their nature, or so essential to the leaf as those already mentioned. The leaves of plants, in this respect, are easily affected by a variety of circumstances, and especially by the nature of the soil they grow in, and of the manure applied to them. Even to the grosser senses of us Europeans, it is known, for example, that pigs' dung carries its *goût* into the tobacco raised by its means. But the more refined organs of the Druses and Maronites of Mount Lebanon readily recognise, by the flavour of their tobacco, the kind of manure employed in its cultivation, and esteem, above all others, that which has been aided in its growth by the droppings of the goat.

But in countries where high duties upon tobacco hold out a temptation to fraud, artificial flavours are given by various forms of adulteration. "Saccharine matter, (molasses, sugar, honey, &c.,) which is the principal adulterating ingredient, is said to be used both for the purpose of adding to the weight of the tobacco and of rendering it more agreeable. Vegetable leaves, (as those of rhubarb and the beech), mosses, bran, the sproutings of malt, beet-root dregs, liquorice, terra japonica, rosin, yellow ochre, fullers' earth, sand, saltpetre, common salt, sal-ammoniac"—such is a list of the substances which have been detected in adulterated tobacco. How many more may be in daily use for the purpose, who can tell? Is it surprising, therefore, that we should meet with manufactured tobaccos possessing a thousand different flavours for which the chemistry of the natural leaf can in no way account?

There are two other circumstances in connection with the history of tobacco, which, because of their economical and social bearings, are possessed of much interest.

First, Every smoker must have observed the quantity of ash he has occasion to empty out of his pipe, or the large nozzle he knocks off from time to time from the burning end of his cigar. This incombustible part is equal to one-fourth or one-fifth of the whole weight of the dried leaf, and consists of earthy or mineral matter which the tobacco plant has drawn from the soil on which it has grown. Every ton, when dried, of the tobacco leaf which is gathered, carries off, therefore, from four to five hundred weight of this mineral matter from the soil. And as the substances of which the mineral matter consists are among those which are at once most necessary to vegetation, and least abundant even in fertile soils, it will readily be understood that the frequent growth and removal of tobacco from the same field must gradually affect its fertility, and sooner or later exhaust it.

It has been, and still is, to a great extent, the misfortune of many tobacco-growing regions, that this simple deduction was unknown and unheeded. The culture has been continued year after year upon virgin soils, till the best and richest were at last wearied and worn out, and patches of deserted wilderness are at length seen where tobacco plantations formerly extended and flourished. Upon the Atlantic borders of the United States of America, the best known modern instances of such exhausting culture are to be fond. It is one of the triumphs of the chemistry of this century, that it has ascertained what the land loses by such imprudent treatment—what is the cause, therefore, of the barrenness that befalls it, and by what new management its ancient fertility may be again restored.

Second, It is melancholy to think that the gratification of this narcotic instinct of man should in some countries—and especially in North America, Cuba and Brazil—have become a source of human misery in its most aggravated forms. It was long ago remarked of the tobacco culture by President Jefferson, in his *Notes on Virginia,* that "it is a culture productive of infinite wretchedness. Those employed in it are in a continued state of exertion beyond the powers of nature to support. Little food of any kind is raised by them, so that the men and animals on these farms are badly fed, and the earth is rapidly impoverished." But these words do not convey to the English reader a complete idea of the misery they allude to. The men employed in the culture, who suffer the "infinite wretchedness," are the slaves on the plantations. And it is melancholy, as we have said, to think that the gratification of the passion for tobacco should not only have been an early stimulus to the extension of slavery in the United States, but should continue still to be one of the props by which it is sustained. The exports of tobacco from the United States in the year ending June 1850, were valued at ten millions of dollars. This sum European smokers pay for the maintenance of slavery in these states, besides what they contribute for the same purpose to Cuba and Brazil. The practice of smoking is in itself, we believe, neither a moral nor a social evil; it is merely the gratification of a natural and universal, as it is an innocent instinct. Pity that such evils should be permitted to flow from what is in itself so harmless!

(To be continued).

The Electric Light.

Suggestions for some new methods for its management by
CHRISTOPHER BINKS, ESQ.

In the ordinary arrangements of the carbon electrodes used for producing light by the passage through them of a current of voltaic electricity, two rods or pencils of solid charcoal are employed, and these, held vertically, are placed end to end, the straight line formed by them being broken at the point where the two ends meet, between which ends is left a minute intervening space, measuring generally from about $\frac{1}{16}$ to $\frac{1}{4}$ inch, according to the strength of the passing current of electricity. These rods though not in actual contact at their points, form part of the circuit, connecting together the two poles of the exciting battery; for the so-called current of electricity passes through the intervening space, giving rise, in its passage, to the peculiar phenomenon of the electric light. So evolved, however, its intensity is in all such arrangements, perpetually varying; for the quantity of the light varies according to the distance, one from the other of the carbon ends or points, and this distance is continually altering, either through alterations in the power of the battery, or through the burning away of the carbon by the disintegrating action upon it of the current of electricity, or through the transference which continually takes place of particles of the carbon from the one electrode to the other. The result, in most or in all cases hitherto, is the production of a light that is intermittent—the effects of fluctuations in the quantity of light evolved from time to time, and which no contrivance that has yet been applied with a view to the maintaining of the carbon points at a fixed distance, under the existing conditions of change peculiar to the elements engaged, has hitherto been able to obviate.

I would suggest, firstly, in place of forming each electrode (whether made of carbon or any other material) of a single rod or pencil, as heretofore, that it be formed of two, three, four, or more separate rods or pencils, and, consequently, have as many light-emanating points as there are separate rods, and that these rods be placed close together, and all act together at their points, as a common centre of emanation for the production of one light; so that the chances of *perceptible* variations in the amount, and in the effects of the light evolved, shall be reduced in the proportion to the number of points in the electrode from which the light emanates, and that are brought into action at one and the same time.

This kind of arrangement I would call a *compound electrode.* A negative compound electrode may consist, for example, of two three, four or more, solid cylinders, or rods of charcoal, or other material, placed side by side, close together, but without actual contact, and having as many points as there are rods brought in juxta-position (for the light emanating points) to the opposite or positive electrode. And the opposite or positive electrode in such an arrangement may consist of several cylinders or rods, placed and acting side by side, or of only one cylinder or rod, with its extremity brought into close juxta-position with the ends or points of the opposite compound electrode. The group, or bundle of separate cylinders, forming a compound electrode, may have one common connection with the battery; or each rod or cylinder may itself be made to constitute an independent conductor of the current.

In all arrangements of light-giving electrodes, wherein the material forming the electrode is destructible, as charcoal is, one of the electrodes under the action of the electric current, is more rapidly worn away than the other; and the one least acted on is called the "non-consuming," and the other the "wasting" electrode. In practically using these proposed compound electrodes, I would suggest, out of the numerous modifications of them that can obviously be adopted, the employment of a single rod of charcoal or other material for the "non-consuming" electrode, and the placing of this undermost: whilst the "wasting" electrode is composed of a combination of *three* separate rods, connected by one common conductor with the battery. But both the electrode may be "compound," and the individual parts of each be collectively connected with the battery; or each of its parts or rods may have an independent connection with the battery. And the "non-consuming" electrode may be a "compound" one, whilst, the "wasting," electrode is made to consist of only a single rod.

But howsoever varied in its details, the character of the proposed plan is the same—resorting for re-adjustment from time to time of the distance one from the other of the acting electrodes, to any of the ingenious plans already in existence for the accomplishment of this object when applied to the single-rod electrodes and which contrivances are equally applicable to these compound electrodes—in place of one point of emanation only, as heretofore, formed by the approximation of the ends of single rods, to have several points of emanation for each light obtained by the employment of compound electrodes, from each of whose points the light is evolved.

In an arrangement, for example, in which *three* of charcoal form a compound wasting electrode, should *one* of three points referred to come to be removed from the opposite electrode beyond the maximum light distance, through waste or transfer, or otherwise, then a quantity of the current of electricity that would otherwise pass through this *one* point is transferred to and passes through the other *two* points that are still within full acting distance from the opposite electrode; and this transference of the current or concentration in two, instead of in three of the rods, serves immediately to increase the action of, and consequently the quantity of, light given out by these two more active points. In the same way it results if *two* instead of *one* of the points be thrown out of action fully or comparatively, and only *one* of the three remains close enough to the opposite electrode, and consequently in full activity—a more active current passes through this one remaining active point, and the light it gives out is increased in proportion, or in a proportion that neutralises the defects in the non or less active points.

After the same manner it occurs when in place of a compound electrode of three points, one consisting of four, five, or of any other greater number is used—the wasting of the material of the electrode, or the shifting in distance from the opposite electrode of all the points in such compound electrodes, can seldom, if ever, take place exactly to the same extent, and exactly at the same moment of time; consequently, a failure in any one point to give out light, or its full amount of light, is comparatively unimportant; and the points that are the least wasted or shifted do, by their consequent increased action, compensate for or reduce the effects of such deficiency to an extent that no contrivance when applied to the old or single rod electrodes has yet been able to secure.

Secondly, there is a certain point in the space between the electrodes, or a certain distance of the one electrode from the other, in all arrangements intended to produce light by the electric current, at which the maximum quantity of light is obtained, but which point is not that of *actual* contact, nor perhaps that the most immediately preceding actual contact in the act of approaching to it. But this maximum light point—or the exact distance corresponding with it, is that which photo-mechanists have hitherto attempted to secure and maintain by a fixture of the electrodes at it, or by contrivances for replacing the points of the electrodes in it when shifted through changes in the structure of the charcoal, by disintegration or transfer, or through alterations in the power of the electric current. But as a solution of the mechanical difficulties that unquestionably exist (whether applied to the single-rod or to the above newly-proposed compound electrodes), in the way of keeping the carbon points or electrodes always at the right striking distance, I would suggest that we should not fix, or attempt to fix, the distance of the electrodes at this point, or to replace them in any fixed position when accidentally shifted from it through structural changes in the carbon, or through variations in the acting condition of the battery, requiring corresponding changes in the relative position of the electrodes, but, on the contrary, that we should bring into action a converse method—that is, I would cause the electrodes, one or both, or all of them, if there should be more than two in the arrangement, successively to approach to, but without actual contact, and to recede from each other by such a movement imparted to one or both, or all of the electrodes, that their relative distance, or the space between them, shall, within certain limits, be continually changing; and this so rapidly that the eye shall be unable to detect the different intensities of the light evolved under the different distances of the electrodes, or when they are the nearest to, and when the farthest apart from each other.

In other words, I would cause the electrodes to be continually changing their relative position, and in doing so to travel through a certain space within the limits of which is embraced the maximum-light point. In this way is obtained a light, the effect or intensity of which is the mean of all the quantities evolved within the space through which the electrodes travel; and which light is apparently steady and invariable, by reason of the rapidity of the movement, and the consequent incapacity of the eye to detect the differences that really occur.

We can obtain these changes in position of the electrodes, or in their relative distance, and the consequent results, by imparting, by any convenient mechanical contrivance, a vibratory, an oscillating, or a rotary movement to one of the electrodes, whilst the other remains stationary, or by giving such motion to both electrodes, or to any set or number of electrodes. And we can either employ a single arrangement of electrodes (that is, a single positive, and a single negative electrode, constituting together a *set*), as the source of the light, or combine together for one light the effects of two or more such *sets*.

The particular motion for working the electrodes may be obtained by the vibration of a wire or wires carrying the charcoal points, and which points, in the act of vibrating, successively approach to, and recede from, each other, within limits that may be adjusted and regulated according to the power of the current of electricity in use; or the motion can be given by the vibration of a metallic fork, carrying the carbon on each branch; or by an eccentric wheel movement, carrying the electrodes within the required limits rapidly towards, and then away from each other, on each revolution; or by the revolution of two discs on a common axis, but revolving in contrary directions, carrying carbon arms or radii, acting as the electrodes and crossing each other scissor-wise, but without actual contact at any time, and in this way causing the light-emanating points or edges successively and continually to close upon, and to separate from each other; or the motion can be obtained by the rapid revolution of two carbon wheels with serrated edges placed and acting edge to edge; or by the revolution of two wheels or rings, placed concentrically with the proximate, or light-emanating portions serrated, or made angular; or the like results can be obtained by a variety of other forms and arrangements of the electrodes, and the requisite motive-power be supplied by clock-work, by magneto-electric action, &c.; but, howsoever arranged or accomplished, mechanically, I would cause the electrodes alternately to approach to, and to recede from each other, by a movement so rapid that a light free from any sudden or apparent fluctuations is produced.

If with a battery there be connected two wires (thick enough not to have their elasticity affected by the heat of the current,) each carrying a ball of solid charcoal, the two balls acting as the electrodes, and these wires be stretched out parallel to each other, and be made to vibrate, so that the carbon balls shall come close together on each vibration but not into actual contact, we have a beautiful illustration of the pure light that vibrating electrodes may be made to yield, when all other essential conditions (as the renewal of the carbon) are provided for.

Again, if two narrow and longish slips or pencils of charcoal (forming the terminals of the circuit, or, in other words, the electrodes) be placed parallel, and close together, and be made to revolve on an axis in contrary directions, scissorwise, they yield a light which, when viewed from a direction in the plane of their revolution, appears as a *long pencil*, and when at right angles to that plane, as a *broad disc* of light, a method which supplies at once and readily a means of diffusing over almost any area the too intense light hitherto obtained by emanation from the minute point of the ordinary electrodes. The light in this arrangement, comes, of course, only from the points of the carbon that at any moment are the nearest together, but so rapidly does the change in position from one point to the other take place in the act of revolving, that the result is the impression on the eye either (according to what direction seen from) of a pencil or of a disc of light, the former of the entire length of the slips carbon used, the latter the size of the area of a circle, the diameter of which is the entire length of the slips.

In reference to a *diffused* electric light, the product of the action of those or of any other kind of *diffusing* electrodes, the writer need not point out among numerous other uses, its important applications in photography.

New uses of the Leaf of the Pinus Silvestris.

Not far from Breslau, in Silesia, in a domain called *la Prairie du Humboldt*, exist two establishments, equally astonishing on account of their objects and of their connexion; one is a manufactory in which the leaves of the pines are converted into a sort of cotton or wool; the other offers to the sick, as a salubrious bath, the waters left from the making of this vegetable wool.—Both were founded under the head Inspector of Forests, M. de Pannewitz, the inventor of a chemical process, by means of which from the long and slim leaves of the pines is procured a very fine filamentous substance, which has been called *wood-wool, (laine de bois,)* because it curls, felts, and may be spun like common wool.

The *pinus silvestris*, or wild-pine, whence this new product is procured, is already much esteemed in Germany, on account of several valuable advantages which it presents; and, in place of abandoning it to its natural growth, extensive plantations of it have been formed, which are true forests. When planted on light and sandy soils, which it prefers, and in which it grows with the greatest rapidity, it gives them consistency and solidity. Associated with the oak, it becomes shelter, under the shadow of which this latter acquires a great strength of development, until in its turn it rises above its protector. When the pine has reached its fortieth year, it furnishes very profitable crops of resin. Its wood is esteemed for buildings, &c. The employment which M. de Pannewitz has proposed to give to its leaves will, without doubt, contribute to spread still more the culture of a tree already so useful, and will perhaps, give it some favor in other countries where it is scarcely known.

All the acicular leaves of the pines, the firs, and coniferous trees in general, are composed of a bundle of fibres extremely fine and tenacious, which are surrounded and held together by a resinous substance in thin pellicles. When by heat, and by the employment of certain chemical reagents, the resinous substance is dissolved, it is easy to separate the fibres from each other, to wash them, and to free them from all foreign bodies. According to the method used, the woolly substance acquires a finer quality, or remains in a coarser state; and in the first case it is employed as wadding; in the second, as filling for mattresses. Such, in a few words, is the account of the discovery due to M. Pannewitz.

In practice, the *pinus silvestris* has been preferred to others because it has the longest leaves. There is no reason to doubt that in the countries in which other species of pines exist with equally long foliage, the same product may be as advantageously obtained. There is no danger in stripping the pine of its leaves even in its youth. This tree has need for its growth only of the whorls of leaves which terminate each branch; all the leaves which surround the rest of the branch may be stripped off without doing any harm. The operation must take place while they are green, for it is only then that they can serve for the extraction of the woolly substance. The stripping of the leaves is the province of poor people, and pays them good wages. The operation can only be performed every two years. The product of each gathering is one pound of leaves for a branch of the thickness of the finger. A beginner can gather thirty pounds per day; an experienced hand may get as much as one hundred and twenty. The profit is greater from a felled tree than one standing.

The first use which was made of this filamentous substance was to substitute it for cotton wadding in quilted coverlets. In the year 1842, the hospital of Vienna bought five hundred of these coverlets, and, after using them for several years, renewed its orders. It was remarked, among other things, that, under the influence of pine-wool, no kind of parasitic insect harboured in the bed, and the aromatic odour which they emitted was considered to be agreeable and beneficial. Soon afterward, the penitentiary of Vienna was provided with the same kind of coverlets. Since then they have been adopted, as have been also mattresses filled with the same wool, in the hospital La Charitè at Berlin, and at the hospital La Maternitè, and the soldiers' quarters at Breslau. An experience of five years in these establments has shown that the *wood-wool* is well fitted for use in coverlets, and for wadded goods, and is very durable.

At the end of five years a mattress of wood-wool had cost less than one of straw, which required the addition every year of at least two pounds of fresh straw. Furniture, in the construction of which this matter was used, was preserved from the attacks of moths. It cost three times less than hair, and the most skilful upholsterer could not distinguish an article of furniture in which it is used from a similar one stuffed with hair. We are, besides, assured that it may be spun and woven. The finest gives a thread resembling that of hemp, and is as strong. When spun, woven, and finished like cloth, it furnishes a product which may be employed for carpets, horse-furniture, &c.; when interwoven with a warp of linen, it may be used as bed coverings. The products of the manufactories of Zuckmantel and La Prairie d'Humboldt gained for their present owner, M. Weis, a bronze medal at the exhibition of Berlin, and a silver medal at that of Altenburg.

In the preparation of the *wood wool* there is produced an ethereal oil with sweet odour. This is at first of a green colour; exposed to the light, it takes an orange-yellow colour; when carried into a dark place it regains its green colour; by rectification it becomes as colourless as water. It has been shown to differ from the essence of turpentine, which is extracted from the stem of the same tree. Employed in various rheumatic and gouty affections, and applied as a balm upon wounds, it has produced salutary effects; as also in vermicular affections, and in the case of certain cutaneous tumours. When rectified, it answers as an excellent oil in the preparation of the finest lacs, which form the base of varnishes: and has been burned in lamps like olive oil. It dissolves caoutchouc completely, and in a short time. The perfumers of Paris use quite a large quantity of it.

It has been found that the liquid residuum which the boiling of the pine leaves leaves, exercises a very salutary action when employed as a bath; so that a bathing establishment has been annexed to the manufactory. This liquid has a greenish colour, verging on brownish; according to the circumstances and the mode of preparation, it is either gelatinous and balsamic, or acid: in this latter case prussic acid is produced. During the nine years since the establishment of the baths, their reputation and the number of their visitors have been constantly increasing.

When it is necessary to augment the efficacy of the baths, there is added an extract obtained by distillation of the ethereal oil of which we have spoken, an extract which also contains prussic acid. The liquid residuum is also concentrated to the consistency of a liquid extract, and then enclosed in sealed vessels to be used for baths at home.

The membraneous substance which is obtained by filtration when the fibre is washed is put in the form of bricks, and dried; it then serves as a combustible, and produces a large quantity of gas for lighting, which comes from the great quantity of resin which it contains. Henceforth, it may be used for heating and lighting the manufactory.—*Bib. Univ. de Generi.*

Manufacture of Sugar—Sugar Extracted from Molasses.

The manufacture of beet sugar has for some years been largely carried on in France. In ten years, the production has doubled notwithstanding the successive duties which have been laid, duties of an excessive character, since 100 kilogrammes of white loaf sugar pay 50 francs of duties, and sell at 150 francs. In 1842, the production of beet sugar throughout France was about 40 millions kilog., and to-day it is 80 millions. This progress has been owing to improvements each year in the manufacture.

Among these improvements, the most important is that called the *barytic*, introduced by MM. Leplay and Dubrunfaut, and which enables them to obtain 50 p. c. of the chrystallizable sugar contained in the molasses. It is well known, that for a long time this molasses was of little value. Its sugar was supposed to be wholly unchrystallizable, and its only use was for making alcohol by fermentation, for which purpose large distilleries had been constructed. In an establishment of this kind, directed by M. Leplay, 12000 killogrammes of the beet molasses were consumed per day, in making alcohol of 94 p. c., which was wholly used in the manufacture of fine liquors.

M. Leplay and M. Dubrunfaut, were the first to recognize that the sugar in the molasses was a sugar perfectly chrystallizable, and having all the characters of ordinary sugar; and that to chrystallize it, it was only necessary to separate the interfering foreign substances, by operating on the juice of the beet which furnishes the molasses. The solution of the problem was one of great importance, since the amount of molasses annually produced in France, was 40 millions kilog., containing more than half its weight of sugar.

Their process, as I have studied it for some years at the establishment of La Villette, near Paris, is as follows. It is based on the insoluble compound, which sugar forms with baryta. When a boiling solution of caustic baryta at 30 ° Baumé, is poured into the ordinary molasses, the substances contained immediately solidify into a porous crystalline mass, insoluble in water, and admitting therefore of thorough washing.

After being thus purified, the saccharate of baryta is white, and has the appearance of a " bouille epaisse ;" it is exposed to a current of carbonic acid, which takes up the baryta and sets the sugar at liberty. This operation is carried on in large vats of wood, 80 to 100 hectoliters in size, into which strong pumps worked by steam, inject carbonic acid obtained by the calcination of carbonate of lime in lime furnaces.

While the reaction of the carbonic acid is going on, it is observed that the " bouillie" of saccharate, before very thick, gradually liquifies, and when complete, the whole is a solution of sugar containing carbonate of baryta in suspension.

To separate the carbonate, the mixture is put up into sacs made of cotton fabric, through which the syrup filters clear, while the carbonate is retained. These sacs, after draining thoroughly, are pressed lightly in a screw press, and then subjected to a heavy hydraulic pressure, in order to extract the syrup from the carbonate. This syrup thus obtained, marks 18 to 22 ° Baumé, it is white, of agreeable taste, and holds in solution some traces of the carbonate and bicarbonate of baryta which may be removed by means of a sufficient quantity of plaster, or of sulphate of alumine. Finally, it is clarified by means of dried blood; it is skimmed and filtered, and boiled down like a syrup for the refinery, after which it is put into forms for chrystallizing. We thus obtain, at once, sugar equal in quality to the finest sugars of commerce.

With regard to the residues of this process—the carbonate of baryta, saline substances contained in the molasses, quicklime proceeding from the calcination of the limestone, etc., I have learned the following facts. The carbonate of baryta may be used an indefinite number of times; it is rendered caustic anew after each operation, by mixing it with charcoal and heating it, and so it serves again. The loss of the baryta, which is unavoidable is resupplied from sulphuret of baryum which M. Leplay prepares by calcining sulphate of baryta with 45 p. c. of charcoal, in a reverberatory furnace, and which he would prepare more advantageously still if he would apply the process suggested by Gibbs. which consists in reducing the sulphate by the gas of the refinery, The sulphuret of baryum possesses equally the property of precipitating the sugar, only there are two equivalents of sulphur when one of oxygen would suffice. In fact this last case gives,

$$\text{Sugar}+BaO+HO=\text{Saccharate of }BaO+HO,$$

whilst the sulphuret affords,

$$\text{Sugar}+2SBa+Ho=\text{Saccharate of }BaO, SBa.$$

There is hence lost 1 equivalent of sulphuret of baryum. To avoid this loss, 1 equivalent of potash or caustic soda is added to the molasses under trial; and then on pouring in the sulphuret of baryum, all the baryta is precipitated in the state of a saccharate, and the liquid retains the potassium in the state of a sulphydrate.

$$2\ \text{Sugar}+2\ SBa+HO=2\ \text{Saccharate of }BaO+SH, SK.$$

The use of caustic potash produces a residue with carbonic acid, like the quicklime, and would be too expensive for the purpose, were it not regenerated with each operation. In fact, the waters after washing are collected in boilers, evaporated, and the product then calcined in a reverberatory furnace with some chalk or lime, and fused. The fused substance is cooled, broken up, lixiviated, rendered caustic by means of lime, and the leyes are concentrated as in the manufacture of soda. The potash is thus obtained for a new precipitation of the saccharate

In this operation, they obtain not only the potash added in the process, but also the potash and soda which existed primarily in the juice of the beet, and which, by accumulation in the molasses amounts to about ten per cent.

In this manner, MM. Lepley and Dubrunfaut have succeeded in isolating, economically, the sugar of beet molasses. But is this process applicable to the extraction of cane sugar? Yes, on one condition; that is, if the manufacture of cane sugar can be so conducted as to give molasses free from unchrystallizable sugar. For MM. Leplay and Dubrunfaut have shewn that for 60 to 70 p. c. of sugar in the molasses, there are 30 p. c. of unchrystallizable sugar, which is a result of the method of manufacture, and not pre-existent in the juice of the cane.

There exists, then, great differences between the manufacture of beet-sugar and cane-sugar; in the former, the molasses contains no altered sugar, and in the latter there is a large quantity of altered sugar.

Manufacture of caustic baryta from the carbonate.—We have mentioned above the general process by means of which MM. Leplay and Dubrunfaut reduce the carbonate of baryta. The point is important and we add some further details; for it has required much time and experiment to accomplish it conveniently on a large scale. The process is now so far perfected, that caustic baryta may be obtained at a very low price.

After reducing the carbonate to powder, it is mixed intimately with 20 to 25 p. c. of pulverized charcoal, then put in a reverberatory furnace made of good refractory brick. At a reddish white heat the reduction commences, and the aspect of the mass shows when it is complete. A single furnace will thus reduce in 24 hours 1200 kilogrammes of carbonate of baryta, consuming 12 hectoliters of charcoal in heating, and 4 hectoliters for the reduction. Three workmen are required. When finished, the baryta is collected in metal cases, ("etouffoirs,") large sheet-iron boxes holding about 1 hectoliter,) where it is cooled. The artificial carbonate is usually reduced more easily than the native. However, the native carbonate from England is easily decomposed.—*Correspondence of Silliman's Journal.*

The Mines and Mineral Resources of America.

Having presented, in the last number of the *Mining Magazine*, the outlines of the mineralogical character of the New England States, with a view to call the attention of the student of geology and the practical miner to the abundance of mineral wealth known to exist in those States, and desiring its speedy development, I will now proceed to state facts connected with the existence of mines and minerals in the Middle and Southern States, commencing with the State of

NEW-YORK.

The first mineral I shall notice is the primitive or black oxide of iron, at Brewster's Station, in Putnam County. This is an ore of the ordinary black oxide of iron, which produces a fair yield of iron by the blooming process. It may be 50 per cent., as stated; but I fear this is an over estimate. By analyses, selected pieces, very pure, have yielded 70 per cent. This ore is very abundant, extending through the States of Maryland, Pennsylvania, New Jersey, New-York, Connecticut, Massachusetts, and Vermont, into Canada. In Washington, Franklin, Jefferson, Essex, Clinton, Westchester, and Putnam counties, in the State of New York, it is inexhaustible for all future time. Although expensive in its reduction, it possesses qualities necessary to make a fair article of steel. It is very uniform in character from the shores of the Atlantic to the Pacific Ocean.

There is also an abundance of hematite ore in the towns of Amenia and Ancram, of the same character as the celebrated Salisbury iron of Massachusetts. Lead ore, highly argentiferous, also occurs in several localities in Dutchess County. Amongst the most prominent are the Amenia and Ancram mines. The latter was formerly worked by Colonel Livingston with success; subsequently the mine has passed through several hands without producing any result; but I am informed it is at present presenting an encouraging aspect. At this location is found ancramitic or green oxide of zinc. It is an artificial production, and was discovered in the bottom of an old furnace erected in the year 1744. According to Professor Silliman, this new ore is cadmia. Sulphate of barytes, pyritous copper, black copper, sulphate of iron, molybdate of lead, and sulphate of zinc, are also found at the Ancram mines.

Hematitic iron ore is abundant in the town of Putnam, a little to the south of Ticonderoga. Marl occurs in several localities in New York; among the most prominent are Boker's Falls, Bethlehem, Catskill, Clinton, Coeymans, Hilderburg, North-East, Rhinebeck, Dutchess County, and in Saratoga, Ulster, and Washington Counties. Little doubt can be entertained that these deposits of marl are to be brought into use by the agriculturist, as most of them possess, in an eminent degree, the fertilizing principles necessary to aid the growth of vegetation. There are many bogs containing excellent peat, not unlike the Irish turf, which is susceptible of being made a very superior article of fuel; but I doubt if it will ever be worked successfully for tallow, oil, soda, pyroligneous acids, or any of the ingredients that hav

e been

extracted from the Irish *peat*.* The following are among the most desirable localities:—Canaan, Clinton, and the towns of North-East, Washington Hollow, and Rhinebeck, in Dutchess County, as well as many other places in the river counties. I am inclined to believe that this substance, properly prepared, where it is not underlaid with marl, may be used in the reduction of the hematite ores to advantage.

Iron Ore.—As this ore is the most abundant mineral and its use almost universal, it may not be out of place to notice some of its important localities in the State of New-York. At Bethlehem, hematite and bog ores are found; at Calais, black oxide of iron; at Canajoharie, hematite. On the West side of Lake Champlain, in Washington, Essex, Clinton and Franklin Counties, is found, in unlimited quantities, magnetic oxide of iron existing in gigantic mountains, and in veins and beds, from one to twenty feet thick; also, specular oxide of iron, iron sand, red hematite, red oxide and brown hematite. At Catskill, specular iron ore is found; at Cold Spring, magnetic iron and iron sand; at Guilderland, bog ore; at the Highlands, magnetic oxide of iron; at Hillsdale, hematite ore; at Malone, black oxide of iron; at Lyons, Wayne County, argillaceous oxide of iron; at Monroe, Orange County, black oxide of iron, very abundant (octahedral iron); at New Lebanon, hematite; at New-York city and island, large beds of bog ore, containing large quantities of manganese; the oxide of manganese is contained in hollow and friable pebbles, very pure; red oxide of iron and green phosphate of iron at Staten Island; black oxide of iron, hematitic iron and chromate of iron in Oneida and Ontario counties, likewise lenticular iron ore, in immense beds, and also in Madison County. Scaly red oxide of iron occurs along the shore of Lake Ontorio; and in Saratoga, magnetic iron, hematitic iron, and magnetic oxide, lenticular, argillaceous oxide of iron; in fact, almost every town in the county has workable veins or beds of iron ore. Lenticular, argillaceous oxide of iron is found, also, in the town of Vernon; arsenical iron in the town of Warwick; granulated oxide of iron at West Point; lenticular argillaceous oxide of iron occurs in the town of Williamson and at Carthage, Jefferson County. In Hamilton, Montgomery, St. Lawrence and Lewis counties, ores of iron, in great abundance and purity, exist in the vicinity of dense forests capable of furnishing fue. of the best kind, with water powers of vast magnitude sufficient to propel the machinery necessary for its reduction. As the coal fields of England, Scotland and Wales, are giving out, may we not hope soon to hear the forests of Northern New York resound with the note of preparation to make the hidden treasures of the earth subservient to man, and thus for ever shut out the pauper product of the Old World? For whilst the English landed proprietors refuse to use our sugar and our cotton because it is the product of slave labor, we consent to use their iron, produced by a system of slavery that would make the iron itself sweat drops of blood were it possible.

Lead ores are found in the following localities:—Cambridge, Canaan, Canajoharie, Carlisle, Catskill, Claverack, Florida and Greenbush. In Lewis County, near the village of Martinsburg, there is an extensive lead and zinc mine of great value, and which cannot fail to be remunerative to parties working the same. It is on the estate of a Mr. Arthur. Lead is found also at Rhinebeck, Salisbury, and Shawangunk Mountains. At the latter, the mine has been worked both for lead and zinc at intervals, but it is evident the vein is copper; and it will eventually be worked successfully. At the Sing Sing silver mine, the vein is highly argentiferous, accompanied with masses and sheets of metallic silver. It was extensively worked by Sampson Simpson, Henry Remsen, Colonel James and others, from the year 1764 to 1776, when the smithy houses were removed by the Continental army to West Point. Valuable specimens of the metallic silver have been preserved by the heirs of Mr. Simpson. Lead also occurs in the towns of Vernon, Wawarsing, Westmoreland, White Creek, and in several other localities. So far as I am acquainted but six of the mines are now worked, one at Wawarsing, the Ulster lead and the Ancram mine, and one in Dutchess County near the residence of Judge Boker, but with what success the writer is unadvised; also, in the northern part of St. Lawrence County, they are working "the Great Northern," formerly "the Rossie" lead mines, and the St. Lawrence Mining Company's mine, and I believe both companies are producing lead. Copper also occurs in several places in the State of New-York, of which the following are the most prominent: At Shawangunk Mountains, the yellow sulphuret; at Ancram, yellow sulphuret, and black oxide, and green carbonate of copper; at Canajoharie, green carbonate of copper; and at Catskill Mountains, green carbonate or malachite of copper. Antimonial gray copper occurs near Keesville in Clinton County; at Florida there is a green carbonate of copper; also, at Fort Lee; also, at Salisbury, in Saratoga County. Green carbonate and yellow sulphuret of copper are found at Staten Island; detached pieces of copper ore are frequently met with near Fort Tomkins. Sulphuret of copperexists near Ticonderoga; copper is also met with in several places in Wawarsing and Mamakating vallies. At this time I am not advised of more than one copper mine worked in the State of New York, and that is at Crown Point. It is worked by Messrs. Hammond & Co., but what results have been realized the writer is not informed.

Zinc ore occurs in several localities of which the following are the most prominent:—Dutchess County; Columbia County; Ancram; Wawarsing; Shawangunk Mountains; Martinsburg, Lewis County; Verona and Westmoreland, Oneida County; Canajoharie, Carlisle, Clinton near the College, Duphney, Florida Highlands, Niagara Falls and Rome. The above locations produce sulphate of zinc, and chromate and carbonate. Eventually they will be worked when the price of labor is reduced or the demand for lead increased.

Sulphate of barytes is found at nearly all the localities of lead and zinc; also in the bed of the Genesee River near Rochester, and at Pillow Point in Jefferson county, near Sackett's Harbour; also in the town of Smithville.

Manganese.—Occurs on Manhattan Island, Staten Island, at Ancram, and several other places in the State. Perhaps the most important locality is near Martinsburg, Lewis county.

Phosphate of Lime.—Many localities of this powerful fertilizer are known to exist in this State; the most important of these are at Crown Point, and Mariah, Essex county. They have been extensively worked. This mineral occurs in twenty-six different places. One of which is in Washington county; one at Anthony's Nose, and one at Lake George, and in most of the magnetic iron mines in the State; also at the Highlands, also on Manhattan Island. Phosphate of iron occurs also at West Point.

Gypsum.—This valuable mineral exists in many parts of the State. The following are amongst the most valuable localities: Near Cayuga Lake, Cherry Valley, Chittenango, Galway, Lewistown, Oneida Creek, on the shore of Lake Ontario, and below the falls on the Genesee River, at Rochester. In the absence of the phosphate of lime, gypsum seems to abound; and in that

* See Kane and Upjohn's report on value of Irish peat, to House of Lords, &c., 1846.

part of the State where neither have been discovered, marl of a fine quality seems to have been abundantly supplied to fertilize and aid the agriculturist in producing his crops. There are many lime formations suitable for agricultural purposes.

Coal.—This mineral has been found in many localities in this State, but not in workable quantities; and I believe it is now pretty generally conceded that the chances are very much against finding it in quantities. The following localities are the most promising: Sullivan County, Dutchess county near Poughkeepsie, Ancram, Bethlehem, Buffalo, Canajoharie, Clinton and Florida. Bituminous coal occurs near Genesee, Little Falls, Salisbury.

Precious Stones.—The following list comprises the precious stones of this State: jasper, agates, garnets, emerald.

Marbles.—Black marble occurs at Crown Point, also at Glenn's Falls; white marble at South Dover, and white calcareous spar at Pleasantville; all of which is a strong and durable building stone. Marble is also found at several places in Westchester county; also verd antique in Putman county.

Mineral and Salt Springs.—These exist at Saratoga, Ballston, New Lebanon, Cherry Valley, and in Westchester county; Salina, Syracuse, Montezuma, Lenox, and in the town of Ellisburgh, Jefferson county, on the farm of Ezra Stearns, Esquire. The waters are impregnated with salt, and present evidences of having been used before that section of the country was inhabited with the present race of people.

I hope to be able to continue the mineral resources of the State of New York in your next number; but, before I take leave for the present month, allow me to make some remarks designed for the profession of which I claim to be an humble member. I have witnessed with regret a disposition on the part of many individuals to pluck prematurely the honors due to older members of a profession, which cannot be acquired in a day. Since the present renewed interest in mining has taken possession of the minds of the public, the clergyman has left his pulpit, the lawyer his briefs, the druggist his pills, and the shoemaker his wax, and before its odor has been exhaled by his contact with the disinfecting principles of the fresh air, he offers himself as a competent person to examine and report on mines, and take the direction and management of them. Thus the capital invested is often lost, and an unfavorable influence prematurely fixed in the minds of those who have lost their money.

In no pursuit is intelligence, judgment, and experience so requisite; and if duly exercised by those who have these qualities, the developement of the mineral resources of the country will advance under the most favorable auspices.—[*Mining Magazine.*

Limestone and Marble Quarries on the Shores of Lake Couchiching.

The existence of a limestone quarry on Lake Couchiching has long been known to the public. The measurements and short descriptions of the Lime-stone are given in the Geological Reports for 1845. The probable presence of Lithographic stone is there alluded to, as well as of most excellent building stone, and stone for burning into lime. The quarry known by the name of the Government Quarry, lately leased by Messrs. W. E. O'Brien and Moberly, of this City, does not appear to have been much worked since the time when Mr. Murray made his report in 1845—neither have the exertions to ascertain the existence of layers of Lithographic bands been prosecuted with much zeal, and it is scarcely to be expected that efforts will be made to set the question at rest, until the demand for building stone will so far facilitate the removal of the superimposed layers as to permit the lower bands, where, most probably, the true lithographic stone exists, to be reached without much trouble and expense. We are glad to find that there is now a prospect of the various bands of Limestone forming the shores of this part of Lake Couchiching, acquiring the importance they merit. We have lately had the opportunity of visiting a new quarry, recently opened on the opposite side of the Peninsula on which the old Government Quarry is situated. The name of this quarry is Tor Thorwald, and its enterprising proprietor, Mr. Carlyle, is now engaged in conveying some very magnificent specimens of limestone for building purposes to Toronto. We were much struck with the singular beauty of many of the huge blocks which we saw ready for shipment at Tor Thorwald. We have no doubt that Marble of exquisite beauty is to be found in the quarry. Some of the specimens we examined were delicately veined with pink and blue, and if layers can be obtained without the occurrence of too fragile chrystaline carbonate of Lime, replacing fossils, we do not doubt that marble of singular beauty and value will be obtained. Bands of limestone much approaching that used for lithographic purposes also exist at Tor Thorwald. They are continuations of the same bands which have been already referred to as existing at the old Government Quarry.

During our stay a schooner was taking on board a cargo of lime, to be forwarded to Toronto; the produce of two limekilns constructed within a few feet of the water, which is sufficiently deep to admit of a schooner of 60 tons approaching within two yards of the shore. The limekilns, like the working of the quarry, is at present an experiment, which we do not doubt will be successful, and amply repay the enterprise and courage of the proprietors, Messrs. O'Brien and Moberly. The lime is of a very pure description and will soon find a ready market. We were glad to hear of the safe arrival in Toronto of the first shipment of lime from the lime-kilns of Tor Thorwald—an event of much importance to builders, and one likely to advance the settlement of that beautiful waste, the north-eastern shores of Lake Couchiching. We understand, however, that it is the intention of Mr. O'Brien to establish limekilns at Barrie, in the Spring of 1854, and convey the stone per schooner from his quarries at Lake Couchiching. Toronto and intermediate places will then always be able to secure any quantity of lime of excellent quality at a few day's notice, and at a reasonable charge. We cordially wish this enterprise all the success it so justly merits.

Aurora and Zodiacal Light.

We enjoyed an opportunity of witnessing a very magnificent, and in these latitudes, a rather unusual description of Aurora at Welch Pool, Severn River, on the morning of Tuesday the 6th inst. Waving streamers of pale light, moved with considerable rapidity from the North-west towards the East. The pale streamers were *apparently* accompanied by dark coloured or rather black waving streamers. At the base of the auroral field —for arch it could scarcely be termed—a dense, long, and very narrow black cloud formed rapidly: the shortest diameter of the cloud was about 10 degrees; it was also removed about 10 degrees from the horizon, and beneath it the stars were plainly visible. When the cloud was fully developed it served as a base, from which a constant succession of long, and unusually broad, pale and black (?) streamers arose. The progress of the Aurora was from North-west to East. The streamers did not appear, in their upward ascent, to converge. Of a sudden, the Eastern portion of the auroral field seemed to be bent back upon itself, and thus, apparently, partially folded, with one part rather lower than the other, the very magnificent spectacle of a nearly circular crown, quite illuminated the North-eastern horizon for the space of two minutes. The time this beautiful phenomenon occurred was about ¼ past 3 a. m. It was succeeded by one equally curious, although not so imposing. A few minutes after the auroral crown had disappeared, no trace of any auroral light could be discerned in the Northern horizon. Toward the East, however a very faint pyramid of light, occupied the heavens to the height of about 50 degrees. Supposing that this might still be a portion of the Aurora which we had just been watching, or that the eye might not have recovered its tone after the recent brilliant display of light in the North, we rested awhile, and, after a quarter of an hour, on again looking toward the East, found that the pyramid of light had not only increased in distinctness, but also appeared to have extended itself in all directions, still retaining the form of a gigantic, faintly luminous pyramid. The Zodiacal light, for such it was, remained visible, and with increasing luminosity, until obscured by morning clouds.

Observations of Meteors at the Provincial Magnetic Observatory.

A look-out was kept for the periodic recurrence of the meteoric fall on or about the 10th of August, known as the St. Lawrence Stream, from the time of its occurrence being near St. Lawrence's Day. With the exception of that between the 12th and 14th of November, the St. Lawrence is the most brilliant and best established of all the periodic falls. It was noticed as early as the tenth century, and its constant recurrence about the same time of the year is attested not only by old traditionary legends, but by ancient church calendars, under the poetical title of "St. Lawrence's fiery tears." Scientific attention was drawn to the fact by Muschenbrock in the middle of last century, and it has since been repeatedly confirmed by Quetelet and others.

According to the observations of Julius Schmidt at Bonn, the number of meteors on an average of 8 years was, for August 9th 29 in one hour; and for August 10th, on an average of 6 years 31 in one hour. The observations of Heis shew for the 10th of August, in 1839, a fall of 160 in one hour; in 1840, a fall of 43, and in 1841, of 50 in that time; while, in 1842, there fell in ten minutes no less than 34. The great frequency of these meteors is sufficient to distinguish them from the merely *sporadic* of which a fall of from 4 to 5 per hour may commonly be expected; they are also distinguished by a tendency to parallelism in their directions, and a common point of divergence or convergence.

At Toronto on August 9th, 1853.—None were observed till 9.47 P.M., between which time and 12.40 P.M, there fell 46 meteors; observation was continued for some time longer, but no more were seen. These may be classified as follows, being at the rate of 16 per hour:—

Of first magnitude	2
" second "	2
" third "	5
" fourth "	9
" fifth and lower magnitude	28
In direction N	1
" S	4
" E	2
" W	5
Between N and E	2
" E " S	15
" S " W	11
" W " N	6

There were 10 which left behind perceptible trains, and in general their flight was very rapid and short, only 12 being visible for one second and upwards. The night was very favourable.

On August 10th, 22 were seen between 8.59 P.M., and 12.9, being at the rate of 7 per hour; but the early part of the evening was unfavourable, being thickly overspread with haze. Not one of the first, and only one of the second magnitude fell, the majority being very small. The directions were as follows:—

N, 2; S, 6; E, 2; W, none; N E, 1; N W, 1; S E, 3; S W, 7

Only 2 had tails, and in no case was the time of flight more than half a second.

August 11th was unfavorable, being overcast; only 2 seen.

August 12th was clear, but only 5 fell in 2 hour's observation.

August 13th, observations made for one hour and twenty minutes before the sky became overcast. Not one meteor was seen.

The following remarkable ones were casually observed during the month:—

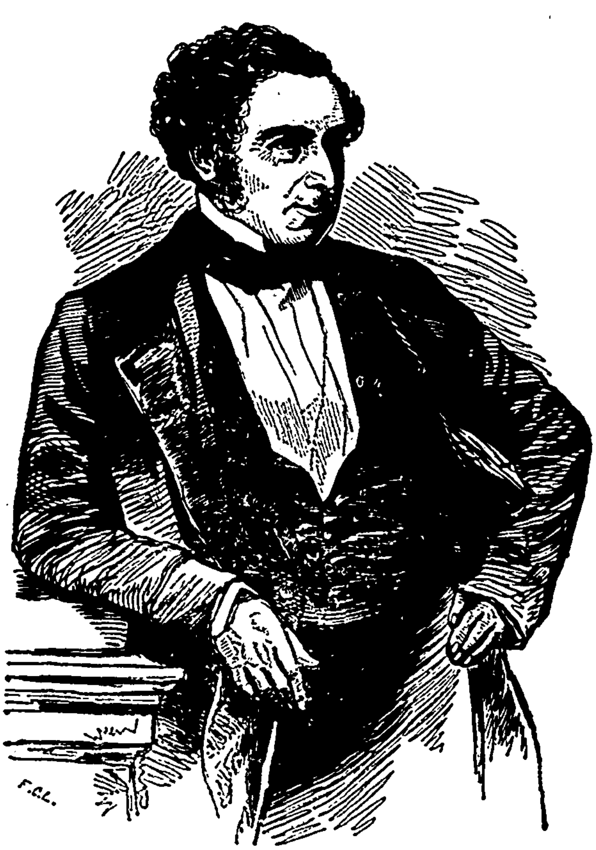
Aug. 6, at 10.45 P.M.—A very large one moving from S E to W N W, in a course of 20° length; time of flight 2 seconds; large train visible some time after its disappearance; colour very bright, with tinge of orange.

Aug. 8, at 8.50 P.M.—One with a course of 35°, in direction S S E, leaving a tail of a dull orange colour throughout the whole of its path, which lasted for some seconds.

Aug. 10, at 8.10 P.M.—A bright-red meteor; time of flight 2 seconds; direction S W; apparently nearer than the clouds.

Aug. 14, at 10.51 P.M.—A bright red meteor about 6 times as large as Jupiter, falling nearly perpendicularly in the West, and bursting when near the horizon, throwing out numerous sparks of bright yellow; it left a train which, just before bursting, assumed a wedge shape.

Aug. 28, at 7.21 P.M.—One falling diagonally towards horizon in North from star Cor Caroli; length of course 30°, and time of flight 3 seconds; it threw out sparks during its course of a dull red, and on bursting, of a bright blue colour; its apparent size was twice that of Jupiter, and just as it burst, there was a smoke-like appearance of light round it to a diameter of 7 degrees. J. B. C.



Robert Stephenson, M. P.

The subject of this notice was born at Wilmington, near Newcastle upon-Tyne, and is the son of the late George Stephenson, of Tapton House, near Chesterfield, in Derbyshire, who from the humblest origin rose to an eminence to which the vast benefits he has conferred on the world justly entitled him. The early life of the elder Stephenson affords a singular contrast to his subsequent history. Born in the village of Wylam, on the banks of the Tyne, near Newcastle; the son of a colliery workman, he had early to labour for a share of the household bread. From picking bats and dross from coal heaps, at two-pence per day, when so young that he used to hide when the overseer was passing, lest he should be thought too small to earn his wages, he became a breaksman on a tram road, and then a stoker to an engine on the estate of Lord Ravensworth, thankful for the advancement of his wages from one to two shillings per day. Here some repairs required by the engine, afforded him an opportunity of displaying that native ingenuity of which he possessed so vast a fund. At this time the dearness of food and the lowness of wages pressed heavily upon him, but his energy triumphed, and as his prospects improved, he gave up the thoughts of emigration to the New World, which he had seriously entertained, and married at the age of twenty-two. On the 16th of November, 1803, his only son Robert was born. Meanwhile, his natural powers of invention and the resources of his mind continued to develope themselves in various ways, so much so, that he early attained a local celebrity, and Lord Ravensworth and other of the Killingworth owners, had sufficient confidence in his ability to advance him sufficient means to build a locomotive, which was first tried on a tramway in 1814. His subsequent success is well portrayed in the following extract from a speech delivered by him on the occasion of opening the Newcastle and Darlington Railway in June, 1844.

"Lord Ravensworth & Co.," said he, "were the first parties who would entrust me with money to make a locomotive engine. That engine was made thirty-two years ago; I said to my friends that there was no limit to the speed of such an engine, provided the works could be made to stand. In this respect, great perfection has been reached, and in consequence, a very high velocity has been attained. In what has been done under my management, the merit is only in part my own. I have been most ably assisted and seconded by my son. In the early part of my career, and when he was a little boy, I saw how deficient I was in education, and made up my mind that he should not labour under the same defect, but that I would put him to a good school, and give him a liberal training. I was, however, but a poor man, and how do you think I managed? I betook myself to mending my neighbours' clocks and watches, at night, after my daily work was done; and thus I procured the means of educating my son. He became my assistant and my companion. He got an appointment as Under-Viewer, and at night we worked together at our engineering. I got leave to go to Killingworth, to lay down a railway at Hetton, and next to Darlington, and after that I went to Liverpool to plan a line to Manchester. I there pledged myself to attain a speed of ten miles per hour. I said I had no doubt the locomotive might be made to go much faster, but we had better be moderate at the beginning: the Directors said I was quite right, for if when I went to Parliament, I talked of going at a greater rate than ten miles an hour, I would put a cross on the road. It was not an easy task for me to keep the engine down to ten miles an hour—but it must be done, and I did my best. I had to place myself in that most unpleasant of all positions—the witness-box of a Parliamentary Committee. I could not find words to satisfy either the Committee or myself: some one enquired if I were a foreigner, and another hinted that I was mad. I put up with every rebuff, and went on with my plans, determined not to be put down. Assistance gradually increased, improvements were made—and to-day, a train which started from London in the morning, has brought me in the afternoon to my native soil, and enabled me to take my place in this room and see around me many faces which I have great pleasure in looking upon."

His connexion with the Liverpool and Manchester Line, placed him in the front rank of the engineers of that day, he also became the proprietor of an extensive locomotive manufactory at Newcastle, and an extensive owner of collieries and iron works. His death took place in August, 1848.

We have seen from his own narrative, that George Stephenson fully appreciated the advantages of education, and he has told us of his manly conflict and stern purpose to win the means wherewith to enable his son to receive that training of which he so much felt the necessity himself, and the value of which he held above all price. At the age of ten, Robert was sent to the academy of Mr. John Bruce, of Newcastle, where he remained until about sixteen; he then for a short time received private lessons in mathematics from Mr. Riddell, (afterwards head-master of the Royal Naval School at Greenwich,) and was subsequently apprenticed as a coal-viewer to Mr. Nicholas Wood, in which occupation he remained three years. The name of George Stephenson was by this time rising into eminence as an engineer, and looking forward to better prospects for his son, he removed him from his underground apprenticeship, and in 1821 placed him in the University of Edinburgh, where he studied under Professor Leslie, Dr. Hope, and Professor Jamieson. His father, however, could afford him no more than one session, but during that period he evinced an extraordinary capacity for acquiring knowledge, and a just appreciation of its value. Incited by the early lessons inculcated by the precepts and the examples of his father, and by the necessity that he should be early at the profession he was destined to live by, his diligence knew no pause,—every hour was improved; and he was rewarded by a corresponding proficiency. At the age of nineteen he returned from Edinburgh, and entered upon a new field of study with his father, who had about that time established his steam engine manufactory at Newcastle. Here the same diligence which had characterized his session at the university induced such incessant application to the study of his profession, as to impair his health, and his father, urged by the medical attendant, consented to his son's acceptance of the charge of an expedition to explore the silver and gold mines of Venezuela, New Grenada and Columbia, which had been set on foot by Messrs. Herring, Graham and others. He sailed on this expedition in 1824, and remained in Columbia about four years.

In 1828 he sailed from Carthagena, round Cape Horn, to New York, whence he travelled through that State, and passing into Upper Canada, he visited this city, then known as "Little York," to which the prefix of "muddy" was, as Mr. Stephenson says, justly added. From Toronto he proceeded through the Lower Province, visited Montreal, and finally took ship at Quebec, for England.

When he sailed on his Columbian expedition, the "Surrey Iron Railway," first chartered in 1801, and again in 1803, connecting the Quarries at Merstham and Reigate with Croydon and the Thames at Wandsworth, a length of 21 miles, was the only public "Iron Road" in England; with this exception, the railways of England were private ones, and its commercial success was not such as to encourage the extension of similar speculations. Many private tramways from coal, iron, and other mines were, however, in existence, and on these some progress had been made in the construction of locomotives.

Locomotion by steam on common roads had been vaguely suggested by Watt, in 1759, and practically realized on a small scale by Murdoch in 1784. The idea of applying steam to the propulsion of wheeled carriages did not therefore originate with Richard Trevithick, yet it is to him we are indebted for its first application in a useful form, acting solely by its expansive force. His first engine was tried on the Myrthir Tydvil tramroad, in 1804, with good success, drawing ten tons of useful load, at the rate of five miles per hour. Trevithick's engine had but one cylinder, and was but ill adapted to maintain an equal continuous motion; the adhesion of the driving wheels to the rails was found to be variable, and these difficulties caused him to suggest auxiliary means of propulsion, the presumed necesssity for which induced the contrivance and patenting of many expedients, some of them sufficiently ridiculous, and others remarkable only for their intricacy.

Passing over the continuous rack and wheel of Blenkinsop, the notable chains and drums of the brothers Chapman, and the automaton legs of Brunton, we find Mr. Blackett, of the Wylan Railway, recurring to the adhesion of the wheels to the rails which he found sufficient when the weight of the engine was properly distributed. To make available the full power of his engines, he used two cylinders, with the cranks placed at right angles, and thus rendered his engines capable of producing an equal, continuous motion—this was in 1813. In 1814, the elder Stephenson constructed his first locomotive, in which and in his subsequent ones, he introduced several improvements, which gave his engines a superiority over those made by his contemporaries.

Although Mr. Blackett, as we have said, applied double cylinders to produce a continuous motion, his modes of attachment and of connecting the wheels was defective;—the wheels were connected by endless chains. These, however, were sufficient to establish the sufficiency of the *bite* of the wheels to draw the requisite number of loaded waggons, and therefore general attention was re-directed to improving the means of applying the power of the steam to the wheels. George Stephenson first introduced an ingenious arrangement of geering to effect the desired end. His first engine, when tried up an incline of 1 in 450, dragged eight loaded waggons weighing 30 tons, at the rate of about four miles per hour. In practice, however, it was found that the spur geering caused considerable noise and jarring, which increased with the wear. To remedy this, Mr. Stephenson, in connexion with Mr. Dodds, patented in 1815 a method of attaching the connecting rods of the engines to crank-pins fixed in the arms of the driving-wheels, and used endless chains to keep the crank-pins at right angles with each other; for these chains outside connecting-rods were substituted; and, except that Nicholas

Wood added wrought iron tires to the driving-wheels, the locomotive remained for many years in the condition to which Stephenson had brought it.

We have thus briefly noticed the progress of locomotives, in order to show the state of utility to which they had been brought when Robert Stephenson returned to England, in 1828. When he departed for America, in 1824, there were very few locomotives in existence, and during his absence, no very important improvements had been made, except that Mr. Hackworth, of the Stockton and Darlington Railway, had introduced the blast-pipe, (as it had been fomerly applied by Trevithick,) into an engine constructed for that line, which had six coupled wheels, and was capable of drawing a gross load of 100 tons, on a level, at the rate of five miles per hour.

During the same period, however, a new era had commenced in the history of railways. They had received an impetus from the increasing success of the locomotive. The Stratford and Moreton line had been opened for the carriage of goods and passengers,—the Stockton and Darlington was opened soon after; and, notwithstanding the commercial panic and the difficulties which had to be overcome in Parliament, the Liverpool and Manchester line was commenced in 1826, under the unconquerable energies of the elder Stephenson, and his assistant, Mr. Joseph Locke. Mr. Nicholas Wood had also published his well-known "Practical Treatise on Railroads," in 1825, —and, in that year of the wildest speculations, the idea of iron highways and rapid travelling by steam first seized upon the public mind. On the return of Stephenson to England, in 1828, he found the Liverpool and Manchester Railway rapidly approaching completion, and a general desire on the part of the public for a higher rate of speed than had yet been attained. The Directors of the Liverpool and Manchester Railway, in consequence of this feeling, and of the non-existence at that time of locomotives capable of meeting the public requirements, seriously contemplated working their road by stationary engines. Previous, however, to deciding this important question, a commission consisting of Messrs. George Stephenson, Locke, Walker, and Rastrick, was appointed to collect information from the managers of the few railways and tramroads then in existence, as to the best power that could be applied, and more particularly as to the comparative merits of fixed and locomotive power. The result of their report showed a proportion of seven to nine in favour of stationary power.

As, however, it was admitted that several improvements were being made in locomotives, the Directors, influenced by the opinions of their Engineer, and by the careful reasonings of a pamphlet, the joint production of Robert Stephenson and Joseph Locke, determined, at the suggestion of Mr. Harrison, one of their number, to offer a premium of £500 for the best locomotive which should conform to certain conditions, namely,—It must consume its own smoke;—the whole weight of the engine and boiler must be carried on springs;—it must not exceed six tons in weight;—if of that weight it must be able to draw a train of twenty tons, including the tender, at the rate of ten miles an hour on a level railway;—if of greater than 4½ tons weight, it must have six wheels. The conditions also announced that an engine of less weight would be preferred, if it performed an equal amount of work.

The local growth of railways and the sudden impulse given to them in 1825, together with the several patents held by George Stephenson in connexion with locomotives, had been the means of causing his steam-engine manufactory at Newcastle to become exclusively a locomotive manufactory; and to it, during a space of three years after his return from America, Robert Stephenson devoted the greater part of his time,—having charge, however, during the same period, of the construction of the Warrington and Newton and of the Leicester and Sawanington Railways. During this period, as we have seen, the nature of the power to be used on the Liverpool and Manchester line had to be determined,—and Robert Stephenson at once entered into the competition, resolved to outstrip the conditions imposed upon the competitors.

(To be continued.)

Address of the President and Council of the Canadian Institute to Mr. Robert Stevenson, M.P., on the occasion of his Visit to Toronto.

TORONTO, UPPER CANADA, August 26, 1853.

To Mr. Robert Stephenson, M. P.,—

SIR,—We, the President and Council of the Canadian Institute, take the earliest opportunity to offer you a most cordial welcome to Upper Canada, on behalf of a Society which has for one of its main objects the cultivation of that branch of Science with which your name is so honorably and eminently connected.

Our Institute, founded in 1849 by Royal Charter, for the promotion of the interests of Science and Art in this Province already numbers nearly 300 members, including the most distinguished Scientific and Literary names in both sections of Canada. We have endeavored to carry out our object by holding winter Sessions, in which papers are read and discussion encouraged; and by the establishment of a monthly Scientific Journal, to serve as a record of the transactions of the Institute, and which, though only just completing its first year of existence, has already a circulation of about 500.

Of a copy of this we beg your acceptance.

We are also successfully engaged in forming a Library of Scientific reference, and a museum illustrative of the productions of the Province.

Such being our aims, and the progression we are making towards their attainment, we beg to hope that you will allow yourself to be nominated an honorary member of the Institute,

And we have the honor to be,

With the greatest respect and esteem,

your obedient servants,

The President and Council of the Canadian Institute.

Signed in behalf of the Council of the Canadian Institute.

J. B. CHERRIMAN, M. A.
Vice President.

FRED. CUMBERLAND,
Second Vice President.

A. BRUNEL, *Secretary.*

MR. STEPHENSON in reply, expressed the deep gratification he had received from the extremely kind welcome he had met with in Canada, which in the present instance he felt the more, from its being offered by a Society devoted more particularly to that profession in which he had been so long and, as the address stated, successfully engaged. Twenty-five years ago, he said, he had been in this place, when at that time he was poor and unknown, and if the contrast of his second visit struck forcibly as regarded himself, so also did the contrast of the appearance of the city then and now. Little did he imagine then that the village of "muddy little York" could have made such astonishing progress as he saw around him, and he must heartily congratulate the people of this country on their having shown such energy and enterprize: when the various railroads in connexion with the city were in full play, he thought Toronto would not be long in enforcing the title she had ambitiously but not arrogantly seized, "The Queen of the West." Such societies as this, he felt sure, must be productive of much benefit, particularly by means of the discussions that would ensue on the reading of scientific papers: such had been the case with their own Society in London: professional gentlemen would be very careful in putting forward statements, and would investigate their subject more thoroughly, when they knew their opinions and calculations would be liable to acute questioning by the best men of the country. He would be happy to accept a copy of their Journal, the existence of which did much credit to them, and could not fail to be of the greatest service to the interests of the profession and science generally. He would forward for their acceptance a copy of his work on tubular bridges, and should feel highly honoured at being enrolled in their Society as an honorary member.

In the course of after-conversation, Mr. Stephenson took occasion to pay Mr. Cumberland a very high compliment on the architecture of the Cathedral, and also denounced strongly the American system of Railroads, and the careless, almost wanton disregard of life and property which characterized their management: speaking of the single track lines, he expressed an opinion that they ought never to be used, until the electric telegraph was in operation throughout the whole extent, so that the passage of every train at each station might be communicated at once to every other station. A good-humoured discussion arose upon this, which bade fair to be considerably prolonged, had not the Deputation, mindful of the arduous task Mr. Stephenson had to go through in the evening, felt it a duty to terminate this very pleasing interview.

The Stephenson Dinner.

The description of this elegant testimonial of respect and esteem, on the part of the Civil Engineers of Upper Canada, towards the most eminent Engineer of modern times, has been already widely circulated in every part of this Province. We content ourselves, therefore, with an extract from a lengthy description which appeared in the *Daily Colonist* of August 27th:

"The Civil Engineers have done themselves the credit of getting up, take it for its all in all, the most splendid Public Dinner that ever took place in Toronto. It was worthy of their guest, Robert Stephenson, C. E., whose well-earned world-wide reputation, does honor to the profession of engineer. The Civil Engineers have done well to entertain him in this manner, and for our part we are obliged to them for the opportunity of hearing him speak. The arrangements for the dinner were very good. The old Chamber of the Assembly was used as a reception room, and it answered the purpose admirably; and the dinner tables were laid out in the old Legislative Council Chamber. This last was most tastefully and appropriately decorated, with flags and engineering devices, models and instruments. "Success to Railway Enterprise," was one of the mottoes, and either side of this were, intermingled with the engineering devices, the letters, in large characters, R. S.

"As to the tables, nothing could exceed the good order of the arrangement they displayed, or the tasteful manner in which they were laid out. Nothing was spared; the table service was all that could be desired; the flowers, and fruit, and ornaments produced a striking effect. Every thing was lavish, but nothing *de trop*, the common fault of bad taste.'

Notices of Books.

The *Mining Magazine*; Edited by William T. Tenney, New York. The second number of this new Periodical is full of interesting and important matter; besides several original and selected articles of value it contains a mass of information under the following headings:—Journal of Mining Laws and Regulations; Commercial Aspect of the Mining Interest; Journal of Gold, Copper, Silver and Lead Mining Operations; Coals and Collieries; Iron and Zinc; Quarries, &c.

Journal of Education for Upper Canada. The July, August and September numbers of the *Journal of Education* are sent forth together, in order that the whole of the Catalogue of Books for Public School Libraries, and the Circulars and Regulations respecting the modes of their establishment, may be laid before the Local Municipal School authorities at one and the same time.

In the official Circular from the Chief Superintendent of Schools to Township Councils and Trustees, upon the establishment and management of School Libraries, Dr. Ryerson says:

"In regard to the selection and procuring of the books mentioned in the catalogue, I may observe, that it is not easy to conceive, and it is needless that I should attempt to describe, the amount of time, labour, and anxiety which has been expended in devising and maturing this system of Public School Libraries, in making arrangements in Great Britain and the United States for procuring these books on advantageous terms, and in selecting them from a much larger number of works on the same subjects; nor am I yet able myself to form an accurate idea of the extent of the additional labour and responsibility incurred by making this Department the medium and agent of providing the Public School Libraries throughout the Province with the Books for which the Municipalities may think proper to apply. But on no part of the work which I have undertaken, do I reflect with more interest and pleasure than on that of rendering accessible to all the Municipalities of Upper Canada—even the most remote—books of instruction and useful entertainment which would not have otherwise come within their reach, and that at prices which will save them thousands per annum in the purchase of them—thus adding to their resources of knowledge and enjoyment by the variety and character of books to which they can have access, and the increase of facilities and the reduction of expenses in procuring them."

The Catalogue is evidently prepared with great care and precision There is attached to the name of each important book a short description of its contents, and not unfrequently short extracts of the opinions of men well known by their writings or position.

The regulations subjoined, being two out of eighteen, established by the Council of Public Instruction for the management of School Libraries, exhibit the scope of these admirable adjuncts to our Common School System. It will be seen that the libraries are to be open to the public under certain regulations.

"There may be School Section Libraries, or Township Libraries, as each Township Municipality shall prefer. In case of the establishment of a Township Library, the Township Council may either cause the books to be deposited in one place, or recognise each School Section within its jurisdiction as a branch of the Township Library Corporation, and cause the Library to be divided into parts or sections, and allow each of these parts or sections of the Library to be circulated in succession in each School Section."

"Each individual residing in a School Section, of sufficient age to read the books belonging to the Library, shall be entitled to all the benefits and privileges conferred by these regulations relative to Public School Libraries; but no person, under age, can be permitted to take a book out of the Library, unless he resides with some inhabitant who is responsible for him; nor can he receive a book if notice has been given by his parent, or guardian, or person with whom he resides, that he will not be responsible for books delivered to such a minor. But *any* minor can draw a book from the Library, on depositing the cost of such book with the Librarian."

Report of a Survey for the Railway Bridge over the St. Lawrence at Montreal, by T. C. Keefer, C. E.—We should have had much pleasure in giving an extended notice of Mr. Keefer's Report, had we enjoyed the opportunity of acknowledging the receipt of a copy; that privilege, however, being denied to us, we are unable to gratify our readers with any description of the propositions submitted by Mr. Keefer, for the construction of one of the most magnificent engineering works of the day.

American Association for the Advancement of Science.

The seventh meeting of the American Association was held at Cleveland, during the week following the 28th of July. Professor B. Pierce, of Cambridge, was President for the year. The meeting was less well attended than those of former years, owing partly to the engagements of many of the members of the Association at the different institutions of the country, with which they are connected. Among the papers presented, those of the departments of Physics and Mathematics were much the most numerous, and were mostly of high merit. There were but few papers brought forward in Geology, or Chemistry. The meeting adjourned on Tuesday, the 2d of August, to meet in Washington, on the last Wednesday of April, 1854.

A committee for revising the constitution of the Association was appointed, consisting of Prof. Bache, Dr. J. Lawrence Smith, Dr. Le Conte, of Georgia, Dr. W. Gibbs, of New York, Dr. B. A Gould, Jr, Prof W. B. Rogers, Prof J. D. Dana, Dr. J. Leidy, Prof. S. S. Haldeman, and Dr. A. A Gould. Resolutions were passed reducing the annual assessment from $3 to $1, and requiring that the Proceedings should be furnished to members at cost, or free of expense when the Proceedings are published by the public liberality of the city where the meeting may be held.

The following officers were appointed for the ensuing year: Prof. J. D. Dana, President; Prof. J. Lovering, of Cambridge, General Secretary; Prof. J. Lawrence Smith, Permanent Secretary, and Dr. Elwyn, Treasurer.

Dr. B. A. Gould. Jr., was requested to prepare an obituary of the late Sears C. Walker, to be presented at the meeting at Washington.

The following is a list of the papers read at the Cleveland meeting. We deem it the only just course to authors not to publish abstracts of their papers, unless such abstracts are made out by themselves, and sent to us expressly for publication.

(1.) *Physics, Mathematics, Astronomy.*

Prof. B. Peirce, of Cambridge, Mass.: Investigations in Analytical Morphology: No 1, Description of the Science; 2. Stable and Unstable forms of Equilibrium; 3, Forms of the Elastic Sac; 4, Stability of Saturn's Ring.

——— Personal Scale of Astronomical Observers.

——— Criterion for the rejection of doubtful observations.

——— Theory of the action of Neptune upon Saturn.

Prof. A. D. Bache, Supt. Coast Survey, Washington: On the Tides at Key West, Florida, from observations made in connection with the U. S. Coast Survey.

——— On the Tides of the Western Coast of the United States, from Observations at San Francisco, California, in connection with the U. S. Coast Survey.

Prof. Stephen Alexander, of Princeton: On some special analogies of Structure in the Eastern Hemisphere of the Earth and the visible Hemisphere of the Moon, with conjectures as to the structure and Appearance of those portions of the Moon which are invisible.

——— On some Relations of the Central Distances of the Primary Planets, Satellites, and Rings of the Solar System, of which Bode's Law would seem to be but an imperfect expression.

——— On the Primitive Form and Dimensions of the Asteroid Planet, the cause of the Instability of the same, and of the Varieties in the Orbits of the Asteroids.

Prof W. Chauvenet, of the U. S. Naval Academy: On the method of finding the error of a Chronometer by equal altitudes of the sun.

——— New Formulas of Spherical Trigonometry.

Dr B. A. Gould, Jr, of Cambridge, Mass.: On Personal Equations in Astronomical Observation.

——— On the Velocity of Transmission of Electric Signals along Iron Telegraph Wires.

——— On the comparative precision of the Electro-chronographic or American Method of Observation

Prof O. M. Mitchel,: On a New Method of securing Uniform Circular Motion in the Machinery used in receiving the Registration of Astronomical Observations of Right Ascension.

Prof. C. W. Hackley, of New York: Mathematical Analysis of the contact of surfaces in oscillating Machinery.

Lt E. B Hunt: On Cohesion of Fluids, Evaporation, and Steam Boiler Explosions.

——— The Conical Condenser, a Telescopic Appendage.

Prof. John H. C. Coffin, of the Washington Observatory: Some errors peculiar to the observer, which may affect determinations of the declinations of the Fixed Stars.

Dr. Julius Friedländer, of Berlin: On the limit toward which the series,

$$1+\frac{1}{2^1+p}+\frac{1}{3^1+p}+\frac{1}{4^1+p}+\text{\&c.},$$

converges for $p=0$.

Prof. O. N. Stoddard, of Miami University: Strictures on the mechanical explanation of the zig-zag path of the Electric Spark.

Prof. J. L. Riddell, of New Orleans: Theory of Molecular Forces, explanatory of the gaseous, liquid, and solid conditions of matter.

Prof. Joseph Henry, of Washington: Illustrations of Cohesion.

Prof Joseph Lovering, Cambridge: On a Modification of Soleli's Polarizing Apparatus for Projection.

———: On a singular case of internal Fringes, produced by interference in the eye itself.

Prof. George Perkins: Description of a plan for furnishing a Fluid Mirror, to be used in a Reflecting Telescope.

D. Vaughan, of Cincinnati: The Zodiacal Light, the periodical appearance of Meteors, and the point in space to which the motion in the Solar system is directed.

(2.) *Meteorology.*

W. C. Redfield: On the value of the Barometer in navigating the American Lakes.

Prof. E. Loomis, of New York: Does the Moon exert a sensible influence upon the Clouds?

———: Notice of a Hail Storm, which passed over New York, July 1, 1853.

J. H. Coffin, of Easton, Pa.: An investigation of the Storm Curve, deduced from the Relations existing between the direction of the Wind, and the Rise and Fall of the Barometer.

Lorin Blodget, of Washington: On the Barometric Pressure in extreme Latitudes, and the existence of Belts of low Barometer in the Arctic Regions.

———: On the South East Monsoon of Texas, the Northers of Texas and the Gulph of Mexico, and the abnormal Atmospheric Movements of the North American Continent generally.

——— On the distribution of Heat over the North American Continent, and the construction of its Isothermal Lines.

——— On the Subordination of Atmospheric Phenomena, or the Position of the several Classes with respect to the primary Cause or Initiatory Processes.

——— On the distribution of precipitation in Rain and Snow on the North American Continent.

Prof. A. D. Bache, Supt. U. S. Coast Survey, Washington: On the Winds of the Coast of the United States on the Gulf of Mexico.

Prof. Joseph Lovering, Cambridge: On Optical Meteorology.

(3.) *Geology, Geography, Chemistry.*

Prof. J. M. Safford, of Lebanon, Tenn.: On the parallelism of the lower Silurian groups of Middle Tennessee with those of New York.

W. C. Redfield, of New York: On the Geological Age and Affinities of the Fossil Fishes which belong to the sandstone formations of Connecticut, New Jersey, and the coal-field near Richmond, Virginia.

A. Winchell, of Eutaw, Alabama: On the Geology of the Choctaw Bluff.

Dr. J. A. Warder, of Cincinnati: A Geological Reconnoisance of the Arkansas River.

J. S. Newberry, M. D., of Cleveland: On the Structure and Affinities of certain Fossil Plants of the Carboniferous era.

——— On the Carboniferous Flora of Ohio, with descriptions of fifty new Species of Fossil Plants

——— On the Fossil Fishes of the Cliff Limestone of Ohio.

Prof J. Brainard, of Cleveland: Origin of Quartz Pebbles in the Sandstone Conglomerate, and the Formation of the Silicious Stratified Rocks.

L. F. Pourtales, Ass't in Coast Survey. Presented by Prof. Bache Superintendent: Notes on the Specimens of the bottom of the Ocean, brought up in recent explorations of the Gulf Stream, in connection with the Coast Survey.

Prof. Bache, Supt: Recent Discovery of a Deep-sea Bank on the eastern side of the Gulf Stream, off the Coast of South Carolina, Georgia, and Florida, by Lieuts. Commanding Craven and Moflit, U. S. N. Assistants of Coast Survey.

Dr. F. A. Genth and Dr. W. Gibbs: On a remarkable class of conjunct bases containing Cobalt and the Elements of Ammonia.

Prof. E. N. Horsford: On the Solidification of the Coral reefs of Florida and the source of Carbonate of lime in the growth of corals.

Dr. W. I. Burnett, of Boston: On the Blood Corpuscle—holding Cells, and their relation to the Spleen.

——— On the Formation and Mode of Development of the Renal Organs in Vertebrata.

——— On the Formation and Functions of the Allantois.

——— Researches on the Development of the Viviparous Aphides.

——— On the Reproduction of the Toad and Frog, without the intermediate stage of Tadpole.

——— On the Signification of Cell Segmentation.

Prof. J. Riddell, New Orleans: On the Histology of Red Blood.

——— On the Origin of Capillary Blood Vessels.

——— On the Structure and Transformation of Oscillaria aureliana.

——— S. N. Sanford, of Granville, Ohio: On some points in the History of Gordius.

R. Howell, of Nichols, New York: On the Wheat Fly, and its Ravages.

Prof. Alphonso Wood, of Cincinnati: On Six New Species of Plants.

(5.) *Miscellaneous.*

Prof. E. Loomis, of New York: On the Measurement of Heights by the Barometer.

Prof. John Brocklesby, of Trinity College, Hartford: On the Rising of Water in the Springs immediately before Rain.

W. H. B. Thomas, of Cincinnati: Indications of Weather, as shown by Animals and Plants.

Prof. E. N. Horsford, of Cambridge, Mass.: On the fatal effects of Chloroform.

Prof. S. S. Haldeman, of Columbia, Pa.: Investigation of the power of Greek Z, by means of Phonetic Laws.

Loren Blodgett, of Washington: On the Earthquake of April 29, '52.

Lt. E. B. Hunt: Remarks on Lithography and Lithographic Transfers.

——— Project of a Geographical Department of the Library of Congress.

Prof J. L. Riddel, New Orleans: On the Binocular Microscope.

Capt. Wilkes: Account of Experiments on Sound.

——— Notice of Bradford's Machine for separating metals by their specific gravity.

Andrew Brown, of Natchez, Miss.: On the effect of the Reclamation of the annually inundated Lands of the Mississippi Valley, upon the general Health of the country, and the navigation of that River.

Rev. P. R. Lynch, of Charlston: The Artesian Well, Charlston.

Herman Haupt, Supt. of the Pennsylvania Central Railroad, Philad: On the resistance of the Vertical Plates of Tubular Bridges.—*Sil. Jour.*

The Comet.—Mr. J. R. Hind, in a letter to the London *Times*, gives the following particulars respecting the Comet:—"The comet which has been so conspicuous during the last week, was very favourably seen here on Saturday, and again on Sunday evening. On the latter occasion, allowing for the proximity of the comet to the horizon, and the strong glow of twilight, its nucleus was fully as bright as an average star of the first magnitude; the tail extended about 3 degrees from the head. When viewed in the comet seeker the nucleus appeared of a bright gold colour, and about half the diameter of the planet Jupiter, which was shining at the same time in the southern heavens, and could be readily compared with the comet. The tail proceeds directly from the head in a single stream, and not as sometimes remarked, in two branches. The distance of this body from the earth at 8 o'clock last evening, was 80,000,000 miles; and hence its results, that the actual diameter of the bright nucleus was 8000 miles, or about equal to that of the earth, while the tail had a real length of 4,500,000 miles, and a breadth of 250,000, which is rather over the distance separating the moon from the earth. It is usual to assume that the intensity of a comet's light varies as the reciprocal of the products of the squares of the distances from the earth and sun, but the present one has undergone a far more rapid increase of brilliancy than would result from this hypothesis. The augmentation of light will go on till the 3rd of September, and it will be worth while to look for the comet in the day time about that date: for this purpose an equatorially mounted telescope will be required, and I would suggest the addition of a light green or red glass, to take off the great glare of sunlight, the instrument being adjusted to focus on the planet Venus. This comet was discovered on the 10th of June by Mr. Klinkerfues, of the Observatory at Gottingen, but was not bright enough to be seen without a telescope, until about August 13.' In a letter copied into the *Times* a few days since, Sir William hints at the possibility of this being the comet I had been expecting, but I avail myself of the present opportunity of stating that such is not the case, the elements of the orbits having no resemblance. The comet referred to will probably reappear between the years 1858 and 186-, and, if the perihelion passage takes place during the summer months, we may expect to see a body of far more imposing aspect than the one at present visible."

Railway Accidents.—The following table shows the comparative statement of casualties upon the railroads of Great Britain and New York, in proportion to the whole number of persons travelling:

	Great Britain.		*New York.*
Passengers killed	1 in 2,785,491	..	1 in 286,179
Employés killed	1 in 742,797	..	1 in 124,010
Others killed	1 in 1,392,714	..	1 in 45,929
Passengers injured	1 in 231,568	..	1 in 90,739
Employés injured	1 in 1,128,427	..	1 in 83,603
Others injured	1 in 3,301,323	..	1 in 79,155
Total killed	1 in 412,665	..	1 in 43,454
Total injured	1 in 183,406	..	1 in 28,078
Killed and injured	1 in 126,973	..	1 in 17,425

Iron Sleepers.—Messrs. Day & Laylee, of Ashford, have recently taken out a patent for semi-tubular wrought and cast-iron transverse sleepers for railways. The sleepers are laid with their concave side downwards, and in those of wrought-iron an opening is left in the centre of them, for the purpose of facilitating the perfect packing of the sleeper, for passing other rails for crossings, and also for convenience of drainage. In the cast-iron sleeper this is accomplished by casting it in two pieces, and connecting them by means of wrought-iron bars. Openings are left in the wrought-iron sleeper to receive the rail seating, which is of cast iron, in two pieces, a wooden key being used to tighten the rail in the usual manner. In the cast-iron sleeper, the seating or chair and the sleeper are in one casting. It is said that to each 15 ft. rail, the bearing surface of the sleepers will be 11½ ft. It is presumed that by this plan the maintenance of the permanent way will cost less than one-half that of a line where ordinary wooden sleepers are used. The ready means of packing at the two ends, and from the central opening will, it is said, save labour; and the bearing surface of the sleeper being near the top of the ballast, a less thickness will suffice. The form of the sleeper, too, it is thought, affords facility for a more perfect drainage than if it were solid; added to which the seating for the rail being 10 inches long, a greater bearing is obtained than with the ordinary chairs.—*Mining Journal.*

Improvement of Railways.—The Crystal Palace Railway from New Cross to the Exhibion is to be constructed in accordance with the plans of the Permanent Way Company, which, amongst other improvements, consists in making the rails into a continuous bar, called fish-jointing. This method is not altogether new, it having been adopted for some while, where the results were singularly convincing and economical, as shown by the various half-yearly reports of the cost of maintenance, nearly fifty per cent. of the labour being spared; and the entire absence of accidents testifying to its more vital principle of safety. To read or converse in a railway carriage was formerly a matter of difficulty, but by this system neither is any longer a task. This fact is exemplified upon the Brighton line where a little below Croydon, and before reaching the Merstham Tunnel, there is about a mile of the new line laid. We are no sooner on it than the change is most perceptible: exchanging an oscillating motion and clicking noise, for a smooth road and a monotonous sound of much less intensity, so that both conversation and reading may be indulged in with comparative ease. The invention which has wrought this comfort and security is a patent belonging to a few engineers, of great practical experience, who have enrolled themselves in an association termed the Permanent Way Company, with the view of rendering the use of this and other patents belonging to them more accessible to the public.—*Illustrated London News.*

Mauvaises Terres (Bad Lands.)—After leaving the locality on Sage Creek, and crossing that stream, and proceeding in the direction of White River, about twelve or fifteen miles, the formation of the Mauvaises Terres proper bursts into view, disclosing as here depicted, one of the most extraordinary and picturesque sights that can be found in the whole Missouri country. From the high prairies that rise in the back-ground by a series of terrrces or benches, towards the spur of the Rocky Mountains, the traveller looks down into an extensive valley, that may be said to constitute a world of its own, and which appears to have been formed partly by an extensive vertical fault, partly by the long-continued influence of the scooping action of denudation.

The width of this valley may be about thirty miles, and its whole length about ninety, as it stretches away westwardly, towards the base of the gloomy and dark range of mountains known as the Black Hills. Its most depressed portion, three hundred feet below the general level of the surrounding country, is clothed with scanty grasses, and covered by a soil similar to that of the higher groud. To the surrounding conutry, howewer, the Mauvaises Terres present the most stiking contrast. From the uniform, monotonous open prairie, the traveller suddenly descends one or two hundred feet, into a valley that looks as if it had sunk away from the surrounding world; leaving standing all over it, thousands of abrupt, irregular, prismatic, and columnar masses frequently capped with irregular pyramids, and stretching up to a height of from one to two hundred feet or more. So thickly are these natural towers studded over the surface of this extraordinary region, that the traveller threads his way through deep, confined, labyrinthine passages, not unlike the narrow, irregular stre ts of some quaint old town of the European continent. Viewed in the distance, indeed, these rocky piles, in their endless succession, assume the appearance of massive artificial structu es, decked out with all the accessories of buttress and turret, arched doorway and clustered shaft, pinnacle and finial, and tapering spire. One might almost imagine oneself approaching some magnificent city of the dead, where the labour and the genius of forgotten nations, had left behind them a multitude of monuments of art and skill. On descending from the heights, however, and proceeding to thread this vast labyrinth, and inspect, in detail, its deep, intricate recesses, the realities of the scene soon dissipate the delusions of the distance. The castellated forms which fancy had conjured up have vanished; and around one on every side is bleak and barren desolation. Then, too, if the exploration be made in midsummer, ths scorching rays of the sun pouring down in the hundred defiles that conduct the wayfarer through this pathless waste, are reflected back from the white or ash-coloured walls that rise around, unmitigated by a breath of air or the shelter of a solitary shrub. The drooping spirits of the scorched geologist are not permitted, however, to flag. The fossil treasures of the way well repay its sultriness and fatigue. At every step, objects of the highest interest present themselves.

Embedded in the debris lie strewn, in the greatest profusion, organic relics of extinct animals. All speak of a vast fresh water deposit of the early tertiary period, and disclose the former existence of most remarkable races, that roamed about in bygone ages high up in the valley of the Missouri, towards the sources of its western tributaries; where now pasture the big-horned *Ovis Montana*, the shaggy buffalo or American bison, and the elegant and slenderly constructed antelope. Every specimen as yet brought from the Bad Lands, prove to be of a species that became exterminated before the mammoth and mastodon lived, and differ in their specific character, not alone from all living animals, but also from all fossils obtained even from contemporaneous geological formations elsewhere. Along with a single existing genus, the rhinoceros, many new genera, never before known to science, have been discovered, and some, to us at this day, anomalous families, which combine in their anatomy structures now found only in different orders. They form, indeed, connecting links between different orders. For example, in one of the specimens from this strange locality, we find united characters belonging now to three orders. Another, the *Oreodon*, has grinding teeth, like the elk and deer, with canines resembling omniverous, thick-skinned animals; being, in fact, a race which live both on flesh and vegetables, and yet chewed the cud like our cloven-footed grazers!

Associated with these extinct races, we behold also, in the Mauvaises Terres, abundant remains of fossil Pachydermata, of gigantic dimensions, and allied in their anatomy to that singular family of proboscidate animals, of which the Tapir may be taken as a living type. These form a connecting link between the tapir and rhinoceros; while in the structure of their grinders, they are intermediate between the damon and rhinoceros; by their canines and incisors they connect the tapir with the horse on the one hand, and the peccary and hog on the other. They belong to the same genus of which the labors of the great Cuvier first disclosed the history, under the name of *Palaeotherium*, in publishing his description of the fossil bones exhumed from the gypsum quarries of Montmatre, near Paris, but are of distinct species; and one at least, of this genus, discovered on the Bad Lands, must have attained a larger size than any which the Paris basin afforded.

A nearly entire skeleton of this animal was discovered, which measured, as it lay imbeded, *eighteen* feet in length, and *nine* in height Besides these various remains of singular forms of Maminiferæ, there were also discovered many turtles, one of which was estimated to weigh a ton. These turtles were chiefly observed in a portion of the Bad Lands, some five or six miles in extent, which has much the appearance of an ancient lake. At one of these lake-like expansions, hundreds of fossil turtles were discovered.—*Ohio Statesman.*

What is Coal?—A curious case relating to a mineral, has lately occurred in Scotland, in which the opinions of many scientific men of the highest repute have been arranged against one another. The main question between the parties, however, was whether the substance was or was not coal. On the part of the plaintiffs, Professors Ansted, Anderson, Mr. Brande, the celebrated chemist, Mr. Alexander Rose, the Rev. Dr. Anderson, Dr. George Wilson, and Dr. J. T. Cooper, were examined. They decided that the mineral was not coal. On the part of the defendants, Prof. Johnson, of Durham, Prof. Ramsay, of London, Professor Hoffman, Chemist in the Government School of Mines, Professor Fyfe, Dr. Douglas Maclagan, Dr. Gregory, Professor Frankland, Mr. Dickinson Goverment Inspector of Coal Mines in England a number of other scientific, practical and operative witnesses, were examined. The result of their evidence was, that it was a coal of the Cannel or Parrot kind, differing in no essential respect from that sort of coal, but agreeing geologically and chemically with it in all its characteristics—that its component parts were similar to those which composed coal, its ash contained the same ingredients, and its combustion agreed in character. After the jury had been addressed by most eminent counsel on both sides, the Lord President summed up. The jury were to determine whether the substance in question fell within the term whole coal in the demise, for it was not pretended that it came within any other term specified in it. On the one side there were four geologists, who gave it as their opinion that it was not coal, and five on the other side, who said it was coal, all speaking with perfect sincerity, according to what they as geologists, classed as coal. Men of the highest reputation in geology and chemistry had been examined, but they differed very much in opinion. On one side there were five of the most eminent chemists, who had applied all their skill and energy to find out whether it was coal or not, and who had expressed themselves as clearly of opinion that it was not coal, while ten equally eminent on the other side, were of a diametrically opposite opinion. Is this substance, then, a coal or not, in the ordinary language of those who deal in it, and of the country? because, to find a scientific solution of it, after what has been brought to light for the last five days would be, he said, indeed a difficult thing. The jury, after retiring for abont five minutes, returned with a verdict for the defendants, thus establishing that in their opinion, the substance in question was, in effect, coal, and removing altogether from the company the slightest imputation of concealment or deceit.

Artificial Fuel Manufacture from Coal Refuse.—In the first place, the coal dust is thoroughly washed in a tank, fitted with a horizontal perforated diaphragm, beneath which it communicates with a cylinder and solid plunger, which being set in action by any primemover, an alternate motion is thereby given to the water, the coal-dust thoroughly washed, and all earthly matter, pyrites, schist, &c., fall to the bottom of the tank, which may be taken out by a lateral opening, and the water removed. The coal-dust is then dried, and passed between two grooved rollers, to reduce it to a uniform size. The next operation is to mix it with seven or eight per cent. of pitch in a heated state which is accomplished in a peculiarly constructed furnace. The heated vapours and products of combustion from a common furnace grate are made to pass under and through a circular chamber, in which is a revolving cast iron receptacle, with proper openings or gratings to admit the vapour, over which is a fixed rake, secured by rods and bolts. The operation may be thus described:—The prepared coal-dust is introduced into the receptacle by a properly arranged door, which, by the rotation and the rake, is uniformly spread over it. When the temperature of the coal has reached 200° Fahrenheit the valve of a pitch boiler, constructed over the furnace fire, is opened, and the liquid descends by means of a pipe into a long vessel, placed over the rake, from which it is distributed in a very uniform manner among the coal. When sufficiently impregnated and mixed, it is by an arrangement of traps and fixed scrapers allowed to fall into a receptable beneath. From thence, while still hot, it is placed in cast iron moulds, of any convenient size, for the formation of the fuel brick, and subjected to a hydrostatic pressure equal to 45,000 lbs., producing a compact and solid mass, exceedingly economical for stowage, and which may be broken up for use as required.

Pisiculture.—M. de Quatrefages has communicated to the Academy some important researches bearing on different points connected with the artificial fecundation of the eggs of fishes. Assisted by M. Millet, of whom we have spoken in our last communication, he has first shown that the temperature of the water for fecundation, is a point deserving especial attention. This temperature varies for each species, and it is well to ascertain it for each separately. In general, for the winter fish, as trout, it is between 6° and 8° C.; for the early spring fishes, as pike, 8° to 10°.; for the later spring, as perch, 14° to 16° C.; and finally, for the fishes of summer, as the barbel, 20° to 25° C. The necessity of a specific temperature is connected also with the vitality of the spermatozoids of different species, which is of short duration, it not exceeding 8 minutes in the pike, whilst in man it lasts 8 hours. The maximum temperature for the spermatozoids of the pike has been obtained at +2° C.; a higher temperature destroys them rapidly. The spawn of the pike is kept perfectly well in ice-water, and the spermatozoids perish only with a cold below 10° or 12°. The influence of temperature on the vitality of the spermatozoids of fishes, and therefore on the fecundation of eggs, presents a reason for the instinct which urges some fishes to ascend streams, and at times to penetrate into rivulets where they have hardly water enough for their movements. M. de Quatrefages deduces some rules which are important to the art of pisciculture, bearing especially upon the preservation of the spawn. 1. The water should not be supplied with the spawn in advance; it is well to leave the spawn in place even till the moment of employing it, and the fecundation should follow soon, upon the death of the male fish. 2. Since the fecundation should take place within a day or twelve hours after the death of the animal, the spawn should be then taken and kept separate. 3. To preserve the spawn, it should not be placed in the water, or in the open air, but better in a moist linen cloth, which is kept at a temperature equal to, or a little below that, which for each species gives the maximum duration to the movements of the spermatozoids. 4. If there are several fecundations to operate successively, it is necessary to detach for each, the quantity of spawn required, and leave the rest in some convenient place.—*Correspondence of Silliman's Journal.*

Monthly Meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West.—August, 1853.

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	Humidity of Air. 6A.M	2 P.M.	10 P.M.	M'N.	Wind. 6 A.M.	2 P.M.	10 P.M.	M's V	Rain in Inch.	S'nw in Inch.
						°	°	°	°												Miles		
b	1	29.652	29 607	29.598	29.619	65 6	68.6	69.5	68.37	0.515	0.636	0 600	0.593	88	91	86	88	W	E N E	N E	1.27	0 280	- -
b	2	621	.617	.588	.605	64 2	75 4	61.7	67 43	.542	.589	.395	.421	93	69	74	80	N	S S E	Calm	3 15	- -	- -
a	3	.551	.505	.447	.491	63 7	73.1	67 3	68 52	.505	.587	.460	.533	88	74	71	79	Calm	E N E	E N E	3 17	- -	-
	4	.419	.417	.450	.428	66.2	79 2	65 0	71 40	.539	.559	.496	.531	86	58	82	72	N b E	S b W	N E b N	1.37	- -	-
	5	.507	.486	.474	.493	66.7	82 0	64.2	72.32	.477	.593	.485	.516	75	57	83	68	N b E	S	Calm	1 07	- -	- -
	6	.566	.558	.676	.570	65 6	79 3	65 0	70.62	.577	.707	.559	.617	94	73	93	85	Calm	S E b E	S	2 78	- -	- -
	7	.629	.609			67.1	83.6			.550	.608			86	51			S	S b E		3 77	0.150	- -
c	8	.669	.614	.629	.652	64.7	81.5	70 0	72 93	.562	.635	.535	.551	91	60	75	71	Calm	S b E	N N E	2 87	- -	- -
b	9	.641	.652	.662	.655	64.7	80.0	72.7	73.02	.486	.735	.662	.650	81	74	85	82	Calm	S E b S	S W b S	1 83	Inap	-
b	10	.699	.657	.677	.674	66 5	88 4	71.6	76 98	.596	.610	.631	.630	91	50	84	73	Calm	S	Calm	1 66	- -	-
c	11	.716	.675	.627	.671	68.1	91.4	75 6	79.25	.519	.688	.685	.647	83	48	80	69	Calm	S	Calm	4 73	- -	- -
	12	.672	.557	.562	.593	71.7	87.9	77 4	79.83	.657	.862	.780	.757	87	67	85	77	Calm	S	N b W	4.31	0.215	- -
	13	.564	.460	.411	.486	73 6	90 8	72.0	78 53	.714	.874	.626	.741	94	63	82	79	Calm	S E	Calm	3 06	0.215	- -
b	14	.416	.410			74.0	83 0			.716	.752			88	69			Calm	N		4 63	- -	- -
b	15	.649	.651	.632	.641	66 8	82.2	69.6	73.38	.492	.576	.510	.541	76	54	72	68	N b E	E b N	E b N	4 48	- -	- -
	16	.651	.623	.678	.612	63.6	84.5	71.1	75.30	.445	.540	.691	.559	78	47	94	72	N N E	E S E	N N E	3 39	- -	-
	17	.516	.415	354	.427	66.6	85.1	67.1	73.77	.527	.656	.593	.601	83	55	92	76	N N E	S E b S	N b E	3.83	0.460	- -
	18	.302	.336	.511	.396	64.9	62.2	55.6	59.77	.536	.417	.294	.403	89	82	67	76	Calm	N N W	N b W	7 11	0 005	- -
	19	.576	.573	.586	.582	49.6	67.9	53.8	57 32	.265	.201	.258	.245	75	31	63	56	N b W	N W	Calm	5 57	- -	- -
	20	.626	.566	.525	.571	48 7	70 7	60.5	60.97	.256	.367	.352	.323	76	50	68	62	Calm	S	N W	5 28	- -	- -
	21	.511	.491			47.6	75.7			243	.511			75	60			N b W	S b W		4.93	- -	- -
	22	.675	.739	.799	.751	56.1	72.9	57.1	62.93	.351	.482	.354	.403	80	61	78	72	N	S E b S	N N E	4.98	- -	- -
c	23	.832	.739	.593	.714	61 4	68.0	65.7	65.22	.408	.402	562	.460	77	60	92	76	S E b E	E	N E	6 36	1 020	- -
b	24	.384	.320	.526	.418	67.7	80.0	61.4	69.07	.619	.592	.365	.593	94	59	68	76	S b E	W N W	N W b W	7.55	Inap	- -
c	25	.681	.739	.750	.732	48 4	65 7	52 0	55.65	.237	.401	.332	.32	70	66	87	73	N W b W	S E b S	S E b E	5.20	- -	- -
d	26	.753	.632	.476	607	48.5	70 7	70.3	65.92	.246	.505	.588	.479	73	69	80	74	N N E	E	S S E	5 17	0.200	- -
b	27	.442	.534	.719	.588	64 4	62 2	55 6	60.50	.549	.322	.310	.382	94	57	71	73	W	W	W b N	9.59	- -	- -
b	28	.850	.827			50 6	66.4			.291	.440			81	70			N W	S		3 48	- -	- -
b	29	.800	.725	.722	.743	49 4	71.6	60.0	61.25	.297	395	.366	.378	85	53	71	69	Calm	S b W	Calm	2.58	Inap	- -
b	30	.670	.568	.598	.569	57.5	70 5	70 4	65 80	.301	.433	.410	.42	65	60	60	68	Calm	S W b S	Calm	2 01	Inap	- -
a	31	.621	.633	.710	.661	64 3	70 8	61.8	65 42	.492	.553	.466	.488	84	69	87	81	N b E	E S E	S E b E	3 33	- -	- -
	M	29 611	29 579	29.588	29 591	62.19	76 39	65.33	68 61	0 471	0.553	0.496	0.513	84	62	78	74	MPs 2 52	MPs 7 63	MPs 2 83	4 23	2 575	-

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

North.	West.	South.	East.
972.76	746.25	1212.66	879.16

Mean direction of the wind S. E. by S.
Mean velocity of the wind - - 4 23 miles per hour.
Maximum velocity - - - - - 18 5 miles per hour, from 4 to 5 p.m. on 18th
Most windy day - - - - - - 27th: Mean velocity, 9 50 miles per hour.
Least windy day - - - - - 5th Mean velocity, 1.07 ditto.
Raining 19 3 hours.

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.

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 - - 29 850, at 6 A. M., on 28th. } Monthly range:
Lowest Barometer - - 29 300, at 8 A.M., on 18th. } 0.550 inches.
Highest regist'd Temp. - 94.9, at — P.M., on 11th } Monthly range.
Lowest regist'd Temp. - 42 5, at — A.M., on 25th } 52.4
Mean Maximum Temperature - - - - 78 50 } Mean daily range:
Mean Minimum Thermometer - - - - - 57 10 } 21.41
Greatest daily range - - - - - 39 1 from P. M. 24th to A. M. of 25th.
Warmest day - - 12th - - - Mean Temperature - 79 83 } Difference
Coldest day - - -25th - - - Mean Temperature - 56 65 } 23.18

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

Possible to see Aurora on 23 nights.
Aurora seen on 3 nights.

Comparative Table for August.

Year.	Temperature Mean.	Max. obs'rvd	Min. obs'rvd	Range.	Rain. D'ys	Inches.	Snow. Dys	Inch.	Wind Mean Velocity
	°	°	°	°					Miles.
1840	64.6	80.1	47.4	32 7	12	2 905	0	--	--
1841	64 4	83.5	46.7	36 8	9	6 170	0	--	--
1842	65 7	80.7	45.3	35 4	6	2 500	0	--	--
1843	66 4	85 5	44 4	41 1	4	4 850	0	--	0.12 lb
1844	64 3	82 5	44.3	38 2	17	imperfect	0	--	0 16
1845	67 9	82 5	41.4	38 1	9	1 725	0	--	0 19
1846	68.4	86.3	50 4	35 9	9	1.770	0	--	0.17
1847	65.1	83.1	44.9	38 2	10	2 140	0	--	0.19
1848	69 2	87.5	49.3	38.2	8.	0 855	0	--	4 55
1849	66 3	79 5	51.4	28 1	10	4.970	0	--	3 76
1850	66.8	84 2	43 0	41.2	13	4 355	0	--	4 46
1851	63.6	79 8	43 6	36 2	10	1.360	0	--	4 62
1852	65.9	81.2	46 7	34 5	9	2 695	0	--	3 30
1853	68 6	91.6	47 6	44 0	11	2 575	0	--	4 23 m
Mean	66 23	83.43	46.39	37 04	9 8	2 990	0		0.47 lb 4.15 M's

The mean temperature of the month is 2 4 above the average of 14 years, and is with one exception (1848) the highest known: the maximum thermometer recorded 94 9 on the 11th, which is the highest that has ever occurred at the Observatory, but the warmest day on the whole was the day following this, which was 13.5 above the normal. From the 9th to the 17th inclusive, the differences above the normal were as follows: 6 5. 10.5, 12.8, 13 5, 12 3,—7,—2, 9.3, 7.8; these were succeeded by three cold days, the remainder of the month being of an average character.

The blanks in the Magnetic column arise from the failure of the Photographic traces from the use of improper paper, the stock of proper paper being exhausted and some delay having occurred in the arrival of a supply from England.

Monthly Meteorological Register, St. Martin, at Isle Jesus, Canada East, August, 1853.

Nine Miles West of Montreal.

[BY CHARLES SMALLWOOD, M. D.]

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

Day.	Barom: corrected and reduced to 32° Fahr.			Temp. of the Air.			Tension of Vapour.			Humi'y of the Air.			Direction of Wind.			Velocity in Miles per Hour.			Rain in Inch.	Weather, &c. A cloudy sky is represented by 10; a cloudless sky by 0.		
	6 A. M.	2 P. M.	10 P.M.	6 A. M.	2 P.M.	10 P.M.	6 A. M.	2 P. M.	10 P.M.	6 A. M.	2 P. M.	10 P.M.	6 A. M.	2 P. M.	10 P. M.	6 A. M.	2 P. M.	10 P.M.		6 A. M.	2 P. M.	10 P. M.
1	29.913	29.818	29.855	63.4	80.1	67.0	.488	.588	.593	.84	.58	.89	N E	N E	NW b W	Calm.	0.67	0.22	Inap.	Clear.	Cum. Str.10	Slight Rain.
2	.882	.818	.887	65.1	86.2	67.0	.555	.787	.570	.89	.65	.81	N	E N E	W N W	Calm.	Calm.	2.50		Str. 10.	Clear.	Clear.
3	.814	.686	.686	70.2	86.9	68.0	.568	.617	.613	.78	.50	.89	S W	S W	S	3 06	1.14	4.12		Clear.	Clear.	Clear.
4	.672	.474	.599	70.2	79.2	69.1	.659	.628	.601	.90	.64	.85	N E b N	N E b E	SW b S	Calm.	0.87	0.03		Cum Str. 4.	Cir. Str. 4.	Clear.
5	.695	.661	.697	68.5	80.0	66.3	.496	.618	.516	.72	.61	.80	N E b E	S E	N E	1 81	Calm.	5.00		Clear.	Clear.	Clear.
6	.798	.786	.788	65.7	72.2	67.0	.473	.638	.626	.76	.82	.94	N E	S S W	E N E	5.25	4 16	0.19	Inap.	Clear.	T S. at 11. 40 a.m	Clear Shooting S.
7	.798	.826	.819	69.0	83.7	68.0	.631	.692	.646	.90	.58	.94	W	S W	S b W	5 00	2.16	1.28	0.232	Shower at 5 A. M.	Show'r at 2 P. M.	C. S. Stars, F. Au.
8	.731	.645	.709	72.2	86.3	70.0	.607	.681	.597	.78	.56	.82	W S W	S	S W	0.25	2.62	2.37	Inap.	Cirr 4 shower in n.	Cum'l. 2.	Clear S. Stars.
9	.695	.709	.799	66.1	82.1	69.8	.516	.597	.634	.80	.55	.90	W	W N W	NW b W	2.90	5.25	3.32		Cum. Str.10	Cirr. Cum. Str. 4.	Clear S. Stars.
10	.798	.686	.726	70.2	92.4	73.2	.568	.638	.568	.78	.46	.71	S	S S W	S b W	Calm.	0 92	0.75		Clear.	Clear.	Clear.
11	.751	.648	.662	74.0	95.4	72 4	.648	.607	.701	.78	.44	.74	W b S	W S W	W N W	1.35	4.75	6.59	0.136	Clear.	Cir. Cum. 4.	Clear, S. at 6 p.m
12	.857	.639	.631	74.4	80.1	76.3	.751	.827	.727	.90	.82	.82	W	E b N	E N E	2 39	Calm.	1.66	0.140	Str. 10, Shw'r 6.20	Show'r 1. 59 P. M.	Str. 10.
13	.627	.511	.540	70.5	86.3	77.6	.692	.751	.617	.95	.61	.67	N E b E	N b E	N E b E	4.89	3.14	2.51	0.300	Str. 6, rain N, d. t.	Cirr. Cum. Str. 4.	Rain, Dis. Thun.
14	.408	.501	.502	66.7	81.0	70.6	.690	.670	.659	.96	.64	.90	N E	E	S E b E	4.93	Calm.	Calm.	2.273	Rain ceased 7. 20.	Str. 5.	Clear.
15	.681	.573	.610	67.0	88.6	70.1	.593	.541	.568	.89	.42	.78	E S E	S b E	S S E	1.24	1.18	0.46		Heavy Fog.	Clear.	Clear.
16	.684	.611	.579	64.2	89.0	74.6	.565	.715	.617	.94	.53	.74	E S E	E S E	N E b N	2 50	Calm.	Calm.		Clear.	Clear.	Clear.
17	.546	.384	.350	65.8	83.0	69.0	.527	618	.601	.85	.58	.85	N N E	S E	N E b E	1 18	5.15	1.30		Cir. Str. 4.	Clear.	Cirr. Cum. 2.
18	.308	.283	.359	66.5	56.6	52.3	.605	.432	.373	.91	.91	.93	E N E	N N E	N b E	2.10	9.00	8.78	0.933	Str. 8, Rain in N't.	Rain b. at 1.40 p.m.	Str. 10.
19	.419	.413	.449	53.1	66.1	54.8	.274	.516	.319	.66	.80	.81	N	W N W	W N W	6.60	6 75	7 79		Clear.	Cum'l. 2.	Cuml. 2.
20	.501	.462	.454	56.0	67.5	58.0	.363	.431	.421	.79	.65	.86	W N W	W b N	S b W	1.12	2 05	4.25		Clear.	Cuml. Str.8.	Clear.
21	.452	.385	.460	60 7	75.0	59.6	.416	.450	.478	.79	.52	.94	W S W	W S W	W b N	3 99	6.00	4.98		Clear.	Cuml. St. 4.	Rain C. at 7.10 p.m
22	.605	.641	.712	54.0	67.9	53.8	.382	.534	.361	.89	.81	.87	N W b N	NW b N	N W b W	0.41	Calm.	0.15	0.373	Cirr. Str. 2.	Cuml. Str.7.	Clear.
23	.796	.702	.634	51 2	75.1	57 3	.326	.428	.398	.76	.50	.81	N E b N	S E	E b S	Calm.	1.01	Calm.		Clear.	Light Cirr. 3.	Clear.
24	.492	.319	.264	60.2	60.0	62.5	.467	.480	.559	.89	.90	.99	S E b S	S E b S	S b W	1.55	9.88	7.62	1.230	Cirr. Cum. 3	Rain at 10.20. a. m.	Ceased at 7.50 p.m
25	.287	.629	.675	53.7	72 2	51.2	.386	.578	.349	.93	.74	.81	S W	S W	S W	4.32	7.62	Calm.		Str. 2.	Cir. 2	Clear Ft. Au. Str.
26	.779	.670	.561	48.1	73 8	63.0	.302	.442	.461	.86	.55	.99	E b S	S E b S	S E b E	Calm.	1.15	2.22		Clear.	Light Cirr. 3.	Cirr. Cum. Str. 9.
27	.315	.300	.444	67.0	75.7	58.1	.531	.607	.412	.81	.71	.81	S b E	S S W	W	17.56	9.12	10.43	1.236	Rain 7. 40.	Ceased at 11.20.	Str. 4.
28	.452	.573	.582	54.0	67.1	56.7	.301	.455	.385	.70	.69	.81	NW b W	NW b W	W b S	7.40	5.62	4.73		Cum. 2.	Clear.	Clear
29	.613	.528	.551	56.6	76.0	65.7	.408	.541	.449	.89	.61	.72	W b S	W b S	W S W	1.93	7.45	5 37		Cum. Str. 2.	Clear.	Clear, Comet still v
30	.580	.450	.418	60.2	81.3	68.0	.441	578	.496	.84	.55	.72	W S W	W b S	W S W	3 30	4.31	2.82		Clear.	Clear.	Rain at 9 p. m.
31	.411	.448	.518	62.8	79 8	62.9	.517	.628	.499	.96	.61	.89	E N E	W S W	W	0.79	2 59	1.20		Cir. Str. 8.	Clear.	Clear.

Barometer.
- Highest, the 1st day - - - - - - 29.913
- Lowest, the 24th day - - - - - - 29.264
- Monthly Mean - - - - - - - 29.598
- " Range - - - - - - - 0.649

Thermometer
- Highest, the 11th day - - - - - 96°.2
- Lowest, the 26th day - - - - - 43°.3
- Monthly Mean - - - - - - 68°.61
- " Range - - - - - - 42°.9?

Greatest Intensity of the Sun's Rays—143°.6.

Mean of Humidity—.741.

Lowest point of Terrestial Radiation 37°.1.

Amount of Evaporation—3.16 inches.

Rain fell in 13 days amounting to 7.089 inches, and was accompanied thunder and Lightning on three days.

Most Prevalent wind—S. W.

Least do. do. E.

Most Windy Day—the 27th day, mean—12.37 miles per hour

Least Windy Day—22d, mean—0.18 miles per hour.

Aurora Borealis visible on 3 nights, and might have been seen on 22 nights.

Shooting Stars very numerous on the nights of 7th, 8th, 9th, 10th, & 13th

Comet first seen here on the 22d day, in N.W., 8 p.m., in constellation Leo. 27th, Comet visible, tail 15° long. On the 29th, at 7.30 : its R. A. was 11h. 40 m. 10 s., and dec. N. 15° 0' 22".

The electrical state of the atmosphere *generally* has indicated rather feeble intensity of Positive Electricity, and during the thunder storms, was of a negative character.