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Geological Survey of Canada.

REPORT OF PROGRESS FOR THE YEAR 1852-3.

The Report for the year 1852-3, recently printed by order of the Legislative Assembly, is one of the most voluminous of the series. It occupies one hundred and seventy nine octavo pages, and embodies a large amount of very valuable and instructive information respecting the Geology and Topography of Canada, as well as the distribution of economic materials in both Provinces. Mr. Logan's examination of the district which lies on the north side of the St. Lawrence, between Montreal and Cape Tourmente, below Quebec, appears to have been rendered very laborious on account of the want of a good map of the country. So inaccurate and deficient were the maps of the settled parts, that it became necessary to go over the whole ground on foot, and to measure, by pacing, the distances travelled. Mr. Logan pithily observes, that "the weariness resulting from the attention required to count one's paces accurately, every day, and all day long, for five or six months of assiduous exploration, *is best understood by those who have made the attempt.*"

"The country which lies between the upper end of the island of Montreal and Cape Tourmente on the left side of the St. Lawrence, and occupies the space intervening between the river and the flank of the metamorphic hills, to which Mr. Garneau, in his History of Canada, has given the name of the Laurentides, has a length of about 200 miles, and it gradually widens from a point at Cape Tourmente, to about thirty miles at Montreal, having thus an area of about 3000 square miles. It presents a general flat surface, rising in many places by abrupt steps, (the marks of ancient sea margins,) into successive terraces, some of which are from 200 to 300 feet above the level of the river, and the whole have a general parallelism with it. These terraces are occupied by clay and sand, and the latter predominating, gives them, as a whole, a light soil. In some parts extensive swamps prevail on the terraces, but there is not a lake in the whole area. The rivers which cross it, (some of them large streams, of which the St. Maurice is the greatest,) descending the flank of the metamorphic hills, all give a succession of falls and rapids before reaching the plain, affording a great variety of picturesque and beautiful cascades, and yielding a vast extent of water-power, capable of application to sawing timber and other manufacturing purposes.

Quitting the metamorphic rocks, these streams at once cut deep into the softer deposits of the plains, sometimes at a leap attaining nearly the level of the St. Lawrence, and intersect the country by numerous nearly parallel ravines; they generally display steep banks of clay and sand, but in a few instances run in troughs, exposing perpendicular sections of slightly inclined strata of limestone or black shale, piled upon one another to the height of from twenty to eighty feet.

The name which has been given in previous reports to the rocks underlying the fossiliferous formations in this part of Canada is the Metamorphic series, but inasmuch as this is applicable to any series of rocks in an altered condition, and might occasion confusion, it has been considered expedient to apply to them for the future, the more distinctive appellation of the Laurentian series, a name founded on that given by Mr. Garneau to the chain of hills which they compose.

The geological formations which underlie the district in ascending order would thus be as follows:—

1. Laurentian series.
2. Potsdam sandstone.
3. Calciferous sandrock.
4. Chazy limestone.
5. Birds-eye, Black-River, and Trenton limestones.
6. Utica slate.
7. Hudson-River group.
8. Oneida conglomerate.

Mr. Logan then proceeds to describe the distribution of these formations, together with the attitude they assume in the physical structure of the region. The occurrence of economic materials is next adverted to. No very promising field of enterprise appears to present itself in any part of the district examined.

"The materials having an economic value seem to be almost wholly confined to bog iron ore and iron ochres, together with stone fit for the purposes of construction and flagging, as well as limestone for burning, clays for common bricks and pottery, and peat, in some parts, fit for fuel." The observations of Mr. Logan respecting the distribution of auriferous drifts are highly important, as they settle, for the time, the question of the presence of workable gold fields in Canada.

"In the month of December, a few days were devoted to a farther examination of the distribution of this metal in the Eastern Townships, and particles of it were found in the valley of the St. Francis at various intervals from Richmond to Hunting's mills on the Salmon river, flowing into the Massawippi, a little above Lenoxville. Though the weather was rather adverse to the examination, on account of the cold and frost, yet the results were much the same as those of similar previous explorations farther to the east. One of the positions examined was on the road passing to the north of the mill-pond on the Magog river above Sherbrooke, where particles were met with in an ancient hard bound gravel, which probably has never been disturbed since the time when the surface arose from beneath a tertiary sea. The position is about 156 feet above the level of the St. Francis at Sherbrooke, and would probably be over 600 feet above the St. Lawrence in Lake St. Peter; this fact serves to shew that the metal is not confined to the lowest parts of the valleys, but will have a distribution co-extensive with the original drift of the district.

It may be considered that the auriferous drift has now been shown to exist over 10,000 square miles on the south side of the St. Lawrence, comprehending the prolongation of the Green Mountains into Canada, and the country on the south-east side of them. In following the range of this drift north-eastwardly, the researches of the survey have not extended beyond Etchemin Lake; but the general similarity of the rocks beyond, renders it probable that little change will be found for a distance extending much farther; perhaps to the extremity of Gaspé. It may be proper to remark that though the ascertained auriferous area is thus so much increased beyond the measure given to it in a previous Report, no fact has come to my knowledge of sufficient importance to authorize any change in the opinion that has already been expressed, *that the deposit will not in general remunerate unskilled labor, and that agriculturalists, artizans, and others engaged in the ordinary occupations of the country, would only lose their labor by turning gold hunters.*"

Mr. Murray's investigations were carried along the line between the neighbourhood of Kingston and Lake Simcoe. The general plan of operations embraced a set of north and south traverses between the shore of Lake Ontario and the rear of the surveyed lands, together with east and west offsets from the general course. The topographical information embodied in Mr. Murray's Report is highly interesting and valuable. The heights of the different Lakes, which appear to form a continuous chain along the line of operations, is given in detail. The following table contains the elevations of each Lake above the surface of Ontario :—

Name.	*Townships.*	*Height in ft*	*Falls into*
Loughboro' Lake	Storrington and Loughboro'	166·12	Rideau River
Sloat's Lake	Loughboro'	187·05	Lake Ontario.
Knowlton Lake	"	217·53	Mud Lake.
Mud Lake	"	217·53	Desert Lake.
Desert Lake	Bedford	217·53	Birch Lake.
Birch Lake	"	217·53	Devil Lake.
Devil Lake	"		Rideau River
Canoe Lake	"	229·97	Desert Lake.
Ratting's Mill Pond	"	287·00	Wolf L. & Rideau R.
Green Bay & Bob's L.	"	384·80	Tay & Rideau Rivers
Crow Lake	"	398·88	Mud Lake.
Sharbord Lake	Oso and Olden	505·29	Madawaska & Ottawa Rs
White Lake	Olden	555·29	Sharbord Lake.
Cross Lake	Kenebec	412·84	Long Lake.
Long Lake	Sheffield	365·69	Beaver Lake.
Beaver Lake	Sheffield	307·22	Salmon R & B of Quinte
Balsam Lake	Bexley & Fenelon	588	Cameron's Lake.
Cameron's Lake	Fenelon	583	Sturgeon Lake
Sturgeon Lake	Fenelon & Verulam	561	Pigeon Lake.
Pigeon Lake	Harvey	556	Deer Bay.
Buckhorn Lake	Ennismore, Smith, & Harvey	556	Deer Bay.
Chemong or Mud Lake	Ennismore & Smith	556	Buckhorn Lake.
Deer Bay	Smith	553	Salmon Trout or Clear L.
Stony or Salmon Trout Ls	Dummer & Burleigh	520	Otonabee R & Rice L.
Rice Lake	Monaghan, Alnwick, Hamilton, Otonabee	364	Trent R. Ontario L.

DISTRIBUTION OF THE FORMATIONS.

"The rocks of the area whose principal geographical features are given in the sketch, belong to two distinctly different periods; one set being fossiliferous and nearly undisturbed, and the other unfossiliferous and greatly disturbed, contorted and altered. The fossils of the former are all of the Lower Silurian age, and the strata to which they belong, as may be inferred, rest unconformably on the tilted edges of the latter. By drawing a straight line from about the middle part of Loughborough Lake, across the heads of Knowlton and Beaver Lakes, to Round Lake in Belmont, a small sheet of water a little beyond Belmont Lake, and then another from Round Lake to the northern extremity of Balsam Lake, a tolerably fair representation of the junction of the two series of rocks will be indicated; the metamorphic, to which you have given the name of the Laurentian series, keeping on the north, and the fossiliferous on the south side of the lines. There will, however, be several deviations from the regularity of the straight lines, occasioned by undulations in the more ancient rocks, bringing them occasionally to the surface on the south, while a number of outlying patches of the more recent formations are spread over portions of the country to the north."

The Laurentian series are described in the Report for 1845-6 on the Ottawa region, and the description there given applies equally to the rocks of the same series which came under Mr Murray's notice in the Survey of 1852-3.

The kind and quality of economic materials met with in this survey are of considerable importance.

"The deposits of iron ore in Madoc, Marmora, and Belmont some of which have long been known and have been worked, will probably hereafter become of great commercial importance The ore which was formerly smelted at the village of Madoc, by Messrs. Seymour & Co., and produced an excellent quality of iron, was mined on the eleventh lot of the fifth concession *of the township. The bed appears to run through a black* soft micaceous rock, and holds a course which as far as it was traced, was about W. by N., and E. by S., while the slope of the bed which is towards the south, was between seventy-five and eighty degrees. The greatest observed breadth of the bed appeared to be about thirty feet, and its average would probably not fall short of about twenty feet. A material similar to the soft black micaceous rock which accompanies the bed of ore on each side, appears every now and then to cut it diagonally in thin belts. In one place the bed is said to have been thus cut at distances of from every three to ten feet, and in another there was an unbroken part with a length of fifty feet. The ore is very black and very fine grained, and while the whole body of it is magnetic, some portions of it have polarity, one end of a fragment repelling and the other attracting the north end of the magnet. When the ore is bruised with a hammer on these portions of the bed, or on fragments taken from them, the particles adhere to one another and stand up on the mass as they would on a magnet, the ore being in short a natural magnet or loadstone. The portions which have polarity appear to run across the ore bed at right angles. Nodules of actynolite or green fibrous pyroxene, made up of radiating crystals, are disseminated in the ore, and yellow uranite is found investing small cracks."

Mr. Murray relates some curious instances of the popular *furor* in the search for precious metals which appears to have unsettled the minds of the inhabitants of our back woods.

"In almost all parts visited this year, but more especially in the back settlements, a great number of the inhabitants are possessed with the delusive belief, that the precious metals abound among the rocky ridges of the Laurentian country, and that they by their own individual exertions, are capable of realizing vast wealth. Iron pyrites, mica, plumbago, specular iron, galena, and other bright or metallic substances are indiscriminately collected, barelled and buried in the woods, with the full impression by those engaged in such business, that they have stored away so much gold and silver; and although every second person met with, had a specimen of some sort to present, with anxious enquiries as to its nature, hardly a single individual could be found who was willing to give the smallest information as to its locality. It was in vain to argue with such persons that the consequences of a proper examination, might possibly be more advantageous to the common interest than anything they were likely to accomplish in secret and unassisted; such an argument was only regarded as the result of a governmental scheme to deprive them of their imagined wealth; and an appearance of anxiety to procure any information only rendered their secrecy the more profound."

Mr. Hunt's Report embraces a valuable classification of the

Mineral Springs of Canada; the discovery of the presence of boracic acid in several springs, and the analysis and description of some new minerals. We proceed to extract the most prominent illustrations of these additions to our knowledge of the physical history of the United Provinces.

"Having in the month of October last, collected a farther supply of the alkaline water from the Grand Coteau at Chambly, described with an incomplete analysis, in my Report for last year, I was enabled to confirm the results before obtained, and to make a more extended examination. It will be recollected that it was described as a strongly alkaline water, containing beside chlorid of sodium, with traces of the iodid and bromid, and carbonates of lime and magnesia, a large proportion of carbonate of soda, besides silica in some soluble state. To these must be added, carbonates of baryta and strontia, and borate of soda. It is but a few months since Professor H. Rose, of Berlin, pointed out a reaction which enables us to detect borates, even when present in minute quantity. It depends upon the power of free boracic acid to change to red, the yellow colour of paper stained with turmeric. The liquid suspected to contain a borate is neutralized with hydrochloric acid, and slips of turmeric paper are dipped in it and allowed to dry, when they are to be moistened with somewhat diluted hydrochloric acid, which at once produces a red-brown colour when boracic acid is present. By the aid of this test, Fresenius, Bouis, and Filhol, have just succeeded in discovering the presence of boracic acid in many of the mineral springs of Germany and France, and the same means have enabled me to detect it in several springs in this Province. When the Chambly water is evaporated to one-tenth, and neutralized with hydrochloric acid, turmeric paper which has been three or four times dipped in it and dried, becomes very red when moistened with diluted hydrochloric acid. Our present processes do not afford us any direct means of determining the amount of boracic acid when associated with carbonates and chlorids; but some experiments to be mentioned farther on, serve to give an approximate notion of the proportion in which it exists."

CANADIAN MINERAL WATERS.

The number of mineral waters described in this and the preceding Reports is in all fifty-four. Of these twenty-two making the water bitter and disagreeable to the taste like sea-water, but far more intense; those chlorids are also present in large proportion in the waters of Kingston, Bay St. Paul, and Riviére-Ouelle, and render them unpalatable. The waters from 3 to 12, that of Riviére-Ouelle excepted, are very much alike in character, and are all agreeably saline to the taste. Of the waters among these last, which have been quantitatively, analyzed, the Intermittent of Caledonia will be seen to contain the largest amount of these earthy chlorids, after which follow the St Léon, and Georgian Springs, then those of Lanoraie, Caxton and Plantaganet, which contain the least of all.

In the second division of saline springs, these earthy chlorids are wanting, and we find instead, a portion of carbonate of soda, which gives to the waters when concentrated, an alkaline or soapy taste. Some of these are at the same time strongly saline, but in others the alkali predominates, and renders the taste of salt in the evaporated waters, hardly perceptible. They all afford the reactions of bromine and iodine, and many, perhaps all of them, contain a portion of borate of soda.—Carbonates of baryta and strontia are found in all those which do not contain a portion of alkaline sulphate.

CLASS I. SALINE WATERS.

Division B. Containing Carbonate of Soda.

Names and Localities.		In 1000 Parts.	See Report for
1 Varennes, (Outer Spring.) . . .	B	10 72	*1849 p. 49
2 " (Inner Spring.) . . .	B	9·58	* " " 51
3 Fitzroy, (Gillan's Spring.) . . .	B	8·34	*1851 " 49
4 Caledonia, ("Gas" Spring.) . . .	S	7·77	*1848 " 141
5 " ("Saline" Spring.) . .	S	7·34	* " " 145
6 Belœil.	B	7·33	*1851 " 51
7 La-Baie, (Courchêne's Spring.) . .	B	7·29	*1853 " 161
8 Chambly, (Rang-des-Quarante.) . .	B	5 74	1852 " 116
9 Ste-Hyacinthe, (Providence Spring.)	B	5 16	1850 " 162
10 La-Baie (Houlè's Spring.)	B	4.96	1853 " 161
11 Caledonia, (Sulphur Spring.) . . .	S	4.94	*1848 " 145
12 Chambly, (Grand-Coteau.) . . .	B	2.13	*1853 " 154
13 Ste-Martine.	S	1 98	1852 " 114
14 Nicolet, (Hèbert's Spring.) . . .	S	1 56	*1853 " 162
15 St.-Ours.	S	·53	* " " 157
16 Ste-Anne-de-la-Pocatière, ...	S	·36	1852 " 113
17 Jacques-Cartier River.	S	·34	*1853 " 159
18 Nicolet, (Roy's Spring).	S	. . . .	" " 162

The quantity of alkaline carbonate bears no constant proportion to the whole amount of saline matter, for while the waters of Varennes, Caledonia, Fitzroy and Belœil, contain but from ·05 to ·58 parts in 1000 parts of carbonate of soda, equal to from 1 to 12 per cent. of the whole amount of soda salts present, the Jacques-Cartier Spring contains 1·95, that of St.-Ours ·134, that of the Grand-Coteau of Chambly 1·06, and Hébert's Spring in Nicolet, 1·13 parts, equalling 82, 63, 52, and 72 per cent. of the whole amount of alkaline salts present. These less saline waters then contain not only relatively, but actually, more alkaline carbonate than the more strongly saline springs. It will be understood that a small undetermined portion of the soda represented as carbonate, exists combined with boracic acid.

The second class of springs consists of a small number containing free sulphuric acid, together with sulphates of lime, magnesia, alumina, protoxyd of iron, and small portions of alkalies, without any trace of chlorine; they all contain sulphuretted hydrogen. Of these four are known, all being in the same region of Western Canada; they are the Tuscarora Sour Spring, containing 1·87 parts of sulphates and 4·29 of free hydrated sulphuric acid, in 1000 (See Report for 1848 p. 152); another in Niagara with about ·6 parts of sulphates of the above bases, and two parts of free acid in 1000; besides a third from near Chippawa, described by Dr. Mack, of St. Catharines, C. W., in the British American Journal, vol. v. p. 63, which in composition and strength is very much like that of Tuscarora, and a fourth furnished me by Dr. Chase of St. Catherines, from the vicinity of St Davids, and similar to the last, although weaker. (Report for 1850, p. 100.) The connection of these springs with the gypsiferous rocks, and their supposed relations to the deposits of gypsum, have been discussed in the Report for 1848.

The Charlotteville Spring is not included in either of the above classes, as its saline ingredients are principally earthy sulphates and carbonates, with but a very small proportion of chlorids; its solid ingredients amount to 2·49 parts in 1000. This water is remarkable for the great quantity of sulphuretted hydrogen gas which it holds in solution, amounting to 32·1 cubic inches to an imperial gallon. (Report for 1848, p. 157.)

The quantity given in that report, 20 8 cubic inches was calculated for an American standard gallon of 231 cubic inches. The feebly saline and sulphurous waters, 23, 24, and 25, of division A, resemble this in the predominance of sulphates.

All of the springs of division A, with the exception of those of Ancaster, which belong to the Niagara group, issue from Lower Silurian rocks; the water of Ste.-Anne, No. 17, comes from the Oneida conglomerate, and of the others, Nos. 3, 8, 16, 18, 21, and perhaps 6 and 14, issue from the Utica slates or the Hudson River group, while the others belong to the Trenton limestone, and that of Fitzroy to the Chazy or Calciferous sandrock, to the latter of which the water of Ste.-Martine is probably to be referred. Of the remaining thirteen, Nos. 1, 2, and 17 rise from the Utica slates, and the others from the Hudson River group, with the exception of 16, which issues from the conglomerates immediately above.

CLASS I. SALINE WATERS.—*Division A Containing Chlorids of Earthy Bases*

	LOCALITIES AND NAMES.		IN 1000 PARTS	SEE REPORT FOR
1	Ancaster (Salt Well)	S	36 57	*1818 p. 161
2	Bay St. Paul	..	20·68	1851 ,, 52
3	La-Baie-du-Fêbvre (Lafort's Spring) ..	B	15 91	1853 .. 160
4	Alfred	B	14·50	1852 .. 112
5	Caledonian ("Intermittent")	...	14·63	*1848 ,, 149
6	St.-Léon	B	13·83	*1849 .. 53
7	Caxton	...	13 65	* .. ,, 55
8	Rivière-Ouelle	S	13 66	1852 .. 113
9	Plantagenet (La Rocque's Spring)	...	13·16	*1849 .. 57
10	Lanoraie	B	12·88	*1851 .. 48
11	Gloucester	B	11·20	1852 ,, 112
12	Plantagenet (Georgian Spring)................	S	10 98	*1851 ,, 47
13	Kingston	S	10·16	1852 ,, 117
14	Point-du-Jour	B	7·36	1850 ,, 103
15	L'Original (Langlois' Spring)	...	6·40	1851 ,, 53
16	La-Baie-du-Fêbvre (Loizeau's Spring) .	B	5·41	1853 ,, 160
17	Ste.-Anne-de-la-Pocatière	S	5 06	1852 .. 114
18	Pike River (Saline)	B	4·76	1849 ,, 59
19	Ancaster (Sulphur)	S	......	1848 .. 162
20	St. Benoit	S	......	1849 .. 60
21	Pike River (Sulphur)................	S	......	1849 ,, 59
22	St. Eustache	S	1·88	1850 ,, 103
23	Les-Eboulmens (Sulphur)	S	70	1851 .. 52
24	Fitzroy (Grant's Sulphur Spring)	S	......	1847 ,, 124
25	Pakenham Village (Sulphur Spring) ...	S	.. ...	,, ...
26	Westmeath (Petrifying Spring)	S	......	.. ,, ..
27	Matan River Gaspé	S	......	.. .. ..

NEW MINERAL.—WILSONITE.

A specimen said to be from the second lot of the ninth concession of Bathurst, furnished by Dr. Wilson of Perth, to Professor Williamson of Kingston, to whose kindness I am indebted for the opportunity of examining it, has afforded me two very interesting species. It consists of a white crystalline pyroxene, or diopside, with copper pyrites, small crystals of silvery-gray mica, prisms of bluish-green apatite, and portions of a milk-white cleavable calcite, together with a rose-red mineral, having in its general aspect some resemblance to a common variety of wollastonite or tabular spar.

It occurs massive, with cleavages which indicate an oblique system of crystallization; according to Prof. E. C. Chapman, of the University of Toronto, who has examined a specimen in the collection of the Canadian Institute, the cleavage prism is apparently right rhomboidal, and the inclination of M : T= 110o—115o. The cleavages with M. and P are perfect and easily obtained, giving to the mass a fibrous aspect, with T the cleavage is imperfect. Hardness, 3 5; density 2 765—2 776. Lustre vitreous, shining, occasionally pearly on the cleavage surfaces. Color, rose-red to peach-blossom-red; sub translucent; fracture uneven.

ANALYSIS.

	I		II		III
Silica..................................	42·90	...	43 00	...	43·55
Alumina .... }	28·10	...	27·80	...	27·91
Oxyds of Iron and Manganese }		...	·70	...	·20
Lime	6·94	...	6·72	...	6·50
Magnesia	3·99	...	3·83	...	3·81
Potash	8·27	...	8·27	...	8·37
Soda	·95	...	·95	...	1·45
Water	9 00	...	9·10	...	8 61
	100·15		100·67		100·43

As this interesting mineral appears to constitute a new species, I have named it *Wilsonite*, after its discoverer Dr. Wilson, who has long been known as a zealous student of the mineralogy of his district. It is to be wished that farther examination may detect distinct crystals of the mineral; a single imperfect one, having its angles rounded, was found in the calcite.

Lievrite.—A mineral which is to be referred to this rare species was received from C. Billings, Esq., of Bytown, a gentleman whose zeal and activity in the pursuit of mineralogy and geology give promise of valuable results. It was found as a rolled mass of some ounces in weight, coated with a hydrated oxyd like limonite, resulting from a superficial decomposition. Within, the mineral is unaltered, and has a hardness of 5 5, and a density of 4·15—4·16. Lustre sub-metallic, shining, occasionally iridescent; color velvet-black: streak and powder yellowish ash-grey; it is slightly translucent on the edges, very thin scales transmit a brownish light. Fracture uneven, brittle, strongly attracted by the magnet. It cleaves imperfectly in two directions oblique to each other.

Before the blow-pipe on charcoal the mineral intumesces and yields a black slag which is still magnetic. It gelatinizes readily with hydrochloric acid, but the silica which separates retains a small portion of iron. The solution contains protoxyd with some peroxyd of iron, besides a little magnesia, lime, and a trace of manganese. For its complete analysis the mineral was decomposed by fusion with carbonate of soda.

The amount of peroxyd of iron was determined by decomposing the finely powdered mineral with hydrochloric acid in a vessel filled with carbonic acid gas, and after adding recently boiled water, digesting it with a weighed plate of metallic copper, in the manner prescribed by Fuchs; the amount of copper dissolved, corresponded to 9 93 per cent, of peroxyd. Another determination was made with similar precautions, by adding to the diluted hydrochloric solution, phosphate of soda, and then acetate of soda in excess. The precipitated perphosphate of iron gave 10 80 per cent. of peroxyd, while the entire amount of iron as peroxyd was 73 6 per cent., giving 56 52 for the amount of protoxyd in the silicate. The results of analysis were as follows:—

Silica	27·80	...	28·20
Protoxyd of Iron	56·52		
Peroxyd ,, ...	10 80	...	9 93
Magnesia	2·59		
Lime	.64		
Loss by ignition	1·20		
	99·55		

The ratio between the oxygen of the silica and that of the other constituents, the water included, is 14 72 : 18 21, or very nearly 4 . 5, which is that required by Rammelsberg's formula for lievrite. In the present specimen, the lime ordinarily present, is replaced by protoxyd of iron and magnesia.

On the Warming and Ventilating of Schools.

By Neil Arnott, M.D., F.R.S.

The lecturer began by remarking that it would be difficult to overrate the importance to this and all countries which have a cold winter season, of the arts of warming and ventilating, but that as yet, although scientific men judge correctly in regard to them, the mass of the people nowhere suspect the true magnitude of the evils springing from the existing defects. The public may be shocked occasionally by hearing of multitudes perishing from jail or ship fevers, or cholera, generated in confined air, and been in crowded and ill-ventilated churches, concert rooms, theatres, &c., but the more permanent injury to health, the early mortality and the diminished enjoyment of life suffered by large classes who occupy ill-ventilated dwellings, manufactories, or schoolrooms, escape common notice. A century ago men did not suspect the possibility of there ever being on earth such steam-engines as we now possess, or railways, steam-ships, gas-lights, penny postage, &c., all of which are the recent fruits of human ingenuity, and chiefly of the ingenuity of men in this country; but now, when all have perceived the extraordinary benefits obtained, and the evils avoided by these novelties, they would deem the world much less worth living in if such things did not exist; so the time is probably not far distant when in public estimation the sanitary arts of which we are to speak to-day will be regarded as things of high value.

The lecturer then observed that nature warms by the sun, and is always ventilating, that is to say, removing from about persons the air rendered poisonous by their breathing, or otherwise, through the agency of wind, and of the warmth given to the breathed air; this warmth, by causing dilatation of that air, or greater lightness under the same bulk, produces a movement upwards, and of the foul warm air departure, urged by the pressure of the surrounding heavier pure air taking its place.

Art imitates nature closely. It warms by fire, and it ventilates by using partly the natural agencies of the wind and the lightness of warmed breath, but also by using the strong upward movement in chimney flues of the hot air which has fed combustion below, and is called smoke. This air, by being made to fill the chimney flue as a light column, is pressed up by the surrounding heavier atmosphere with force proportioned to the difference of specific gravity and the height of the chimney. A heated chimney with an open fire-place is, therefore, constantly changing the air in the bottom of the room.

The lecturer then referred to the new arrangement of the open fire-place described in a paper read by him two months ago in the hall of the Society of Arts, and which was favorably received by the scientific men then assembled. He briefly recapitulated and explained, by diagram, the chief peculiarities of that fire-place—1st, Its being smokeless; 2d, Its saving much fuel; 3d, Its having much stronger ventilating force than other open fires; and 4th, Its taking away the foul air collected near the ceiling of the room instead of the purer air from below. He gave his opinion that this fire-place having the dimensions of its parts and adjuncts adjusted to the purpose in view, will be found to be the best simple means of warming and ventilating schoolrooms.

The modifications required for a school are—

1. The chimney ventilating valve to be larger.

2. The chimney-flue also from above the valve to be larger than below.

3. The chimney top to be surmounted by a moving cowl, or one of the fixed wind-guards, of kindred nature, which, when the wind blows, produce a degree of pumping action.

4. The large quantity of fresh air required for a schoolroom, to be caused to enter in a distributed manner, or at various inlets besides the principal one near the fire—as from the ceiling—or in summer by the tops of the windows opened a little on the side towards the wind, or by openings near the floor; all considerable openings on the leeward side being closed.

He remarked with respect to larger schools that—

1. It may be necessary in winter to warm the air which enters at a distance from the fire, by letting it touch the surface of tubes or flat vessels of metal, filled with water, circulating from a boiler at the fire.

2. It may be expedient to use, "at certain times of no wind and medium temperatures," the cheap ventilating pump, with light curtain valves, which has been adopted advantageously in passenger and convict ships. This pump injects or extracts any desired quantity of air with mechanical certainty, and is worked as easily as the bellows of a church organ.

3. It may be desirable to economise fuel by using the more complex pumping apparatus (already proved but not yet publicly exhibited), which causes the vitiated hot air in passing away from any crowd to give up its warmth to the pure air entering.

He then spoke of some other means of ventilating which are useful for particular cases, and under certain circumstances; but which, by unskilful persons, are often deemed universally applicable, and are so often employed amiss—

1. *Open Windows.*—Often allowable in summer—in winter dangerous if more than a chink at the top be opened. A thin sheet of cold air entering the room aloft, will, in descending, so mingle with the hot air of the room as not to be felt by persons below.

2. *Perforated or opening window panes, or openings in the wall.*—The same remarks apply to these as to the window opened. Such openings produce strong cold currents, where there is an open fire, and foul air does not pass out by them.

3. *The windsail of ships.*—A capacious tube of canvas suspended from the rigging, and leading to the spaces between the decks; the mouth, expanded by a hoop, or otherwise, is kept turned to the wind. This acts powerfully in strong winds, but in calms not at all.

4. A wooden or metallic tube or shaft leading from the open air into a room, and surmounted by a moveable cowl or hood, of which the mouth always turns to the wind by the action of the wind itself.—This may be regarded as a self-adjusting windsail of inflexible material.

5. Two such tubes opening into the same room or cabin—the mouth of one of the cowls being always towards the wind, to receive fresh air; the mouth of the other being turned away from the wind to let used air escape. The two together act with double force.

6. Mines are commonly ventilated by two shafts, one having a fire at the bottom, to render it the ascending air shaft; the other, without fire, lets fresh air descend. If there were no fire, the ventilating action would be in many cases so imperfect, that workers would not be safe below.

7. In some cases a single large shaft is made to answer the

purposes of two smaller. It is divided into two channels by a partition, called a brattice, made of iron plate or other fit material, and running down from the top to the bottom. One of the channels serves as the smoke-flue. This arrangement is objectionable on several accounts.

8. In imitation of this, a single short tube of metal, divided by a brattice or partition of metal into two channels, has been fixed through the ceiling of rooms, stables, &c., to ventilate them. It is much better than an open pane in the window, or a hole in the wall—and either of these is much better than no ventilation at all; but it has many faults. It has no source of heat immediately in one channel, like the mine-shaft, to make it draw strongly. The most impure air approaching the opening to pass out is always rubbing against, and mingling in a degree with the new air passing in. It injects and extracts much less strongly than the twin tubes described above, at No. 5. When there is little wind, and little difference of temperature in the two channels, there is little or no action. With closed doors and windows in the rooms below, and a strong fire, both channels become inlets of cold air. The cold air entering by it is not diffused in the room, and may prove hurtful, like that from an open window. Yet, with all these defects, it will, in certain cases, prove a useful aid, because it is a high opening to the external air, and has tranquil action. The model containing one or more burning candles, to represent men, which has been used to illustrate its action, is calculated to give to ordinary observers a very fallacious notion of its nature and power.

Anthracite Coal in the United States.

There are few subjects in the history of mining operations more remarkable than that of the anthracite coal field of Pennsylvania. For a century and a half after our countryman, William Penn, had founded that colony, and established that commonwealth, wood was the only fuel known to its population; but in time increased cultivation cleared away the forests, and Providence directed attention to the vast beds of coal to be found in the mountain ranges of the Schuylkill. The old German residents long laughed at the idea of making fires with what they called "black stones," and the adaptation of anthracite to the purposes of domestic fuel was generally ridiculed. The same silly prejudices still prevail in Ireland, where the anthracite abounds, and the inhabitants unaccountably prefer to expend the resources of their country in importing an inferior fuel to employing their own. Perseverance and science in the United States, however, overcame every difficulty, and by the use and construction of improved stoves, on new principles of strong draught and ventilation, anthracite coal is now burnt in the American cities with as much facility as bituminous coal is with us, while its radiation of heat and consequent power of imparting warmth are far more intense.

The anthracite coal trade of Pennsylvania is of recent creation, while its rapid and progressive advance in that state alone is a source of wonder. It commenced in 1820, in which year the quantity of Pennsylvanian anthracite sent to market was 365 tons. In 1830, ten years after, it reached 174,734 tons. In 1840, another interval of ten years having elapsed, it reached 865,414 tons, and in 1853 it swelled to the prodigious amount of 5,195,151 tons. The value of this mineral fossil fuel is every day winning its way with the people, who are adapting it to their wants and their comforts, so that the demand is daily increasing with more than progressive rapidity. For the express purposes of furnishing supplies to meet the demand, railways have been laid down, others are in course of formation, and still more have been projected. We are beginning to follow the example of the Americans in using anthracite coal in our steam-ships—for instance, in the *Great Britain*, for her voyages to Australia; and it is not impossible that before long their methods and appliances for using it will be adopted for domestic purposes in many districts.

We are enabled to present to our readers a very interesting detail of a recent visit to the coal field of Pennsylvania. The coal bed lies in a range of the Blue Mountains, and is found on the north side, extending from east to west about 70 miles, varying in width from 6 to 12 miles, while on the south side there is nothing seen but mould and red shale rock. When digging in the very centre of the summit, a black line was discovered, running along the range east and west, which is, in fact, a line drawn by nature, dividing the coal from the stony rock. The face of the country, with the exception that the hills are higher, resembles the coal and iron region of the Forest of Dean, in Gloucestershire; the coal dips in various angles from the horizon, and in no instance horizontally, as in some coal fields in England. The seams and veins the best of which are about 60 feet wide and 12 feet thick, converge towards a common mass at the eastern end of the range, near a portion of the mountain called Mauch Chunk. Here, except the outside covering of rock and earth, the masses of the hills are solid coal, so much so, that a slice of the hill is cut away, exposing the coal, where is is actually quarried like stone, instead of being reached by subterraneous galleries and shafts, as at Pottsville. Many of the shafts in the latter district are 1000 feet deep, while a few are horizontal tunnels running into the mountains, while in some of the collieries there are horizontal tunnels, and then deep and perpendicular shafts crossing them. The mines are valuable in proportion as the coal is above or below the water-level of the springs.

The vast expanse of the galleries and shafts, of course, requires large quantities of timber for shores and props, and all the large timber in the vicinity of the collieries has been long exhausted. Although the neighbouring mountains would appear to be covered with trees, they are as yet too young and too small to be of much use, and timber for the use of the mines—and a few large ones will require a forest—has to be hauled for 15 or 20 miles, the expense of which exceeds that of the trees. The water raised from those mines is impregnated with iron and sulphur, and one feature in these valleys strikes the stranger with surprise—that is, that millions upon millions of tons of coal dust, or as it would be called in England small coal, are collected in heaps, apparently valueless. Hitherto these vast mounds of refuse, being anthracite, have been almost useless; had they been bituminous they would have been mixed, and converted into some kind of fuel; but we are told that as yet in America, means have not been adopted to render the small anthracite available for that purpose. Both in Wales and in Ireland it has long been the practice to mix the small anthracite with clay, which mass is then rolled into fire-balls, and used by the farming classes as fuel. Large quantities of it are also employed in the burning of lime for agricultural purposes, uses to which it will probably be hereafter extensively applied as cultivation spreads in America. Most of the collieries of Pennsylvania are worked upon royalties—that is, a coal company pays the owner of the land and mine at the rate of from 25 cents to 40 cents per ton for all raised, the company paying all the mining expenses, the land-lord keeping a clerk to check the produce, which is also tested by the receipts from the mines at the railways and canals.

It would appear that the most improved methods of working coal practised in this country are also adopted at the great coal mines of Pennsylvania. The descent is often by shafts, with an inclination of 55°. They have, as with us, a subterraneous road, called the highway, to which the coal is brought by branches, and it is raised by the methods which we adopt.—The price of the anthracite is \$6½ in Philadelphia and \$7½ in New York, per ton of 2000 lbs.; but wages are rising at the collieries, and labourers, who three years ago only received from 87½c. to \$1, are now paid from \$1 to \$1½ per day.

Great quantities of the coal of this region are carried by the railway from Pottsville, through Reading, to Philadelphia, generally known as the Reading Railway. Much English capital is invested in this company, and as it is believed that the present floating debt will be absorbed by the profits in about a year, the stock has recently advanced from 31 to 36¼. The details respecting a railway almost entirely dependent for its prosperity on its coal traffic are curious. Its working stock consists of 105 locomotive steam-engines; general freight cars, 684; passengers' cars, 40; coal cars, 4792. The receipts from the road, in 1853, were \$2,688,283, of which passengers contributed \$225,783; merchandise, \$180,612; and coal, no less than \$2,254,694—a state of traffic contrasting strangely with the railway returns of England. We are assured that recently no fewer than 2500 cars, each containing 4½ tons, were in one day sent down the road from Pottsville and Schuylkill Haven to Philadelphia, Richmond. The present freight to Philadelphia is \$2¼ per ton, and the receipts are frequently \$20,000 per day.

Railways in America necessarily possess vast advantages over canals for the carriage of coal, railways being open and in action all the year, while canals are closed by ice all the winter. and as the coal railways of the American Union promise well, we are glad to learn that a large proportion of their stock and bonds is held in England. The Reading Railway has been the cause of converting the upper part of the city of Philadelphia, called Richmond, into an American Newcastle-upon-Tyne, and a fleet of coal vessels is now to be constantly seen lying there.

The canals communicating with the Pennsylvania coal field appear to be also highly prosperous, and the details which we have thus in a condensed form presented to our readers, must satisfy them that, however great and rapid the general advance of the United States has been, the singular increase, within a limited and defined period, of the anthracite coal trade, is probably the most striking and remarkable feature which it presents to our consideration.—*Mining Journal.*

The Report on Railways for 1853.

BY CAPTAIN GALTON, R.E.

The length of new lines of railway sanctioned by the legislature in the United Kingdom during the year 1853, was 940 miles, which amount is very considerably greater than that sanctioned during any year since 1847. Of this amount 589 miles were in England, 80 miles in Scotland, and 271 miles in Ireland.

Among the most important of the new lines in England appear to be the following, viz:—A line from Strood to Canterbury, by which the communication by railway along the south bank of the Thames will be rendered continuous as far as the North Foreland. The Portsmouth railway by which a direct communication will be afforded between Portsmouth and the metropolis. An extension of the Midland railway from Leicester to Hitchin on the Great Northern Railway, by which a second line of communication will be afforded from the Midland districts to the metropolis, and the Worcester and Hereford Railway, by which a more direct road will be opened between the Midland Counties and South Wales.

In Ireland the most important line would appear to be the Londonderry and Coleraine Railway, by which a direct route will be afforded between Belfast and Londonderry; and the Londonderry, Coleraine, and Sligo Railway, which will afford a direct railway communication from Sligo to Londonderry and to Dublin.

The total length of railway which has been authorised by Parliament to the end 1853 is 12,688 miles. Of this number of miles 7686 have been opened for traffic, leaving 5002 miles to be completed; but the compulsory powers of 2838 miles have expired without being exercised, or the railways being opened to the end of 1853. The length of railways for the construction of which Parliamentary power exists is 2164 miles. The length of railway opened previously to December 1843, was 2036 miles. The length opened in the year 1844 was 204 miles; in 1845, 296 miles; in 1846, 606 miles; in 1837, 803 miles; in 1848, 1182 miles; in 1849, 869 miles; in 1850, 625 miles; in 1851, 269 miles; in 1852, 446 miles; in 1853, 350 miles; making the total length then opened 7686 miles; of which 5848 miles are in England, 995 in Scotland, and 843 miles in Ireland. The length of narrow guage railway, including the Irish guage of 5¼ feet, is 6965 miles, of the bread guage 626 miles, and of the mixed guage 95 miles. The number of railway companies having single lines of railway at the end of 1853 was 97, the length of single narrow gauge lines, including the Irish gauge, 1543 miles, of broad gauge, 112 miles, and of mixed guage 53 miles—total, 1768 miles; of which 1135 miles of single line are in England, 132 miles in Scotland, and 441 miles in Ireland.

Of the single lines opened at the end of the year 1852, 32 miles 46 chains in England, and 41 miles 76 chains in Ireland, have been made double during the year 1853.

The total length of new lines which were opened during the year 1853 amounted to 350 miles.

Of the lines opened in England, the principal ones are—the Oxford, Worcester, and Wolverhampton railway from Wolvercot to Evesham, by which the manufacturing districts near Birmingham, the town of Worcester, and the important agricultural districts between Worcester and Oxford are accommodated with a direct route to London; the Newport, Abergavenny, and Hereford Railway, by which a direct route is afforded from Birkenhead to South Wales; and the Thirsk and Malton, and Malton and Driffield Railways, by which railway communication is afforded to an important district in Yorkshire.

In Scotland the only line of importance opened for traffic was the Deeside Railway. In Ireland the most important lines are the Waterford and Kilkenny, and Waterford and Limerick Railways, by which Waterford has been connected with the Irish railway system; and the railway from Killarney to the Great Southern and Western Railway.

All these lines of railway were inspected, previous to being opened for traffic, by officers of the Railway department of the Board of Trade, who required the opening to be postponed in twenty-eight instances. The total number of inspections which were required to be performed by the officers amounted to fifty-eight.

Of the railways opened during 1853, twenty-five portions of railway, representing a total length of 298 miles, consisted of single line open at the end of 1853, viz., 1708 miles, was between one-fourth or one-fifth the whole amount of railway open. It is to be observed that the length of single line open at the end of 1852 was 1485 miles, and at the end of 1851, 1307 miles. A single line of railway cannot be worked with safety except under special regulations, so framed as to prevent the possibility of engines or trains moving in opposite directions, from meeting on the single line; such regulations are, however, inconsistent with a large amount of traffic. In all cases of single lines opened during 1853, the regulations required generally either that the trains should be worked by means of one engine moving backwards and forwards over the line, or over particular portions of it, or that some particular man should be appointed to accompany the trains moving over the portions of single line. And in cases where the electric telegraph is in use, the regulations required were, that the persons employed to start trains should be distinctly responsible for ascertaining, before starting the trains, that the line is clear so far as the next station.

The amount of capital invested in railways at the end of 1852 was £264,165,680, of which £161,400,256 consisted of ordinary capital, £38,700,655 of preference capital, and £64,064,668 of loans. The amount of capital raised for railway purposes in 1849, was £29,574,720; in 1850, £10,522,967; in 1851, £7,970,151; and in 1852, £16,398,993; thus increasing the amount invested in railways at the end of 1849 from £229,747,778 to £264,165,680 at the end of 1852. The amount of money which was raised by railway companies during 1853 has not yet been returned to Parliament; but it may be assumed not to have been less than that raised during 1852, and it is therefore probable that the whole sum raised by railway companies to the end of 1853 is not less than £281,000,000, of which about £42,000,000 may be assumed to have been preferential capital, and nearly £70,000,000 would appear to have been borrowed on the security of the undertakings.

The number of miles of railway in course of construction on the 30th of June, 1853, was 682 miles, and the number of men employed on them was 37,764. The number of miles open for traffic at that date was 6512, and the number of men employed, 80,409. The number of men employed on railways open for traffic was 9·5 per mile in 1852, and 10·7 per mile in 1853.

The total number of passengers conveyed on railways in the United Kingdom in the year 1853 amounted to 102,286,660; the number in 1852 had been 89,135,729. The total receipts from all sources of traffic amounted in 1853 to £18,035,879, and in 1852, to £15,710,554.

The receipts from goods have increased from £4,750,504 in 1849, to £8,112,477 in 1853, being an increase of from £1090 per mile, in 1849, to £1415 per mile, in 1853; and whilst the receipts from passengers in 1849 were larger than the receipts from goods in the proportion of 53·42 to 46·48, in 1853 the contrary was the case, viz., the per centage of the passenger traffic was 47·45, and of the goods traffic 52·55.

In Scotland the progress of traffic on railways has been similar. The mean length of railway open during the year has increased from 795.5 miles open in 1849, to 987 miles open in 1853. The number of passengers conveyed in 1849 amounted to 7,902,228, and in 1853 to 10,999,224, which represents 9993 per mile in 1849, against 11,246 per mile in 1853. The relative number of passengers of each class conveyed would appear to have slightly varied, the number of first and third-class passengers having increased, and the number of second-class passengers having diminished, the number in 1849 being 720 first-class passengers per mile, 2035 second class passengers per mile, and 6997 third-class passengers per mile, against 1107 first-class, 1971 second-class, 8165 third-class passengers per mile in 1853. The receipts from passengers having increased from £540,778 to £697,712; or from £680 per mile, in 1849, to £713 per mile in 1853; and the proportion of receipts from each class conveyed having been in 1849, £149 per mile for first-class, £196 per mile for second-class, and £331 per mile from third class passengers, against £181 per mile from first-class, £179 per mile from second-class, and £345 per mile from third-class passengers in 1853.

It would, therefore, appear that in Scotland the third-class traffic preponderates considerably both as regards numbers and receipts. There is also in the Scotch lines a preponderance in the receipts from goods traffic over the receipts from passenger traffic.

The amount received from goods in 1849 was £650,640, and in 1853 it was 1,068,016, representing £818 per mile in 1849, against £1075 per mile in 1853. The relative proportions of the two descriptions of traffic were, in 1849, passenger traffic 45 38, and goods traffic 54 62; and in 1853 the receipts from goods traffic amounted to 60 48 per cent. of the whole traffic.

The mean length of railway opened in Ireland in the year 1849 was 428 miles, and in the year 1853 it was 771 miles.

The total number of passengers conveyed in 1849 amounted to 6,059,947, or 14,142 per mile; and in 1853 it amounted to 7,074,475, or 9175 per mile.

The receipts from goods are also largely increasing, and they bear every year an increasing proportion to passenger traffic.

With respect to accidents, it appears that in 1852, 217 persons were killed, and 486 injured on the railways in the United Kingdom out of a gross total of 89,135,729 passengers; of these persons 181 were killed and 413 were injured in England; 24 were killed and 71 injured in Scotland; and 11 were killed and 2 injured in Ireland. In the year 1853, out of a gross total of 102,286,660 passengers conveyed by the railways of the United Kingdom, 305 were killed, and 449 injured; of these 243 were killed and 369 injured in England; 37 were killed and 68 injured in Scotland; and 25 were killed and 12 injured in Ireland.

On an Improvement in the Manufacture of Iron and Steel.

BY M. AUGUST LAUGEL, PARIS.*

Scientific revolutions are always caused by the discovery of some entirely new principle; industrial ones by a new and happy application of principles long known, but from which all the results have not yet been obtained.

* From the "Journal of the Franklin Institute."

I propose in this brief memoir to demonstrate the possibility of an industrial revolution in the United States with regard to the manufacture of cast iron, iron, and steel.

A few historical considerations must first be presented. It is universally known that iron was at first manufactured exclusively by means of charcoal with apparatus of small dimensions. This method precluded the preparation of large quantities, and it became quite insufficient when the introduction of steam-engines gave to industry so much wider a field. The immense importance of coal began to be recognised, and iron was manufactured by its means, according to new methods, which favoured its more rapid production in greater quantities.

A rivalry thus commenced between coal foundries and those kept up by wood, in which the latter were evidently to be overcome. The nations possessing great coal districts, particularly Great Britain, became the producers of iron for all the rest.

In these circumstances, if suddenly there should be discovered a new means of making iron with wood as rapidly and as economically as it is done at present with coal; if, besides, the iron thus prepared should offer in quality very great advantages in comparison with that made with coal; is it not natural to suppose that the consumers who are only attracted by the cheapness of English iron, would cease to employ it? Even admitting that under certain circumstances this iron would be dearer, they could more advantageously use it for those purposes for which iron of the first quality is indispensable, such as the manufacture of steel.

The country best situated for the success of this industrial revolution is undoubtedly the United States of America. For example, wood is found there in great quantities, and may in some places be obtained at a very low price: on the other hand, the beds of mineral iron are very numerous; modes of transport, always important in the working of iron, exist in great numbers. Here we find all the conditions necessary to success; it remains only to establish with certainty the advantage of this new method of manufacturing iron, and to explain its high importance.

1st. Wood is not charged with those mineral substances which injure at once the calorific effect and the quality of the metals fabricated by it. Coal contains often ten per cent. of matters either useless or injurious. Wood, on the contrary, contains hardly one-half per cent. of mineral substances, which besides are never injurious. All wood has great chemical uniformity, while coals differ much from each other, which involves the disagreeable necessity of ranging the methods of employing them. It is well known to metallurgists that wood should n t be employed as a combustible without previous preparation, on account of the large proportion of water which it contains.

For many years the most various experiments have been made to prepare the wood before using it as a combustible. The method to which we would now call attention has been used for a short time in Styria and Carinthia, which consists in taking from the wood only the water, and stopping the distillation as soon as the substances which begin to escape contain carbon. Two methods have been used to effect this conversion of wood into *ligneux* (lignum).

1st. The gases coming from the fire-place are brought into immediate contact with the wood; thus the wood is raised to a temperature above 100° Centigrade, which favours still more the vaporisation by the tendency the gases themselves have to be saturated with vapour.*

In the second method, only the heat radiating from the gases in the fire-place is employed. These gases are not brought into immediate contact with the wood, but are conducted in pipes of cast or sheet iron, around which the wood is piled.

This second method affords by far the most satisfactory results, being the more economical, and avoiding the disadvantage which sometimes attends the first, of making the *ligneux* pyrophoric, and thereby liable to spontaneous combustion on exposure to the air.

It is important to render the second method still more perfect. The following means might be advantageously employed: —The combustion of the wood employed effects the conversion into *ligneux*, which is thus raised to a temperature of 150° Centigrade. All the water contained in this wood escapes in vapour; but the heat contained in this vapour and in the *ligneux* should be made useful, as well as the latent heat contained in the vapour. For this three successive chambers will be necessary. The wood loaded on waggons, passes in succession from one chamber to another. In the first chamber the wood will begin to be heated and to dry by means of the latent heat of the vapour, disengaged in the second, and condensed in the third; and also, by means of the latent heat of the air, cooled in the third, and brought back to the first. It is in the second chamber that the entire conversion of the wood into *ligneux* takes place; the *ligneux* will pass into the third chamber to cool; the heated air will be conducted to the first chamber to heat another load of wood; the vapour which is found there, and which comes overheated from the second chamber, will be condensed, and thus will give more heat to the first chamber, with which it communicates by pipes.

In following the preceding method, it is possible to change 10 parts of wood (standing for 1·00 of *ligneux*, 0·40 of water) into *ligneux*, by means of one part of wood employed as a combustible.

There is another method more economical which might be employed to convert the wood into *ligneux*. It consists in utilising the wasted flame of the metallurgic apparatus, after having of course previously used it for other purposes; for example, heating the cauldrons; because on coming from the apparatus the gas is of too high a temperature for the operation in question, and is still sufficiently hot after having been employed for the previous processes. But this method, by which economy is carried to the utmost extent, though very suitable in France or Germany, does not seem necessary in America, on account of the cheapness of the vegetable combustible.

Thus far we have only explained, and very briefly, the first part of the new method of manufacturing iron. We now come to the second part, which is the *puddling process* with *ligneux*. The puddling, it is well known, is effected by burning in a reverberatory furnace the combustible gases which come from a lateral fire-place. The important part of the operation is to conduct into the furnace a sufficient quantity of air to produce a total combustion of the gaseous substances. Generally too much air is admitted, which has the disadvantage of uselessly absorbing the heat. Mineral combustibles are much better

* It is unnecessary in this memoir to describe either the chamber in which this process takes place, or the requisite apparatus and details of the different processes.

adapted than wood to the operations of the puddling furnace, on account of their superior density; they develop a greater quantity of heat, and also produce a more regular current of gas; besides which, the interstices between the pieces of wood permit too much air to pass. In the new puddling process, the quantity of air introduced into the furnace is, so to speak, mathematically regulated; the combustible mixture, and the current of air which serves to ignite it, are admitted separately into the laboratory. Here the fireplace must be of entirely different dimensions. It is very long vertically; the grate is very low, and composed only of a few bars to support the wood; the air no longer enters freely into the fire-place; the bellows send a graduated current of air under the wood, which traverses it, producing its distillation. On account of the pile which the air is obliged to traverse, this distillation takes place, so to speak, in a gradual and progressive manner; the air thus admitted into the lower part is in proportion to the quantity of *ligneux* required to be carbonised in a given time. The current of combustible gas which is found in the pile of wood passes into the laboratory, where the puddling takes place, and is met by a current of air carefully regulated and driven through a pipe; thus the laboratory obtains, instead of an ordinary flame, a combustible gas, free from all traces of pure oxygen. Nothing is more easy, when one understands the composition of *ligneux*, than to know the exact quantity of air to admit into the furnace; but in what proportion shall the whole amount of this quantity be divided? How much shall go to the furnace, and how much to the laboratory? This is a question which experience alone can answer. We can only say in general that the latter proportion depends upon the more or less combustibility of the mixture of gases, and consequently on the temperature required in the furnace, the rapidity of the distillation and the operation itself.

This last term has evidently in all cases a limit, which fixes the proportion to be established between these two currents of air. Registers also connect them with each other, which can be managed by the workmen themselves. This mode of combustion is very remarkable, both theoretically and practically; it produces a very great regularity in the labour, and gives a current of very pure gas; the purification of the cast iron is thus effected under the most favourable circumstances, and even very impure kinds give excellent iron. It is quite otherwise, it is well known, with the ordinary method of puddling with coal, and we may assert in general, that the impurity of iron is attributable less to the cast iron than to the imperfection of the mode of reviving. In the United States the cast iron made with wood or anthracite would never be of a very bad quality;* the admirable perfection of the puddling with *ligneux* would warrant the excellence of the products of the new method. It now remains, and this is the main point, to consider the economical conditions of the question.

The following are the facts of the case, the exactitude of which we will warrant.

The consumption of cast iron, labour, and *ligneux* are per on of iron:—

Cast iron,		tons	1·242	
Labour	For the puddling,	days	3·86	11·35
	For forging and rolling,	"	4·69	
	Sundry processes,	"	2·80	
Ligneux	For the puddling,	tons	1·20	2·50
	For forging and rolling,	"	1·30	

* It remains to be seen, perhaps, if it would not be advantageous to manufacture the cast iron also with *ligneux*.

This estimate may serve to establish the *special* expenses in each particular case. In order to establish the *general* expenses, it will be necessary to obtain information on the following points:—

1st. The purchase of land.

2nd. The price of building materials, stones, bricks, clay, &c., &c.

It will be important, in order to diminish as much as possible the total amount, to choose a situation where wood is cheap and abundant, and in the neighbourhood of the mines, from whence the ore could be brought at a small expense (In case it should be preferable *not* to manufacture the cast iron, this last observation applies to the cast iron which it would be necessary to buy.) It is also important to take into account the means of transport of the produce to the great industrial markets, by canal or railroad; the price of labour, &c., &c.

It would be well perhaps to annex to the establishment a manufactory of cast steel; the *ligneux* would be very suitable for this species of manufacture, and it would be very easy to prepare for this purpose iron of the best quality. The establishment of the works required by this new method must be on a very large scale; its success depends almost entirely on the employment of the most economical means of manufacturing *ligneux;* this condition can only be fulfilled by preparing the *ligneux* in great quantities, and consequently the metallurgic apparatus must be very numerous.

The solution of this problem which we have been examining is in the highest degree important to the future progress of industry in the United States It will enable them to employ to advantage the mineral wealth scattered over their territory, and upon a point of the utmost consequence will render them independent of other nations. It therefore eminently deserves the attention of the metallurgist and the manufacturer.

On Silica and some of its Applications to the Arts.*

BY REV J. BARLOW, M.A., F.R.S., V.P.R.I.

SILICA is one of the most abundant substances known. Quartz, common sand, &c., flint, chalcedony, opal, &c., and a variety of sand described by Mr. J. T. Way,† may respectively be taken as examples of crystallised and uncrystallised silica. Under all these forms silica is capable of combining with bases as an acid. Heat is however essentially necessary to effect this combination, a combination of which all the well-known silicates, whether natural, as feldspar, mica, clay, &c., or artificial, as glass, &c., are the results. The common forms of insoluble glass are produced by the union of silica with more than one base. But, when combined with an alkaline base only, silica forms a soluble glass, the degree of solubility of which depends on the proportion which the siliceous acid bears to this alkaline base. This soluble silicated alkali (or water-glass) may be prepared by various processes. If sand be used, 15 parts of find sand, thoroughly incorporated with 8 parts of carbonate of soda, or with 10 of carbonate of potass and 1 of charcoal, fused in a furnace, will produce a silicated alkali which is soluble in boiling water. Messrs. Ransomes obtain

* Substance of a Lecture delivered at the Royal Institution of Great Britain, April 7, 1854.

† Quarterly Journal of Chemical Society, July 1, 1853, and Journal of Royal Agricultural Society, Vol. xiv. p. 1.

this silicated alkali by disolving broken flints in a solution of caustic alkali at a temperature of 300° Fah.* And, more recently, Mr. Way has observed that the sand which he has described will combine with caustic alkali at boiling heat, also producing a water-glass.

This water-glass has been applied to several important purposes, three of which were specially noticed.

1. *To protect building-stones from decay.* The stone surfaces of buildings, by being exposed to the action of the atmosphere, become liable to disintegration from various causes. Moisture is absorbed into their pores. The tendency of their particles to separate, in consequence of expansion and contraction, produced by alternation of temperature, is thus increased. Sulphurous acid is always present in the atmosphere of smoke-burning cities, and cannot but corrode the calcareous and magnesian ingredients of oolites and dolomites. It is true that good stone resists these sources of injury for an indefinite time, but such a material is rarely obtained. As a preventive of destruction, whether arising from physical or chemical causes, it has been proposed to saturate the surfaces of the stone with a solution of water-glass.

It is well known that the affinity of silica for alkali is so feeble that it may be separated from this base by the weakest acids, even by carbonic acid. According to the expectation of those who recommend the silication of stone, the carbonic acid of the atmosphere will set the silica free from the water-glass, and the silica, thus separated, will be deposited within the pores and around the particles of the stone. The points of contact of these particles will thus be enlarged, and a sort of glazing of insoluble silica will be formed sufficient to protect the stone against the effect of moisture, &c. This cause of protection applies chiefly to sandstone. But wherever carbonate of lime or carbonate of magnesia enters notably into the composition of the building-stone, then an additional chemical action, also protective of the stone, is expected to take place between these carbonates and the water-glass. Kuhlmann † remarks "Toutes les fois que l'on met en contact un sel insoluble avec la dissolution d'un sel dont l'acide put former avec la base du sel insoluble un sel plus insoluble encore, il y a echange; mais le plus souvent cet echange n'est que partiel." In consequence of this "partial exchange" an insoluble salt of lime may be looked for whenever a solution of water-glass is made to act on the carbonate of lime or carbonate of magnesia existing in oolitic or dolomitic building-stone.

This expectation, however, has not been altogether sanctioned by experiment. A gentleman, eminently conversant with building materials,‡ immersed a piece of Caen stone in a solution of a silicate of potass in the month of January, 1849. This fragment, together with a portion of the block from which it had been separated, was placed on the roof of a building in order that it might be fully exposed to the action of atmosphere and climate. After four years the silicated and the unsilicated specimens were found to be both in the same condition, both to be equally corroded. These specimens were exhibited in the theatre of the Institution. But whatever ultimate results may ensue from this process, the immediate effects on the stone are remarkable. Two portions of Caen stone were exhibited, one of which had been soaked in a solution of water-glass two months before. The surface of the unsilicated specimen was soft, readily abraded when brushed with water, and its calcareous ingredients dissolved in a weak solution of sulphurous acid. The silicated surface on the other hand, was perfectly hard, and resisted the action of water and of dilute acid when similarly applied.§

II. Another proposed use of the water-glass is that of *hardening cements mortars*, &c., so as to render them impermeable by water.

Fourteen years since, Anthan‖ of Prague proposed several applications of the water-glass. Among others he suggested the rendering mortars waterproof. He also suggests that this substance might be beneficially employed as a substitute for size in whitewashing and staining walls. It was demonstrated by several experiments that carbonate of lime mixed up with a weak solution of water-glass and applied as a whitewash to surfaces, was not washed off by sponging with water, and that common whitewash laid on in the usual manner with size, was rendered equally adhesive when washed over with water-glass

III. *The Stereochrome of Fuchs.*

The formation of an insoluble cement by means of the water-glass, whenever the carbonic acid of the atmosphere acts on this substance, or whenever it is brought in contact with a lime-salt, has been applied by Fuchs to a most important purpose. The stereochrome is essentially the process of fresco secco¶ invested with the capability of receiving and perpetuating works of the highest artistic character, and which may be executed on a vast scale. Fuch's method is as follows**:—

"Clean and washed quartz-sand is mixed with the smallest quantity of lime which will enable the plasterer to place it on the wall. The surface is then taken off with an iron scraper in order to remove the layer formed in contact with the atmosphere, the wall being still moist during this operation. The wall is then allowed to dry; after drying it is just in the state in which it could be rubbed off by the finger. The wall has now to be fixed *i. e.*, moistened with water-glass.†† (An important point is not to use too much water-glass in the moistening the wall.) This operation is usually performed with a brush. The wall must be left in such a condition as to be capable of receiving colours when afterwards painted on. If, as frequently happens, the wall has been too strongly fixed, the surface has to be removed with pumice and to be fixed again. Being fixed in this manner, the wall is suffered to dry. Before

* Report of a communication made to the Royal Institution by Prof. Faraday, May 26, 1848. *Vide* Athenæum, June 17, 1848.

† Experiences Chimiques et Agronomiques, p. 120.

‡ Charles H. Smith, Esq., one of the Authors of the "Report on the Selection of Stone for the building of the New Houses of Parliament."

§ Siliman's American Journal, January, 1854, contains a notice of the application of the water-glass to the decaying surfaces in the Cathedral of Notre Dame in Paris.

‖ Neuere Mittheilungen uber die Nutzanwendung des Wasser-glases 1840. This subject has been fully treated by Kuhlmann in his "Memoire de l'Intervention de la potasse ou de la soude dans la formation des chaux hydrauliques," &c. 1841. Experiences Chimiques et Agronomiques.

¶ Vide Eastlake's Materials for a History of Oil Painting, p. 142.

** These particulars were obtained by Dr. Hofmann from Mr. Echter. A stereochromic picture by Echter, and a sample of the water-glass as prepared by Fuchs, were also exhibited by Dr. Hofmann.

†† The composition of the specimen produced was—Silica, 23·21 per cent.; Soda, 8·90 per cent.; Potass, 2·52 per cent.; and the specific gravity of the solution was 3·81.

the painter begins he moistens the part on which he purposes to work with distilled water, squirted on by a syringe. He then paints; if he wishes to repaint any part he moistens again. As soon as the picture is finished, it is syringed over with water-glass. *After the wall is dry, the syringing is continued* as long as a wet sponge can remove any of the colour. An efflorescence of carbonate of soda sometimes appears on the picture soon after its completion. This may be removed, either by syringing with water, or may be left to the action of the atmosphere." Not to dwell on the obvious advantages possessed by the stereochrome over the real fresco, (such as its admitting of being retouched and its dispensing with joinings,) it appears that damp and atmospheric influences, notoriously destructive of real fresco, do not injure pictures executed by this process.

The following crucial experiment* was made on one of these pictures. It was suspended for twelve months in the open air under the principal chimney of the New Museum at Berlin; "during that time it was exposed to sunshine," "mist, snow, and rain," and nevertheless "retained its full brilliancy of colour."

The stereochrome has been adopted on a grand scale by Kaulbach, in decorating the interior of the great national edifice at Berlin already alluded to. These decorations are now in progress, and will consist of historical pictures† (the dimensions of which are 21 feet in height and 24½ feet in width,) single colossal figures, friezes, arabesques, chiaroscuro subjects, &c. On the effect of the three finished pictures, it has been remarked by one whose opinion is entitled to respect, that they have all the brilliancy and vigour of oil paintings, while there is the absence of that dazzling confusion which new oil paintings are apt to present, unless they are viewed in one direction which the spectator has to seek for.

Mr. A. Church has suggested that if the surface of oolitic stone (such as Caen stone) is found to be protected by the process already described, it might be used, as a natural intonaco, to receive coloured designs, &c., for exterior decoration; the painting would then be cemented to the stone by the action of the water-glass.

Mr. Church has also executed designs of leaves on a sort of terra-cotta, prepared from a variety of Way's silica rock, consisting of 75 parts clay and 25 of soluble silica. This surface, after being hardened by heat, is very well adapted for receiving colours in the first instance, and for retaining them after silication.

Phenomena Connected with the Motion of Liquids.

BY PROFESSOR TYNDALL.

The Lecturer commenced by referring to certain phenomena exhibited by liquids, and at variance with our commonly received notions as to their non-cohesive character. According to Donny, when the air has been, as far as possible, expelled from water by persistent boiling, such water possesses an extraordinary cohesive power, sufficient, indeed, to permit of its being heated at a temperature of 275° Fahr. without boiling. The adhesion of water, thus prepared, to the surface of a glass *tube, was shown experimentally; the force being sufficient to* sustain a column of water of considerable height. The contractile force of a soapbubble was referred to, and the lecturer passed on to the exhibition of the phenomena resulting from the shock of two opposing liquid veins. In this case, though the forces are in opposite directions, motion is not annihilated; but the liquid, as first shown by Savart, spreads out so as to form a thin transparent film, the plane of which is at right angles to the direction of the jets. By varying the pressure on one side or the other, or by making the jets of different diameters, the plane film could be converted into a curved one, and sometimes actually caused to close, so as to form a pellucid sack. A vein was caused to fall vertically upon a brass disk upwards of three inches in diameter. The liquids spread laterally on all sides, and formed an unbrella-shaped pellicle of great size and beauty. With a disk of an inch in diameter a pellicle of at least equal magnitude was formed. When a candle was placed *underneath the curved sheet of water, a very singular effect* was produced. The film above the candle was instantly dissipated, and on moving the candle, its motion was followed by a corresponding change of the aqueous surface. On turning a suitable cock, so as to lessen the pressure, the curvature of the film became increased, until, finally, the molecular action of the water caused it to form a curve returning upon itself, and exhibiting the appearance of a large flash. When the film completely embraced the vertical stem which supported the brass disk, a change in the form of the liquid flash was observed. The latter became elongated, and was sometimes divided into two portions, one of which glided down the vertical stem and was broken at its base. When the jet was projected vertically upwards, large sheets were also obtained. The jet was also suffered to fall into small hollow cones of various apertures, and the shape of the liquid sheet received thereby some beautiful modifications. The enclosed sides of the hollow cone gave the liquid an ascending motion, which, combined with the action of gravity, caused the film to bend, and constitute a work of great beauty.—*Lecture delivered at the Royal Institution.*

Determination of the per-centage of Tannin in Substances used for Tanning.

BY PROFESSOR FEHLING.

Among the various substances which precipitate tannin from solution, such as gelatin, quinine, animal skin, &c., the latter has hitherto been recommended as the most appropriate for determining the per-centage of tannin. This method of valuation has been preferred because it represents in miniature the operation to which the results refer. There are, however, no detailed directions for its application, and in repeated trials made by the author, under a variety of conditions, he has found that the tannin is never perfectly precipitated, and that the *solutions soon become mouldy. Experiments* with a solution of quinine, freshly precipitated oxide of iron or alumina, did not give more satisfactory results. He then tried gelatin in solution, and instead of weighing the precipitate obtained, by adding an excess of gelatin, preferred adopting the volumetrical method, estimating the quantity of solution of gelatin of known centigrade value required to precipitate the tannin. For this purpose it is indispensable that the precipitate should separate readily, but with most kinds of tannin this is not the case. The author has found it advantageous to use a dilute solution of gelatin, and to have the liquids quite cold. His mode of operating is as follows:—

* Communication from Mr. George Bunsen.

† Three of these pictures are finished, viz. 1. The fall of Babel; 2. Die Bluthe Griechenlands ("the golden age of Grecian art and poetry"). 3. The Fall of Jerusalem. (an engraving of this picture was exhibited by Mr. Ackerman).—Two other compositions are drawn, viz. 4. The battle of the Huns; 5. The Crusaders' arrival before Jerusalem.—6. This subject not yet decided on.

The solution of gelatin is prepared by digesting ten grm. of dry gelatin (containing about eighteen or nineteen per cent. of water) in water for twelve hours, and then applying heat until the solution is complete. The volume is then made up to one litre.

For the purpose of determining the centigrade value of the gelatin solution, 0·2 grm. of pure gallo-tannic acid dried at 212° F. is dissolved in 100 or 120 grm. of water, and the gelatin solution added from a graduated burette until the precipitation is complete. Filtration is generally necessary towards the end of the operation, or as a substitute the following plan may be adopted:—A narrow open glass tube is covered at one end with some tolerably thick linen bound tight by cord; on immersing this covered end into the liquid, and sucking out the air by the mouth at the other end, a portion is rendered clear by passing through the linen, and may be poured into a tube, and tested with gelatin.

The author found that the 0·2 grm. of pure dry tanno-gallic acid required from 32·5 cub. cent. of the gelatin solution for perfect precipitation; when the solution is some days old, a larger quantity is necessary, 35, 38, or even 40 cub. cent. It is therefore necessary in all cases, when the gelatin solution has been kept any time, to determine its centigrade value by means of gallo-tannic acid immediately before making any experiments with it.

If it is required to estimate the value of oak or other barks for tanning, they are first dried in a warm room, powd red finely, digested in quantities of 10 grms. with warm water, and exhausted by means of a displacement apparatus constructed of a tube two feet long, one inch wide, and drawn out at the lower end, which is loosely stopped with cotton wool. Some substances may be introduced dry into this apparatus, and exhausted by the warm or cold water. The extraction may likewise be facilitated by the pressure of a column of water applied by fitting a narrow glass tube with a cork into the upper end.

In most cases, the extraction is completed in one or two days. When the operation is properly conducted, the quantity of liquid extract amounts to half a pound or a pound. It is then treated with gelatin solution so long as a precipitate is produced. A few drops of dilute hydrochloric acid facilitate the separation of the coagulum.

The quantity to be taken for an experiment of substances rich in tannin, such as galls, is about 0·5 or 1·0 grm. A simple calculation gives the per. centage of tannin.

The author states that he has adopted this method in repeated examinations of tanning materials during the last ten years; he has found the results tolerably constant, and nothwithstanding its apparent imperfection, more trustworthy than any other yet known.

He estimates the relative value of several substances of this kind as follows:—

Pine bark...............	contains from	5 to 7	per cent.	tannin.
Old oak bark	"	9......	"	"
Best oak bark.........	"	19 to 21	"	"
Gall nuts.........	"	30 to 33	"	"
Aleppo galls...........	"	60 to 66	"	"
Chinese galls..........	"	70......	"	"

These data at least admit of comparison with each other, and indicate with tolerably certainty the respective value of these substances to the tanner. This method of valuation is indeed based upon the assumption that the same kind of tannin exists in all these substances. It is however, extremely probable that this is not the case; but at the same time it may fairly be assumed that if different kinds of tannin combine under similar conditions with different quantities of gelatin, they will also combine with animal skins in the same relative proportions. If, therefore, this method does not indicate the absolute percentage of tannin, it still gives the per-centage value of the substances examined, and it is precisely this which the tanner requires.

It is another question whether gelatin solution precipitates all the substances of the tanning material which combine with the skin, and it therefore remains to be determined by experience whether such a method of valuation is sufficient for the purpose of the tanner.—*Polytechnisches Central Blatt*, 1853, *through Journal of Industry Progress.*

Twenty-fourth Meeting of the British Association for the Advancement of Science.

LIVERPOOL, SEPTEMBER, 1854.

On the Anthropoid Apes; by PROF. OWEN.

The Lecturer defined the known species of those large tail-less Apes, which form the highest group of their order (Quadrumana), and consequently make the nearest approach to man; he determined the true zoological characters of the known orangs and chimpanzees, as manifested by adult specimens; pointed out the relative proximity of the orangs and chimpanzees to the human species; and indicated the leading distinctions that separate the most anthropoid of those apes from man. The Professor then entered upon the subject of the varieties of the human species, and defined the degree in which the races differed from each other in colour, stature, and modifications of the skeleton. He entered upon a disquisition of the causes of these varieties, and proceeded to examine how far any of the known causes which modify specific characters could have operated so as to produce in the chimpanzees or orangs a nearer approach to the human character than they actually present. He pointed out some characters of the skeleton of the ape, *e. g.* the great superorbital ridge in the Gorilla Ape, which could not have been produced by the habitual action of muscles, or by any other known influence that, operating upon successive generations, produces change in the forms and proportions of bones. The equable length of the human teeth, the concomitant absence of any interval in the dental series, and of any sexual difference in the development of particular teeth, were affirmed to be primitive and unalterable specific peculiarities of man. "Teeth," the Professor proceeded to state, "at least such as consist of the ordinary dentine of mammals, are not organized so as to be influenced in their growth by the action of neighbouring muscles; pressure upon their bony sockets may affect the direction of their growth after they are protruded, but not the specific proportions and forms of the crowns of teeth of limited and determined growth. The crown of the great canine tooth of the male *Troglodytes gorilla* began to be calcified when its diet was precisely the same in the female, when both sexes derived their sustenance from the mothers' milk. Its growth preceded and was almost completed before the sexual development had advanced so as to establish those differences of habits, of force, of muscular exercise which afterwards characterize the two sexes. The whole crown of the great canine is, in fact, calcified before it cuts the gums or displaces its small deciduous predecessor; the weapon is prepared prior to the development of the forces by which it is to be wielded; it is therefore a structure foreordained, a predetermined character of the chimpanzee, by which it is made physically superior to man; and one can as little conceive its development to be a result of external stimulus, or as being influenced by the muscular actions, as the development of the stomach, the testes, or the ovaria." The difference in the time of disappearance of the suture separating the premaxillary from the maxillary bone, was not explicable on any of the known causes affecting such character. There was not, according to the Lecturer, any other character than those founded upon the developments of bone for the attachment of muscles, which was known to be subject to change through the operation of external causes; nine-tenths, therefore, of the differences, especially those very striking ones manifested by the pelvis and pelvic extremities, which Pro. Owen had cited in his 'Memoirs on the Orangs and Chimpanzees,' published in the *Zoological Transactions*, as distinguishing the great chimpanzee from the human species, must stand in contravention of the hypothesis of transmutation and progressive developement, until the supporters of that hypothesis are enabled to adduce the facts and cases which demonstrate the conditions of the modifications of such characters. There was the same kind of difficulty in accounting for the distinctive characters of the different species of the orangs and the chimpanzees, as for those more marked distinctions, that remove both kinds of apes from man. And with regard to the number of the known species, Prof. Owen remarked, it is not without interest to observe, that as the generic forms of the Quadrumana approach the Bimanous order, they are represented by fewer species. The gibbons (Hylobates) scarcely number more than half-a-dozen species; the orangs (Pithecus) have but two species, or at most three; the chimpanzees (Troglodytes) are represented by two species. The unity of the human species is demonstrated by the constancy of those osteological and dental characters to which the attention is more particulary directed in the investigation of the corresponding characters in the higher Quadrumana. Man is the sole species of his genus—the sole representative of his order: he has no nearer physical relations with the brute-kind than those which arise out of the characters that link together the great group of placental mammalia, called "Unguiculata." In conclusion, the Professor briefly recounted the facts at present satisfactorily ascertained respecting the antiquity of the Quadrumana and of man upon the surface of the earth. At the time of the demise of Cuvier, in 1832, no evidence had been obtained of fossil Quadrumana, and the Baron supposed that both these and the Bimana were of very recent introduction. Soon after the loss of that great re-constructor of extinct species, evidence with regard to the fossil Quadrumana was obtained from different quarters. In the oldest (eocene) tertiary deposits in Suffolk, specimens of jaws and teeth were found, that unerringly indicated the former existence of a species of monkey of the genus Macacus (*Macacus cocenus*). About the same time, the tertiary deposits from the Himalayan mountains gave further evidence of the Quadrumana: jaws, astragali, and some other parts of the skeleton, having been found completely petrified, and referable to the genus called Semnopithecus, which is now restricted to the Asiatic Continent. Dr. Lund discovered in Brazil fossil remains of an extinct platyrhine monkey, surpassing any known Cebus or Mycetes in size: the platyrhines are peculiar to South America. Lastly, in the middle tertiary series in the south of France, was discovered a fragment of the lower jaw, proving that at that period some species of the long-armed ape (Hylobates) must have existed. But no fossil human remains have been found in the regularly deposited layers of any of the divisions (not even the pliocene) of the tertiary series. Human bones have been found in doubtful positions, geologically considered, such as deserted mines and caves, in the detritus at the bottom of cliffs, but never in tranquil, undisturbed deposits, participating in the mineral characters of the undoubted fossils of those deposits. The petrified Negro skeletons in the calcareous concretes of Guadalope are of comparatively recent origin. Thus, therefore, in reference both to the unity of the human species, and to the fact of man being the latest, as he is the highest, of all animal forms upon our planet, the interpretation of God's works coincide with what has been revealed to us as to our own origin and zoological relations in his Word. Of the nature of the creative acts by which the successive races of animals were called into being we are ignorant. But this we know, that as the evidence of unity of plan testifies to the oneness of the Creator, so the modifications of the plan for the different modes of existence illustrate the beneficence of the designer. Those structures, moreover, which are at present incomprehensible, as adaptions to a special end, are made comprehensible on a higher principle, and a final purpose is gained in relation to human intelligence; for, in the instances where the analogy of humanly invented machines fails to explain the structure of a divinely created organ, such organ does not exist in vain, if its truer comprehension in relation to the Divine idea lead rational beings to a better conception of their own origin and Creator.—The discourse was illustrated by drawings and diagrams of the principal external and osteological characters of the different species of orangs and chimpanzees, and of the different varieties of the human race.

On Luminous Meteors: by Prof. Powell.

The Report consists almost entirely of details of observations on appearances of meteors, collected and communicated by various observers who have in former years contributed to the Reports successively printed in the volumes of the British Association. The observations are chiefly from Mr. E. J. Lowe, Mr. King Watts, the Rev. J. B. Reade, Mr. Bulard, and Mr. Farel, the latter of whom accompanies his observations by beautifully-executed diagrams, giving projections of the sky, with the paths of the observed meteors. Considerable discussion has taken place on the subject,—of which some account was given in the report,—between MM. Coulvin-Gravier and G. Von Boguslawski, more especially on the constancy of the August periodical shooting-stars, which had been denied by M. Coulvin-Gravier. It appears to have been perfectly verified in the last year. An unusual number seem also to have been observed on the 17th of October. Also a very remarkable large meteor was seen over a large part of England on the 28th of October.

Mr. Greg read a paper on 'Meteorolites and Asteroids,' in which he brought forward some circumstances in connexion with those bodies not hitherto noticed, in favour of the theory that they are identical in nature and origin. After stating some arguments against the theory of the atmospheric origin of ærolites, Mr. Greg proceeded to give an abstract of some results he had lately obtained in analyzing a very complete catalogue of ærolite falls. It would appear that since the year 1500 A.D. there are 175 authenticated instances of falls of ærolites, the month of whose fall is known. The number for each month being as follows:—For January 9, February 15, March 17, April 14, May 15, June 17 falls,—first half of the year, 87 falls; July 18, August 15, September 18, October 14, November 16, December 7 falls,—second half, 88 falls. Giving an average of 14·6 for each month. The most important thing to notice is the small number of ærolites registered for the months of December and January, and the comparatively large number for June and July. The former two showing but 16 instances of falls, the latter two 35, or more than double. Now, granting that these ærolites, or meteorolites, belong to the system of the asteroids, having orbits therefore whose mean distance is superior to the earth's orbit, it is certainly reasonable to conclude, than it is when the earth is farthest from the sun, *i. e.* at her aphelion, that the meeting with ærolities is rendered most probable. This is what would appear really to be the case, for the earth is at her greatest distance from that luminary on the side of the summer solstice, *i.e.* in June and July, precisely the months shown to be most abundant in ærolites. Mr. Greg then referred to a recent number of the *Comptes Rendus*, in which there is a paper by Le Verrier on the asteroids. M. Le Verrier shows by calculation that the sum of the mass of the fragmentary planets called asteroids cannot exceed one-fourth of the earth's mass; and also shows it probable that their mean mass or system is at its perihelion, and consequently nearest the earth, at the time when the earth herself is on the side of the summer solstice. This would appear again confirmatory of the theory that ærolites are the minute outriders of the asteroids. There would appear to be also further evidence, though of another kind. It has been supposed that some of the larger asteroids have irregular and angular surfaces, which is precisely the case with the majority of the meteoric stones which fall to the earth. Again, taking the average specific gravity of ærolites at 3·0 (they vary from 1·7 to 3·9), further indirect evidence is afforded as to their position with regard to distance from the sun, and, taking water as 1·0, the following table shows the relative densities of several of the planetary bodies, following the order of their distances from the sun:—Mercury, 15·7; Venus, 5·9; Earth, 5·6; Mars, 5·2; Aerolites, 3·0; Asteroids, (?), Jupiter, 1·4. Another circumstance relating to ærolites which was alluded to by Mr. Greg was the periodicity of those bodies, and he mentioned more particularly the 19th of May, 29th of November, 13th of December, 15th to 19th of February, and 26th of July, as being ærolitic epochs, ærolite falls having been recorded on the following days:—February 10, 10, 13, 15, 15, 15, 18, 18, 18, 19, 19, 25, 27, 27; May 9, 10, 17, 17, 17, 18, 19, 19, 20, 22, 26, 26, 27, 28; July 3, 3, 4, 7, 8, 12, 14, 17, 18, 22, 24, 24, 26, 26, 26, 30; November 5, 7, 11, 13, 17, 20, 23, 25, 27, 29, 29, 29, 29, 30, 30; December 11, 13, 13, 13, 13, 13, 14. In referring, however, to the epochs most remarkable for the periodical displays of luminous meteors, as November and August 9th to 14th days, Mr Greg observed that the number of ærolites recorded as falling on those days is remarkably small, indeed under the average of the year, for out of 155 falls (the day as well as month of fall being known), but four have fallen between the 9th and 14th days of August and November. The ærolitic and (luminous) meteoric epochs also would appear to differ, with the exception of the 29th of November. From this circumstance it seems probable that ærolites, and the majority of luminous meteors (especially periodic and conformable ones), are resolvable into separate classes; and in corroboration of this it may be mentioned, that while the number of ærolites whose falls have been recorded are about equally divided for the first as for the second half of the year, this is very far from being the case with luminous meteors, by far the larger numbers of which are observed during the second half of the year, viz., from July to December. While, then, we consider ærolites as belonging to asteroids, with orbits superior to the Earth's and partaking of the nature of true though minute planets, the majority of luminous meteors may be considered as having characters more in common with comets. It has been shown by several astronomers, as Olmsted, Pierce, Erman, and others that the majority of periodic meteors have orbits inferior to the Earth's, and their perihelia near the planet Mecury. Mr. Greg concluded, after making some observations in favour of the self-luminosity of meteors, by suggesting the probability of their having a nature less dense than that of ærolites, but denser than that of comets, and that it is not improbable they have a fluid or viscid nature.

On some Peculiarities of the Magnetic field: by Professor TYNDALL.

The Professor said, a piece of soft iron suspended between the flat poles of an electro-magnet set its largest dimension from pole, the residual magnetism of the cores being sufficient to produce the effect. This is the normal deportment of magnetic bodies, but it is by no means universal. By mechanical agency, by pressure for example, the structure of a magnetic body can be so modified that its shortest horizontal dimension sets from pole. Prof. Tyndall exhibited actions of the kind where the body operated on was compressed magnetic dust. In such a body two opposing tendencies were at work,—the tendency due to length, which sought to set the length axial, and the tendency due to structure, which sought to set the line perpendicular to the length axial. Between the flat poles the latter tendency was predominant, but between pointed poles this was not the case; here the attraction of the ends of the magnetic mass constituted a mechanical couple of sufficient strength to overcome the directive tendency which was due to structure, and to draw the mass into the axial line. But in raising or lowering the body operated on out of the sphere of this local attraction, by bringing it into a position where the distribution of the magnetic field resembled that existing between the flat poles, the body forsook the axial position and turned into the equatorial. The complementary phenomena were exhibited by bismuth. A normal bar of this substance sets its length at right angles to the line from the poles; but Prof. Tyndall exhibited a bar of this substance, which set between the flat poles exactly as a magnetic body. Such a bar, however, between the points set equatorial. On raising it or lowering it, however, it forsook the equatorial position and set axial. In this case the local repulsion of the ends between the points caused the bar to set equatorial, the influence of length thus predominating over the influence of structure; but removed from the sphere of this local action, the directive tendency of the mass triumphed and caused the bar to set axial. The bar in this case was cut with its length at right angles to the planes of most eminent cleavage of the bismuth:—it is a proved fact, that these planes while the influence of form is annulled, always set at right angles to the line piercing the poles, and hence where they are transverse to the length, the bar will set axial. These phenomena were examined in a great number of cases, bars were taken from substances possessing a directive tendency, and it was so arranged that the directive tendency due to structure was always opposed to the influence of length; between the points the former tendency succumbed to the latter, while between the flat poles, or above and below the points, the former was triumphant. It is amusing to observe the strife of these two tendencies in substances possessing a strong directive action. A plate of crystallized carbonate of iron, when properly suspended, will wrench itself spasmodically from one position into the other, and find rest nowhere. The simple law which governs all these actions is, that if the body, cut as above, be diamagnetic, its length sets equatorial between the points, but above and below them axial. If the body be magnetic it sets axial between the points, above and below equatorial. Hence the rotation of a magnetic body, on being removed from between the points, is always from axial to equatorial; while the corresponding rotation of a diamagnetic body is always from the equatorial to the axial. The deportment of wood in the magnetic field was next described. Nearly sixty specimens examined by Prof. Tyndall were all diamagnetic; each of them was repelled by the poles of the magnet; cubes of each when suspended with the fibre horizontal set between the excited poles, the fibre perpendicular to the line which unites the poles. Thinking that wood, on account of its structure, would exhibit those directive phenomena which had been demonstrated in the case of the bodies mentioned at the commencement, bars were taken from nearly forty kinds of wood, the fibre being at right angles to the length of the bar; in the centre of the space, between two flat poles, all those bars set their lengths from pole to pole. But Prof. Tyndall afterwards observed the remarkable fact, that homogenous diamagnetic bodies did the same. Bars of sulphur, of salt of hartshorn, of wax, and other diamagnetic substances, when suspended in the centre of the space between two flat poles, set their lengths from pole to pole. Now, as diamagnetic bodies always take up the position of weakest force, it was proved by these experiments, and corroborated by others not cited here, that the true force of the centres of the two flat poles contrary to the general opinion hitherto received, was the line of minimum force.

The Rev. Dr. Scoresby stated, that, by subjecting to force ordinary magnets of hardened steel, as by suddenly bending them, or striking them in particular modes, they may have their poles reversed or be deprived of their magnetism, or hardened non-magnetic steel may be instantly rendered magnetic and he considered that these facts, which he had long since made public, should be kept before the mind in such investigations as the very original and interesting facts just brought under the notice of the Section.—Prof. Faraday, after very briefly, yet lucidly, explaining to the Section the leading distinctions between paramagnetic and diamagnetic bodies, and their behaviour in the magnetic field, said that it was conceded on all hands that the explanation was erroneous, which Plücker had given of the phenomena which he first discovered connected with the branch of research to which Prof. Tyndall had just been directing their attention, and which he was so ably hunting down. But when he said the original explanation of Plücker was erroneous he did not mean that as the slightest disparagement to that philosopher. It was well understood by all who had any pretensions to scientific knowledge since the days of Bacon, that it was through the mist of error that the most important discoveries had to be made, and that in pursuing any research it was much better in the first stages of the inquiry to have erroneous views, than to be without any views that would tend to connect the scattered facts. For his part, he was not ashamed to own that he was a learner, and that in almost every instance it was through the clouds of error that he arrived at the conclusions which satisfied him most. And as his mathematical skill and acquirements were by no means such as to entitle him to despise instruction, he should feel particularly grateful to his mathematical friends present, Dr. Whewell and others, if they would explain to him and to the Section the law of distribution of the magnetic force in the magnetic field, if it was known.—Dr. Whewell explained how the force would be distributed upon the old theory of magnetic lines; but he said he was aware, and he believed it was now generally admitted, that this theory must be greatly modified, if not given entirely up. But as he saw Prof. W. Thomson in the Section, who had paid particular attention to the developement of the mathematical theory of magnetical and electrical forces, he trusted that that gentleman would favour the Section with his views.—In answer to Prof. Faraday's question, as to the mathematical conditions under which a uniform field of magnetic force may be produced, Prof. W. Thomson remarked that the mathematical theory of the distribution of force both afforded a remarkably simple and definite general answer, and pointed out the most convenient practical means of fulfilling these conditions either approximately or rigorously. For, in the first place, it is strictly demonstrable that if the force be rigorously uniform in some locality, in the neighbourhood of any kind of magnet or electro-magnet, through even one one-thousandth of a cubic inch, in fact, through any finite bulk however small, it cannot but be vigorously uniform through every portion of space to which it is possible to go from that locality without passing through the substance of the magnet. Hence, although between flat poles, such as Mr. Faraday first introduced for obtaining uniformity of force, we have in reality a most excellent practical approximation to a uniform distribution of very intense magnetic force, through a space of several cubic inches, in a locality not only visible but in every way convenient for experimental purposes; yet it is absolutely impossible that the force can be rigorously uniform through the smallest finite bulk of the magnetic field in any such arrangement, or generally, in any locality external to a magnet. If an experimenter wants a rigorously uniform field of force, he can only have it in the interior of his magnet; and he must be contented not to see the action he experiments on at the time it is being produced, unless he will follow the example of Prof. Faraday, who "went into a hollow cubical conductor of electricity and lived in it," and so was enabled to observe some most interesting and important fundamental properties of electrical force. It would be easy to make a hollow electro-magnet, in the interior of which the experimenter could observe with the minutest accuracy the bearings of all kinds and shapes of bodies in a vigorously uniform field of force. All that is necessary to make such a conductor is to take a hollow papier mâché globe, say six feet in diameter, and roll galvanic wire over its surface in a succession of close parallel circles, having their planes at equal distances from one another. A hollow non-magnetic body of any shape, cubical for instance, may have a rigorously uniform distribution of magnetic force produced in its interior by a suitable distribution of galvanic wire over its surface, determinable according to the form of this surface, by the mathematical theory from which these results are stated. But it would be difficult, perhaps practically impossible, to get a sufficient intensity for exhibiting the forces experienced by diamagnetic or weakly paramagnetic bodies in a uniform field of such extent that the operator could himself enter it; and experimenters must be contented either with approximations to uniformity, such as in the arrangement with flat poles, so successfully used by Prof. Tyndall in the beautiful experiments which he had exhibited to the Section, or they must arrange to test effects in the interior of hollow electro-magnets without seeing them at the time they are taking place. Interesting questions, which the mathematical theory answers decisively, had also been asked regarding the minimum condition of the central line in a field between opposite flat poles, of two cylindrical soft-iron bar magnets, and the effects of rounding off the edges of these poles. It appears that, if we consider the intensity of the force in a plane perpendicular to the magnetic axis through the centre of the field, we find it increasing from the central point to a certain circle of maximum intensity, beyond which it diminishes gradually and falls to nothing at an infinite distance. If the edges of the cylinders be *rounded off, the circle of maximum intensity contracts*, its centre always being a point of minimum intensity, until a certain degree of convexity of the poles is attained, when the circle of maximum intensity becomes contracted to a point—the central point of the field —which will then be a point of maximum intensity (the central minimum being eliminated), and will continue a maximum, as regards all points in the plane through it, perpendicular to the axis, for any less flat or more prominent or pointed forms of poles. No form of rounded poles, by doing away with maximum or minimum points, can possibly give a uniform distribution of intensity through ever so small a finite bulk of the field.

On the Deviation of the Magnetic Needle peculiar to Liverpool, by SIR JOHN ROSS.

Ever since the year 1799, when my attention was first directed to the deviation of the magnetic needle, I have lost no opportunity of making observations in many parts of the globe, on the interesting phenomena appertaining to that influence,—a statement of which has been published by me in the narrative of my first two voyages of discovery to the Arctic regions. Since which my attention was called to the frequent losses of ships consequent on the fallacious system adopted by the Admiralty, called "adjusting the compass," at Gravesend and other places; and after the loss of the Birkenhead, I felt it my duty to publish a pamphlet, which, although dedicated by permission to the First Lord of the Admiralty, did not at once obtain their Lordships' approbation, inasmuch as it exposed the absurdity of the system then in practice under the superintendence of a naval officer attached to the Admiralty. But I maintained the truth of my statement; and, after some correspondence on the subject, my assertions were found to be correct, and, consequently, the office of Superintendent of Compasses was abolished, and circulars issued by the Admiralty, not only ordering a monthly examination of the deviation, but that such observation should be instituted at every change of the ship's position, and on every circumstance which was known or supposed to affect the ship's deviation, or local attraction, which is now admitted to be of infinite service. But my attention has for some time been called to the fact of ships sailing from the port of Liverpool, after having been swung in the Mersey to obtain the amount of deviations, or as it is called, *to have their compasses adjusted*, that immediately on their proceeding on their voyage it was found that the deviation observed in the Mersey was incorrect, and there have been lamentable instances of shipwreck in consequence. It has occurred to me that this untoward circumstance is very easily explained. The fact is, that the Mersey is not locality eligible for ascertaining the true deviation of the magnetic needle, the ships being in a position between establishments in which large masses of iron are deposited, which must have an influence on the magnetic needle during the evolution of swinging the ship, while the embarkation of passengers with their luggage, or anything else subsequent to that process, cannot but have the effect of producing a false and dangerous result to the observations. But this evil is not without an effectual remedy, which is within the power of every captain of a ship after he has left the port of Liverpool, and which will be found in the following proposals.—It is proposed that the present method of swinging the ship in the Mersey shall be continued; and, in order to obtain a verification or a correction of results observed that time, it is proposed to place on the sandhills of Rockland (near the Rock Lighthouse), *two posts or beacons, true north and south of* each other, in the positions best seen near the red buoy of the Rock Channel, when the ships passing will be steering about true west, or west-north-west, by compass. When these two objects can be brought into one, *i.e.* due north of each (both being south of the ship), either a verification of the deviation that was observed in the Mersey, or the amount of difference to be taken into consideration or account on that particular point of the compass, will be shown, from which a calculation may be made in approximation of the other points; and if, further on, two other posts were erected on the magnetic meridian, the ships, on passing them, when in one with each other, could observe the exact amount of the deviation either in the increase or the diminution of the variation on the course of the ship, keeping in mind that it will be on the south point of the compass that the observations will be made. Posts placed due south of Lizard Lighthouse would be useful, and also on the magnetic meridian. But all posts or beacons denoting the true north or south bearings, and those further off denoting the magnetic meridian, should be painted of different colours. The former, that is, the true or nearest, should be red; while the latter, showing the magnetic meridian, should be chequered. Great Ormshead and Holyhead should have beacons placed on them, which would be observable to ships both outward and homeward bound.

On a New Refractometer: by Prof. BENNARD.

This instrument was founded on the principle of passing a ray through a medium bounded by two parallel surfaces, and might be called the refractometer of separation (*réfractomètre de transport*). When a ray passes through such surfaces, if it be incident perpendicularly, it emerges in the same course. If it be incident obliquely, its emergent course is parallel to that of its incidence. Then the relations which connect the perpendicular distance between the incident and emergent rays—the angle of incidence—the thickness of medium, or distance between the surfaces bounding it—the index of refraction is known—the first two can be observed, the third measured, and then the fourth—which is what we seek—is a matter of simple calculation.

Dr. Whewell expressed the pleasure he experienced at seeing these very beautiful instruments; and was particularly struck with the clear proof arrived at by Prof. Bennard, that the light at the several parts of the solar spectrum was simple, and not compounded light; and that thus the view, which had been some years since propounded, and which was still entertained by some, that the spectrum obtained by the prism was composed of several superimposed spectra, is proved to be unfounded and must be abandoned.

On the influence of the Solar Radiations on the Vital Powers of Plants growing under different Atmospheric Conditions: by MR. J. H. GLADSTONE.

This was the second Report given by the author under the same title, and commenced by describing accurately what portions of the prismatic spectrum were cut off by the various coloured glasses employed in his experiments. A series of observations followed on hyacinths grown under very varied influences of light, and solar heat and chemical agency. Among the results may be mentioned the power on the yellow ray to diminish the growth of rootlets, and the absorption of water; the power of the red ray to hinder the proper developement of the plant; and the effect of total darkness in causing a rapid and abundant growth of thin rootlets, in preventing the formation of the green colouring matter, but not of that of the blue flower, nor of the other constituents of a healthy plant. A series of experiments on germination was then detailed. Wheat and peas had been grown without soil under large colourless, blue, red, yellow, obscured colourless and obscured yellow glasses, and in perfect darkness. The effects resulting from these varied conditions were very marked; and the description of them occupies a considerable space in the report. The two plants experimented on—being chosen from the two great botanical divisions—exhibited a wide diversity, sometimes amounting to a direct opposition, in their manner of being affected by the same solar ray; but in the case of both the plants, under the circumstances of the experiment, the following effects were observed:—The cutting off the chemical ray facilitates the process of germination, and that both in reference to the protrusion of the radicles, and the evolution of the plume; the stem grows unnaturally tall, and there is a poor developement of leaves in darkness, becoming more manifest as the darkness is more complete; and the yellow ray exerts a repellant influence on the roots, giving the wheat a downward and the pea-roots a lateral impulse. A few experiments on the germination of other seeds were then narrated; and the report concluded with an account of experiments on the germination of wheat and peas in oxygen, hydrogen, and carbonic acid gases, as well as in ordinary atmospheric air, and in air from which carbonic acid was at all times certain to be removed. The results confirmed former observations on the necessity of oxygen.

Prof. Miller, in thanking the author for his valuable researches, made some remarks on the interesting results that the investigation had brought to light, and drew especial attention to the remarkable fact stated in the paper, that the blue rays retarded the action of germination at first, although they probably accelerated the growth of the plant afterwards,—the act of germination being attended with the absorption of oxygen, but the process of developement being, on the contrary, attended with the extrication of this gas.—Prof. Anderson remarked that a similar difference in the rate of growth of the leguminous plants and grasses to that described by Mr. Gladstone had been observed when they were manured with the same material. Nitrate of soda, which was found to be an excellent fertilizer for grasses, had comparitively little influence upon leguminous plants.

On the Physiological Properties of some of the Compounds of the Organic Radicals—Methyl, Ethyl, and Amyl, by Dr. James Turnbull.

The author commenced by saying, that considering the vast number of new compounds discovered of late years, it was surprising that so few of real value should have been added by medical men to their stores of remedies. The progress of therapeutics, though disproportionately slow when compared with the advance of organic chemistry, was marked in our day by the discovery of a new and most valuable class of agents—the anæsthetics. The effect of this narcotic and the antiperiodic alkaloids, morphia and quinine, were well understood, but nothing was known of any relation that may exist between their chemical constitution and the different actions they exert on the animal economy. It is probable that an examination of the action of the artificial alkaloids upon the system would throw some light on this subject. Already one of them, Furfurine, has been found by Dr. Simpson to possess antiperiodic properties like quinine. The physiological properties of the pure hydro-carbons were then alluded to: several of them were stated to act as local and general stimulants, and some of the volatile ones had been found to possess anæsthetic properties, as had been demonstrated by Dr. Snow and Mr. Nunnerley with regard to benzine, and by the author with eupion and Persian naptha.

On the Physiological Properties of Carbazotic Acid: by Prof. C. Calvert.

The author stated that Dr. Bell, Physician to the Royal Infirmary, Manchester, had cured several cases of intermittant fever with this acid. He also said, that he should be very happy to furnish any physician with a small quantity of this substance, so that its real medical value might be ascertained. After describing the process by which pure carbazotic could be procured from carbolic acid he impressed upon the meeting the value of the pure acid as a yellow dye for silk.

Mr Warrington observed that carbazotic acid was first employed in silk-dyeing at Lyons—that in 1851 its price at Paris, where it was manufactured, was 10s. per lb.; and that if the grass tree or black bay gum (which could be imported into this country from Australia for 14s. per cwt.), were employed and treated with nitric acid (a process originally suggested by Dr. Stenhouse) he believed that it might be prepared for a shilling per lb.

On the Results of Experiments on the Preservation of Fresh Meat: by Mr. G. Hamilton.

This inquiry was undertaken with a view of discovering a method by which beef could be brought in a fresh state from South America. The experiments were made by inclosing pieces of beef in bottles containing one, or a mixture of two or more of the following gases:—chlorine, hydrogen, nitrogen, ammonia, carbonic acid, carbonic oxide, and binoxide of nitrogen. Of these, the last two only possessed the power of retarding putrefaction. Beef that had been in contact with carbonic oxide for the space of three weeks was found to be perfectly fresh, and of a fine red colour. Binoxide of nitrogen is capable of preserving beef from putrefaction for at least five months, during which time the beef retains its natural colour and consistence. When meat that had been preserved by the last process was cooked by roasting, it was found to possess a disagreeable flavour. If cooked by boiling, the ebullition must be continued for a much greater length of time than is necessary for fresh meat.

Dr Calvert remarked, that he had opportunities of observing the well-known valuable anti-putrid properties of carbolic acid,—and instanced the case of the carcase of a horse that was at present in a fresh state, although four years had elapsed since it had been soaked in liquor containing the acid. He recommended the use of this acid for preserving bodies intended for dissection, as it neither affects the tissues nor discolours the organs.

On the Preservation of Milk; by the Abbe Moigno.

This was a description of the process invented by M. Mabbru, which consists in expelling the air and gases from milk by heating it in tinned or glazed iron cylinders to a temperature of 217°, in an atmosphere of steam.

On the apparently Mechanical Action accompanying Electric Transfer: by Mr. A. Crosse.

The author found that by electrifying a sovereign positively in close contact with a piece of carbonate of lime, under nitric acid diluted with fifty times its quantity of water, that a portion of the milled edge of the coin was struck off in pieces, some of which were large enough to retain the milled edge upon them distinctly. The voltaic action was kept up for fifty hours; and at the expiration of that time the coin had lost three grains in weight, and a ground glass rod that used to keep the coin in contact with the limestone was permanently gilded; and this took place at the positive pole. The weight of the portions removed from the coin exactly corresponded with the deficiency. The solution being tested contained nitrate of lime, but no gold nor copper. I likewise found on repeating this experiment with sulphuric acid, similarly diluted—the voltaic being kept up for ninety hours—that six grains of gold were removed from the edge of the coin; and the pieces broken off weighed the same. A strip of glass being placed on the edges of the jar containing the dilute acid, and half an inch above its surface, and in a line with the electric current, had its lower part covered with crystals of sulphate of lime, each one of which was at right angles to the electric current. The friction of the carbonic acid gas liberated from that part of the limestone in contact with the coin, was apparently the mechanical cause of the removal of the edges. The author stated that he had tried various experiments both with frictional and voltaic electricity upon different substances, which in his opinion proved the effects of the mechanical action accompanying electric transfer.

On the Action of Gallic and Tannic Acids on Iron and Alumina Mordants: by Prof. Calvert.

The author drew the following conclusions from the facts contained in his communication:—1st. That there can be no doubt that tannic acid is the matter in tanning substances which produces black with iron mordants; 2ndly. That the reason of gallic acid producing no black dye is, that it reduces the peroxide of iron in the mordant, forming a colourless and soluble gallate of protoxide of iron; 3rdly. That gallic acid has the property of dissolving hydrate of alumina, and also of separating alumina mordants from the cloth on which they are fixed; 4thly. That the reason of extracts of tanning matter losing their dyeing properties is, that the tannin is transformed into gallic acid; 5thly. That gallic acid possesses the property of dissolving iron, and thus lays claim to the character of a true acid; whilst tannin, not having this action, appears to me to be in reality a neutral substance.

On the Action of Citric, Tartaric and Oxalic Acids on Cotton and Flax Fibres under the Influence of Dry Heat and Pressure of Steam: by Mr. F. Grace Calvert.

Mr. Calvert has observed that when two to four parts of these acids are dissolved in 100 parts of water, and linen or cotton dipped into the solution obtained, and afterwards dried in the air, they, on exposure to certain temperatures, completely destroy the tenacity of the fibre. This action of organic acids is interesting when it is known that it takes place even at the low temperature of 180°, 212° and 260° Fahr. He also found that cotton and flax fibres when prepared as above, and then submitted to the influence of steam, of three lb. pressure, were destroyed.

On the Heating Effects of Secondary Currents: by Mr. J. P. Gassiot.

In January last Mr. Gassiot communicated to the Editor of the *Philosophical Magazine* an account of experiments made with Ruhenkooff's induction coil, and alluded to the fact, that the heating effect, which had already been noticed by Masson, took place in the contrary direction to that which is produced in the primary current; which heating effect had been observed as far back as 1838. Since January last Mr. Gassiot has had several forms of apparatus constructed for the purpose of observing the phenomena of secondary discharge in relation to its heating effects:—1. If the discharge of the secondary current takes place in air the negative terminal (which in these experiments were of platina wire) became heated.—2. If the wires are sealed into small (thermometer) straight tubing neither terminal appears to be heated, but the discharge takes place, filling the entire tube with a brilliant clear white light.—3. If any part of the tube is blown into small bulbs that portion of the discharge which passes through the bulbs is spread as illuminating that portion with a brilliant blue light.—4. If the discharge takes place in a globe, or in a tube of about one inch diameter, the negative terminal is intensely heated. In the course of the experiments Mr. Gassiot noticed that the glass at the heated end became quite black; in fact, the heat of the electrode had fused the glass and reduced the lead. He, therefore, had another apparatus constructed, taking care that whenever he experimented with it the current should invariably be sent in the same direction. The result has been that the negative end has become quite black, the glass being apparently oxidized in regular layers, the most intense being nearest the wire. The positive end of the glass remains quite clean, as does the platina wire, except about 1-92 of an inch, which appears covered with a minute black deposit. At this terminal, whenever the discharge is made, a minute, but brilliant spark appears, from which the electric brush flows in great beauty and brilliancy. The negative is at first covered with the well known blue flames until it becomes red hot, or no deposit appears to remain in the negative terminal. In all the experiments made with closed glass tubes the air was exhausted by means of an air pump.

On the Structure of Lunar Volcanic Craters: by MR. JAMES NASMYTH.

This communication was illustrated by a model of the lunar volcano Copernicus, and a diagram of Simpelius, each of which consists of a plateau, with a small central cone, surrounded by a ring shaped elevation, exhibiting concentric ridges or terraces. The circular elevations were supposed to have been formed by the accumulation of materials erupted with great energy to various distances, according to the intensity of the force; giving rise to concentric ridges, or *terraces of deposition*, which are often nearly entire circles, one within the other. Besides these there are other terraces, forming only segments of circles within the principal rings, which were attributed to the agency of landslips, these in most instances correspond to notches in the edge of the crater from which they have slipped, and their debris has rolled onward over the plateau, towards the centre. The central cone was attributed to the last expiring efforts of the eruptive action.

Prof. Phillips observed that although there might be no sign of the existence of water on the present surface of the moon, he thought there were many indications of former aqueous action. There were elevations like the *escars* of Sweden and Ireland, and small gullies converging into larger, like the channels of mountain streams. He also called attention to the narrow, dark lines, many miles in length, occasioned by shadows which change with the direction of the sunlight, showing that the level is higher on one side than the other, as in cases of *fault*. Mr. Hopkins inquired into the evidence respecting the existence of an atmosphere, or of water, on the moon. If any atmosphere existed, it must be very rare in comparison with the terrestrial atmosphere, and inappreciable to the kind of observations by which it had been tested; yet the absence of any refraction of the light of stars during occultation was a very refined test. No equal means existed of ascertaining the presence of water on the moon; and if it did not now exist, the opinion of its former existence rested on very uncertain evidence. The large size of the lunar craters compared with any on the earth was accounted for if they were produced by the expansion of a fluid mass; for there was no reason why such a force should be materially less in the moon than the earth, whilst gravitation was much less. The result would be not only a much greater elevation, but less tendency to fall. He considered the annular craters were the remains of dome-shaped elevations, of which the central part had fallen in. The lunar craters were more numerous in proportion to the terrestrial; but there might have been many more on the earth which have been washed away. Mr. James Smith remarked that the perfection of the lunar volcanoes might be due to atmospheric conditions; and referred to the great circular crater of the Sandwich Islands as being terraced like Copernicus. Mr. Nasmyth expressed his very strong conviction of the total absence of water, or of traces of watery action, on the moon; and also of the absence of any atmosphere. The sudden disappearance of stars behind the moon, without any change or diminution of their brilliancy, was one of the most beautiful phenomena that could be witnessed.

On the Probable Former Existence of Palæozoic Glaciers: by PROF. RAMSAY.

Admitting the probability that the earth had cooled down from a molten condition, the author contended that little trace of that refrigeration could be detected, as regards the climate of the globe, since the formation of the oldest fossiliferous strata. For a long time it had been supposed that the coal Flora indicated the influence of high internal temperature; the same inference was derived from the reptiles of the oolites and the nautili of the tertiaries. It had however lately been shown that the Silurian Fauna indicated a temperate climate in our latitude, and the other instances might be accounted for by a different geography. He then proceeded to show what he considered evidence of glacial action, during the latest Palæozoic period, in South Staffordshire and the Malvern district. This consisted in the occurrence of *trappean breccia*, sometimes more than 100 feet thick, amidst the marls and sandstones of the Permian series, or resting on the Silurian strata of Malvern and the Abberleys, where it had been described as trap by Sir R. Murchison. The base of the breccia is a fine soft red marl, like tertiary boulder-clay, containing angular masses of trap, of various sizes, up to two or three feet in diameter, seldom much water-worn, but having their surfaces more or less flattened and polished and scratched like stones from the moraines of Alpine glaciers. These blocks consist of greenstone, feldspars and feldspathic porphyries, altered slate-rocks, ribboned slates, green slates and sandstones, purple slates, and quartz rock, not derived from the underlying rocks, but brought from the Longmynd and Silurian Strata north of Bishop's Castle, some of them having travelled more than forty miles. The Longmynd is now only 1,900 feet above the sea; but on its eastern side, between it and the breccias, there is the great Church Stetton fault, a downthrow to the west of 3,500 feet. And although an elevation of even 6,000 feet would not give rise to glaciers on the Longmynd, Prof. Ramsay believed that in the Permian period they formed a mountain tract from which glaciers descended to the sea, and bergs broke off and floated away, as in the latest glacial seas. There are traces of this action being renewed twice,—the last being in the new Red Sandstone. Outlying fragments of Upper Silurian rest on the Longmynd, showing that it was originally covered, whilst the breccias prove that its denudation took place before the Permian period.

Sir C. Lyell admitted the failure of the old proofs that internal heat had controlled the climate within the historico-geologic period. The idea of glaciers in the Permian age was rather startling, and out of harmony with the fact that large Monitors existed in Thuringia, and tree-ferns flourished at the same period; but it was quite possible that the Permian period included temperate and torrid climates, just as both were found indicated in the tertiary. Prof. Phillips stated, that when he first examined this trappoid breccia at Malvern, where it exists at an elevation of 1,000 feet, he had been impressed with the conviction that it was very different, as to its origin, from the ordinary conglomerates of the new Red Sandstone, and even the notion of a glacial explanation had passed though his mind. Mr. Page declared himself a believer in the operation of glacial action from a period much earlier than the Permian; some of the conglomerates of the Old Red Sandstone were so like the accumulations of angular detritus carried by bergs and piled up on the shores of Polar Seas, that an Arctic voyager might suppose them formed in the same manner. Prof. Morris referred to the existence of a series of fossils, apparently indicating a warm climate in the strata immediately beneath the supposed glacial deposit, and to the recurrence of a similar series in the beds immediately above; and also to the existence of rock-salt and gypsum, supposed indications of a warm sea, in the New Red Sandstone. Prof. Forbes observed, that if the views of Prof. Ramsay were confirmed, they would throw great light on the changes of organic life at the close of the Permian period.

On the Thickness of the Ice of the Ancient Glaciers of North Wales, and other Points bearing on the Glaciation of the Country: by PROF. RAMSAY.

Prof. Ramsay stated his belief that there had been two sets of glaciers in North Wales since the ground assumed its present general form The first was on a very large scale, followed by a slow subsidence of the whole country to the extent of 2,800 feet, until only the tops of the highest hills remained uncovered by the sea, and when the mountains again rose, a set of smaller glaciers was formed. The thickness of the ice in existing Swiss glaciers was known to be very great, in the Grindelwald it had been ascertained to amount to 700 feet, and in other instances was probably thicker. The observations of Agassiz and Prof. James Forbes on the height to which grooved and polished surfaces span up the sides of Alpine valleys, had led to the conclusion, that the ice had once been much more extensive, and that in the glacier of the Aar, for example, it must have amounted to 2,000 feet. The same method of observation had been applied to North Wales, and it had been ascertained that in the Pass of Llanberris the grooves and roundings of the rocks extended to a height of 1,300 feet above the bottom of the valley. The drifted deposits which overlie these rounded surfaces must have formed during the slow depression which followed, and the glaciers must still have existed, since these deposits, though marine, are still of a moraine character. The cold climate continued during the period of depression, and for some time after it, and there was beautiful evidence in the side valleys of the gradual decrease of the glaciers until they died away amongst the higher mountains in the form of moraines stretching across the valleys, one within the other. The scratches made by the first set of glaciers passed down the valleys, those of the smaller glaciers crossed the first obliquely.

On the Anthracite Deposits, and the Vegetable Remains occurring in the Lower Silurians of the South of Scotland: by PROF. HARKNESS.

These strata form the high land south of the Firths of Forth and Clyde, and have a general inclination to the N.N.W. The highest beds are on the northern side of the range; and consist, near Girvan, of limestone and sandstone, with fossils of the Llandeilo rocks. To the southward fossils are rare, but near the lowest part of the series, at Glenkiln, nine miles from Dumfries, organic remains are found in beds of anthracite, resting on 1,500 feet of unfossiliferous purple and grey sandstones and shales. The fossils are *Graptolites saggitarius, Diplograpsus pristis* and *D. ramosus*. *Siphonotreta micula* occurs with the Graptolites in a thin bed of black shale at the base of the anthracitic beds. At Duff-Kinnel, crustaceans of the genus Dithyrocaris have been found. These fossils do not account for the carbonaceous matter in the black shales, but indications of "fucoids" have been found; and it is supposed that much of the hydrocarbon of these beds has been lost through the influence of mechanical forces. Fucoids of the genera Palæochorda and Chondites are found in the ripple-marked flags of a much higher part of the series, north of New Galloway, unaccompanied by anthracite, but associated with a zoophyte (*Proto-virgularia*) and tracks of Annelides. The Anthracite beds were supposed to have derived their carbonaceous matter from sea-weeds floating like the gulf-weed of the present day.

Prof. Ramsay considered these black schists were of the age of the lower part of the Bala or Llandeilo series. Prof. Forbes remarked that the fossils usually called "fucoids" were rather to be regarded as zoophytes; and the "Nereites" were believed by German palæontologists to be flexible bodies similar to Graptolites and not tracks of Annelides.

On the Sub-division of the Palæozoic Rocks of Scotland: by MR. D. PAGE.

Passing by the oldest systems, the author proceeded to describe the typical developement of the Old Red Sandstone, remarking that the classification of strata should always be founded on the district which exhibited their characters in the highest degree. The system was considered to extend downwards to the lowest stratum, containing remains of fishes, and to consist of three divisions:—1. The lowest, or Grey Sandstone series, 2. The Old Red Sandstone and conglomerate, (*par excellence*); 3. The Yellow Sandstone series. The spinny-finned fishes (Cheiracanthus, &c.) were most abundant in the lower division; bony-cased fishes (Cephalaspis, Coccosteus' &c.) in the middle; and Holoptychii in the upper series. The "fucoids" were regarded as merely structural peculiarities of the rock, but according to Dr. Fleming, true plants also occurred. The whole system was considered of marine origin, and the conglomerates were believed to have been transported from a great distance by the agency of ice, because the material is not sorted as it would be in a free flowing sea. The Carboniferous system represented the limestone, mill-stone grit, and coal measures of England, but in the east of Scotland there was a peculiar set of sandstones below the carboniferous limestone, called the "calciferous sandstone" by McLaren, and representing the carboniferous slate of Ireland. These lower coal-measures included also the fresh water limestone of Burdie-house, and numerous beds of trappean ash, the sandstones were often ripple-marked, and apparently sub-aerial in their origin. The beds of coal were not workable, and were associated with peculiar fire-clay and shale, Araucariæ were more prevalent than tree-ferns, and Megalichthys and Palæoniscus the characteristic fishes. no shells occurred in the fire-clay, but only in the shales with the fish remains, indicating periodical inundations of the sea. 2. The carboniferous limestone was sometimes a very thin band, or several bands, at most amounting to 60 or 70 feet, the associated shales were fully developed, and the whole contained encrinites, reteporæ, minute trilobites, and other marine fossils, affording even when but a few feet thick an unerring guide to the miner. 3. The millstone grit was very thin, but in some places exactly like the grit of England. 4. True coal-measures, containing a greater variety of coal than in any other field —caking, free-burning, splint, and cannel coal of every variety, besides the "black band," which, if not "coal," passed insensibly into cannel, and was so coaly as to have been interdicted from being worked; "mussel-bands" were of frequent occurrence; and there were indications of rapid formation and drift in the fish-scales and sea-shells. The Permian system was not represented in Scotland, unless the "flat coal" of the Fifeshire coast could be regarded in that light.

Dr. Griffiths remarked, that the term "yellow sandstone" had been already, and long ago, employed by himself for a lower division of the carboniferous system in Ireland; it was several thousand feet in thickness, and included shales, thin, unworkable coal, and limestone, with marine fossils, all characteristic of the carboniferous system.

On the Foliation of some Metamorphic Rocks in Scotland: by PROFESSOR E. FORBES.

It was of great importance to geologists to distinguish between lamination, cleavage, and foliation: the first resulted from original planes of deposition; the second was a superinduced structure, dividing rocks into laminæ of bedding, thirdly, foliation was the division of a rock into laminæ of different mineral condition. Cleavage had been attributed, by Prof. Sedgwick, its first definer, to electrical action; by Mr Sorby, to a mechanical force, and by Mr. D. Sharpe, to mechanical and chemical influence. The foliation of mica slate, or separation of its mineral constituents into distinct layers, had been attributed to metamorphic action on layers of different constitution; Mr. Darwin had considered it identical with cleavage, and due to the same cause, —the one passing into the other. the same view has been maintained by Mr. Sharpe. Professor Forbes agreed with those who considered it a superinduced structure quite distinct from cleavage or lamination. The author then referred to examples of foliated structure. In a roadside quarry at Crianlarich, near the head of Loch Lomond, where the metamorphic limestone is not distorted, and exhibits distinct lines of bedding, of a pale blue colour, caused by the presence of iron; also lines of different mineral matter, the laminæ frequently curved round nuclei, and dark lines of crystals of calcareous spar produced, perhaps, by the metamorphism of bands and fossils. In the upper part of the quarry the limestone becomes foliated with mica,—the foliation being at first parallel with the bedding, then becomes wavy and contorted, is affected by small faults, and contains nuclei of calcareous spar, and at length passes into a mica slate. At Ben Os there is a calciferous band in the mica slate, which, having the same strike with the Crianlarich beds, may eventually prove a guide in unravelling the structure of the country. Two miles from Inverarnon there is a bed of porphyritic trap in mica slate, and the foliation on the sides of the trap is conformable. Four miles from Inverarnon, in a quarry of trap, which sends large and small veins into the mica slate, there is evidence of a second foliation having taken place, following the same veins of trap. Near Tarbert the mica slate is foliated and contorted; and a bed of calcareous grit cuts through it, without disturbing the relations of the curves and laminæ. In a slate quarry at Luss, the foliation accords in the main with the cleavage, as observed by Mr. Sharpe, in the corresponding district; but whilst the foliation curves round the nuclei of quartz, the cleavage abuts against them. Foliation has also been noticed in the baked rocks of Salisbury Crags. Prof. Forbes concluded, 1, that foliation was a superinduced structure; 2, that it was distinct from cleavage; 3, that it was not of mechanical origin, but a chemical phenomenon, 4, that it was, perhaps, induced by more than one agency.

Sir C. Lyell remarked, that the Plutonic action, which had changed loose sand into quartz rock, shells into marble, and clay into feldspathic rocks, had often left the planes of stratification still visible. The unaltered sedimentary beds were frequently affected by irregularities as great as those of the altered rocks, and by crumplings which it seemed impossible to explain. If these were rendered metamorphic, there would be danger of attributing to chemical action peculiarities which existed whilst the beds were yet unaltered.

CANADIAN INSTITUTE ESTABLISHED 1849

INCORPORATED BY ROYAL CHARTER.

The attention of members of the Institute is requested to the subjoined extracts from the Regulations and By-Laws :—

1. The Sessions of the Institute shall commence annually on the first Saturday in December; and ordinary meetings shall be held on every succeeding Saturday (omitting the Christmas holidays), until the first Saturday in April; but it shall be in the power of the Council to protract the sessions if it should seem necessary. The chair may be taken when five members are present.

2. The chair shall be taken by the officer or member entitled to the same; and the business of the evening commence at eight o'clock precisely, and be conducted in the order prescribed in the By-Laws.

3. Every member shall have the privilege of introducing two visitors to be present at the public business of the Institute by ticket of admission, on which the name and address of each visitor must be written.

4. The annual general meeting of the Institute shall be held on the third Saturday in December, at seven o'clock in the evening, to receive and deliberate on the report of the Council on the state of the Institute, and to elect the officers and members of the Council for the ensuing year.

5. The Council may, at any time, call a special general meeting of the Institute for a specific purpose, giving to city members six days' notice; and they are at all times bound to do so, on the written requisition of five members, which shall specify the nature of the business to be transacted.

6. Those members of the Institute residing at a distance from the city, shall have the power of forming themselves into Branch Societies, for the purpose of holding meetings, and discussing scientific and other subjects; and are to be governed by the regulations of the Institute, and such other By-Laws hereafter to be enacted by them and approved by the Council.

BY-LAWS.

I. At the ordinary meetings of the Institute, every Saturday evening, the following order of business shall be attended to, as closely as circumstances will admit:—

1. The Minutes of the previous meeting to be read and confirmed, and signed by the chairman; and no entry shall be considered valid until this be complete.
2. New members present to be introduced to the meeting.
3. Names of candidates for admission to be announced.
4. Business arising out of the Minutes to be entered on.
5. Communications received since the last meeting to be announced, and read if required.
6. Donations received and acknowledged.
7. Communications from the Council to be brought forward.
8. Candidates to be ballotted for. A ballot shall be taken for the entire body of candidates proposed for admission; if one or more black balls appear, the ballot shall be taken for each individually, and any candidate shall be rejected against whom appear a number of black balls equal to one-fourth of the number of members voting.
9. Papers on the lists to be read.

II. Notices of questions to be brought forward for discussion, must be given at least one week before the same shall be brought forward; and it shall be competent for the Council, or for any member to propose a subject for discussion.

III. A circular letter may be sent to all the country members, at the commencement of each session, with a list of questions that are appointed for discussion at the ordinary meetings of the Institute, requesting communications from the members on them, or on any other subject connected with the objects of the Institute.

IV. A similar letter may also be transmitted about the middle of the session, with the addition of any new questions that may have been brought forward and accepted; and at the end of the session, a list of questions shall also be sent to all the members, in order to collect information during the recess. Each letter shall contain a list of the written communications that have been made to the Institute.

COUNCIL MEETING,

THURSDAY, 9TH NOVEMBER, 1854.

DONATIONS.

Annales des Mines ou Recueil de Mémoires sur l'exploration des Mines et sur les sciences et les arts qui s'y rapportent; rédigees par les engénieurs des mines, et publiées sous l'autorisation du ministre des travaux publiques. 1st and 2nd livraison de 1854, presented by M. C. de Boilleau.

Journal of the Geographical Society, with Maps, Vol. 23.

General Index to the second ten volumes of the Journal of the Geographical Society.

Quarterly Journal of the Geological Society, Vol. IX., Part 1, 1853.

Trade and Navigation Reports for the Province of Canada, by the Hon. W. B. Robinson.

Various Parliamentary documents, by the Hon. W. B. Robinson.

Box of mineral specimens from Sault Ste. Marie, by Mr. A. McIntosh per Mr. S. Spreull.

LITERARY AND HISTORICAL SOCIETY OF QUEBEC.

INCORPORATED BY ROYAL CHARTER.

OFFICERS FOR 1854.

President:
G. B. FAIRBAULT.

Vice-Presidents—E. A. MEREDITH, L.L.B.; LIEUT. A. NOBLE, R.A.; LIEUT. E. D. ASHE, R.N., F.R.A.S.; G. T. KINGSTON.

Recording Secretary—HENRY E. STEELE.

Corresponding Secretary—LIEUT. H. G. SAVAGE, R.E.

Council Secretary—NOEL H. BOWEN.

Curator of Museum—ROBERT H. RUSSELL, M.D.

Curator of Apparatus—WILLIAM BONNING.

Treasurer—G. T. CARY.

Librarian—E. T. FLETCHER.

LITERARY OR STATED MEETING,
WEDNESDAY, 4TH OCTOBER.

The following donations were announced :—

An Oil Painting of the Steamship "Royal William," the first Steamship which crossed the Atlantic, from Captain McDougall.

A plan of Docks proposed to be erected on the beach of the River St. Charles, and approved of by the Earl of Dalhousie, from William Henderson.

Several curious Fossils and specimens of Natural History, from William Cooper, Toronto.

A paper was read by E. A. Meredith, L.L.B., on "the resources and capabilities of the Island of Anticosti," by A. R. Roche.

Henry E. Steele, of Quebec, was proposed as an Associate Member.

GENERAL MONTHLY MEETING,
WEDNESDAY, 11TH OCTOBER.

Mr. Roche's communication on "the resources and capabilities of the Island of Anticosti" was, on the Report of the Committee of Literature, ordered to be published in the transactions of the Society.

The following donations were announced :—

Specimens of Fossils from the Bermudas and other places, from John Fraser.

The following gentlemen were elected Associate Members :—

Captain A. T. Hamilton, 71st. Regiment, Lawrence Oliphant; A. R. Roche, and Henry E. Steele.

LITERARY OR STATED MEETING,
WEDNESDAY, 18TH OCTOBER.

An interesting paper was read by E. D. Ashe, Lieutenant, R.N. F.R.A.S., on "the Water Power of Quebec."

Literary and Historical Society of Quebec.

The Council of the Canadian Institute, at the request of the Council of the "Literary and Historical Society of Quebec," have authorized the publication in the *Canadian Journal* of a synopsis of the proceedings of the Quebec Society. As it is probable that the history and objects of this valuable Association are not generally familiar to our readers, we subjoin a brief account of its past progress and present condition.

The "Literary and Historical Society of Quebec," the oldest chartered Association of the kind in Canada, was founded in 1824, and owes its origin to the zeal and munificence of the Earl of Dalhousie, at that time Lieutenant Governor of Lower Canada. He is said to have suggested its formation, and in its early days, the Society was largely indebted to his fostering care. The preamble of the Charter of Incorporation states that the Society was formed "for the prosecution "of researches into the early history of Canada, for the recovering, "procuring and publishing of interesting documents and useful "information, as to the Natural, Civil, and Literary History of British "North America, and for the advancement of the Arts and Sciences in "the said Province of Lower Canada, from which public benefit may " be expected."

The inaugural address, and first Essay (on the juridical history of France) were read by Chief Justice Sewell, the first President, on the 31st May, 1824. This paper was followed by others of no common interest and ability, on the Geology of the country by Captain Bayfield, R. N. Captain Bonnycastle, R. E.; Lieut. Baddely, R. E.; and others. The Flora of Canada was investigated by the Hon. W. Sheppard, and W. Green, Esq., and papers on the Plants and Shells of the vicinity of Quebec, were transmitted to the Society by the Countess Dalhousie, and Mrs. Sheppard. Among the contributors to the department of Natural History and Climatology appear the Hon. J. Hale, Joseph Skey, M. D., and Wm. Kelly, M. D., Surgeon R.N.; W. Henry, Surg. 66th Regt., and H. D. Sewell, M. A. The History of the aborigines was largely discussed by Major Mercer, R. A., and others, and the late Rev. D. Wilkie, L. L. D.; Andrew Stuart, Esq., and Dr. Fisher, also appear among the list of contributors to the published transactions.

The amalgamation of this Institution with the "Society for the encouragement of Arts and Sciences," founded a few years later, took place in 1829. His Excellency, Sir James Kempt, who at that time became the patron of both Societies, suggested the advantage that must accrue by bringing together whatever talent and resources either possessed.

The progress of the Association has of necessity been considerably retarded by the calamity of the 2nd. February last, when the parliamentary buildings, part of which was occupied by the Society, were destroyed by fire. On this occasion all the furniture of the Society, nearly the whole of its Museum and apparatus, and great part of its Library were consumed; and it was only by the most strenuous efforts, that the valuable "Records of the Realm," in eighty or ninety folios, and the unique collection of Historical manuscripts, procured at an expense of many hundred pounds, were saved from destruction.

Paralysed by this severe blow, uncheered by sympathy from those around, without a shadow of assistance from the authorities, and compelled for the time to fall back on the individual exertions of its members, the Society deemed it proper, in the interests of science, to submit its condition to other American Institutions of a similar character. A petition has also been laid before the Legislature, and strong hopes are entertained that its affairs, ere long, will assume a more favourable aspect, and its effectiveness and utility be completely restored.

It is a gratifying fact, however, and one which reflects great credit upon the officers of the Society, and on its members generally, that notwithstanding the severe ordeal through which the Society has lately passed, it evinces at the present moment greater activity and zeal, and numbers more members, than it has done for many years before.

It may be as well to mention, in reference to the proposed publication of the proceedings of the Society in the "Canadian Journal," that under the Charter "General Meetings" of the Society are held on the second Wednesday of every month, for the transaction of the business of the Society, and that under the By-Laws of the Society, Literary, or Stated meetings are held on the first and third Wednesday of every month from October to April, both inclusive.

Meteorology of Quebec.

We are again indebted to Lieut. A. Noble, now assisted by Mr. W. Campbell, for the Monthly Meteorological Table for Quebec, which appears in the present issue of the *Canadian Journal.*

While thankfully acknowledging the resumption of the Quebec observations, we cannot but express great regret that uncontrolable events should have prevented their continuance during the past remarkable summer. Nearly simultaneous observations during that interesting period at Quebec, Montreal and Toronto, would have possessed no ordinary interest or value.

Monthly Meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West.—October, 1854.

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

Day.	Barom. at temp. of 32 deg.				Temp. of the Air.				Mean Temp. + or — of the Average	Tension of Vapour.				Humidity of Air.				Wind.				Rain in Inch.
	6 A.M.	2 P.M.	10 P.M.	Mean.	6 A.M.	2 P.M.	10 P.M.	M'N.		6 A.M.	2 P.M.	10 P.M.	M'N	6 A.M.	2 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.	Mean Vel'y	
					°	°	°	°	°													
1	29·523	29.285	—	—	53·2	61·4	—	—	—	0·365	0·486	—	—	·91	.91	—	—	Calm	S W b S	—	5·74	0·145
2	·535	·466	29·394	29·453	39.5	63·5	49·5	51·55	+ 1·62	·208	·241	0·251	0·251	87	42	·72	·69	Calm	S S W	Calm	3·02	...
3	·119	28·756	28·795	28·885	49·2	63·5	52·8	55·77	+ 6·23	·270	·424	·344	·365	78	75	87	83	E N E	E S E	SWbW	8·01	0·465
4	28·949	29·288	29·599	29·313	46·0	56·3	40·9	47·35	— 1·68	·256	·231	·192	·224	83	52	75	70	SW bW	NWbW	NWbW	11·12	...
5	29 818	·886	·841	·856	31·6	56·4	45·2	45·33	— 3·28	·168	·233	·252	·229	95	53	85	78	Calm	W	Calm	2 98	...
6	·886	·813	·816	·837	41·7	63·7	51·7	54·05	+ 5·83	·166	·318	·316	·285	63	55	84	69	Calm	SW bS	SWbW	4·44	...
7	·841	·818	·863	·840	50·3	74·2	60·1	61.48	+13·63	·305	·470	·450	·404	85	57	88	77	SW bW	S W	N W	2·06	0·005
8	·835	·722	—	—	57·2	68·4	—	—	—	·397	·462	—	—	87	68	—	—	Calm	E b S	—	2·02	...
9	·633	·567	·669	·629	50·4	70·7	54·9	57·18	+10·12	·303	·458	·364	·370	84	63	86	80	Calm	W S W	N b E	3·27	0·035
10	·781	·775	·702	·748	50·6	47·0	51·3	50·05	+ 3·38	·330	·286	·340	·309	91	90	91	87	E N E	E N E	E b N	5·79	0·275
11	·626	·548	.493	·549	47·6	68·2	53·0	56·82	+10·57	.306	·486	·367	·387	94	72	93	85	Calm	S S W	Calm	2·35	0·110
12	·447	·435	·627	·524	55·6	64·0	50·8	56·10	+10·13	·403	·496	·298	·387	93	86	81	86	Calm	S W	N N W	4·82	0·015
13	·740	·740	·670	·715	43·1	49·2	44·9	46·07	+ 0·50	·232	·274	·252	·250	84	79	85	81	N	E	Calm	3·50	0·205
14	·387	·295	·465	·385	48·8	53·8	37·7	45·97	+ 0·70	·330	·235	·179	·239	97	58	80	77	E	N W	N N W	13·41	...
15	·519	·461	—	—	36·6	45·7	—	—	—	·155	·130	—	—	72	43	—	—	NWb N	NW bN	—	10·77	...
16	·277	·259	·415	·324	36·6	50·6	42 8	43·05	— 1·48	·192	·261	·238	·230	89	72	88	84	W N W	W N W	N b W	7·47	0·010
17	·551	·597	·602	·580	35·9	49·2	39·0	40·75	— 3·48	·180	·225	·207	·212	86	65	88	84	NW bN	S S W	NWbW	3·52	...
18	·596	·731	·873	·743	34·1	41·6	33·0	36·60	— 7·43	.162	·115	·155	·149	82	44	82	70	W b N	NWbN	NWbN	9·43	...
19	30·012	30·042	30 017	30·034	29·8	45·2	33·4	35·78	— 8·00	·136	·179	·166	·158	82	60	87	76	Calm	S b W	Calm	2·32	...
20	30·023	30·017	30·006	30·019	36·8	49·9	44·9	43·85	+ 0·28	·173	·237	·226	·211	79	67	76	74	Calm	S S E	Calm	1·85	...
21	30·010	29·993	29·972	29·995	37·0	53·6	42·0	44·50	+ 1·25	·182	·194	·204	·202	83	48	77	71	N b E	S b E	N b E	2·40	...
22	29·943	·924	—	—	46·3	51·5	—	—	—	·249	·290	—	—	80	78	—	—	N N E	E N E	—	6·64	0·055
23	·899	·867	·890	·890	49·2	53·6	52·2	51·40	+ 8·65	·260	·322	·294	·292	76	80	77	78	E b N	E	E b N	4·12	...
24	·941	·953	30·016	·975	48·8	60·8	48·8	52·77	+10·27	·292	·376	·283	·314	86	72	83	80	E b N	S	Calm	0·81	...
25	30·102	30·085	30·072	30·087	50·5	59·7	49·2	53·32	+11·03	·281	·398	·269	·328	78	80	78	81	N b W	S	Calm	0·77	...
26	30·097	30·037	29·988	30·036	41·3	61·1	43·7	48·72	+ 6·73	·211	·388	·262	·287	82	74	93	84	Calm	S S E	Calm	1·74	...
27	29·983	29·944	·906	29·942	44·3	55·3	41·5	46·22	+ 4·43	·262	·375	·240	·289	91	88	93	92	Calm	Calm	Calm	0·43	0·040
28	·873	·830	·809	·839	42·4	59·8	50·3	50·90	+ 9·42	·252	·383	·341	·327	94	76	95	89	Calm	E S E	NEb N	2·17	0·015
29	·729	·645	—	—	56·0	57·4	—	—	—	·379	·415	—	—	86	90	—	—	N E b E	N E b E	—	2·39	0·050
30	·655	·592	·498	·574	53·8	62·5	59·1	58·62	+17·67	·363	·388	·426	·401	89	70	87	84	Calm	E b S	E b N	3·58	0·035
31	·374	·278	·278	·311	57·8	58 5	46·4	53·42	+12·67	·442	·398	·282	·371	95	83	90	92	Calm	S S W	W	9·86	0·035
M	29·699	29.677	29·703	29 6955	44 33	57 38	46 89	49 52	+ 4·48	0·256	0·323	0·277	0·287	87	68	85	80	3·13	7·14	3·76	4·60	1·495

Highest Barometer...... 30·121, at 8 a.m. on 26th } Monthly range:
Lowest Barometer....... 28·731, at 3 p.m. on 3rd } 1·390 inches.
Highest registered temperature 75°·4, at p.m. on 7th } Monthly range:
Lowest registered temperature 26°·4, at a.m. on 19th } 49°·0.
Mean Maximum Thermometer.............. 58° 97 } Mean daily range:
Mean Minimum Thermometer............... 41°·32 } 17°·65.
Greatest daily range.........27°·4, from p.m. of 4th to a.m. of 5th.
Warmest day....... 7th. Mean temperature...... 61°·48 } Difference,
Coldest day......... 19th. Mean temperature...... 35°·78 } 25°·70.
Greatest intensity of Solar Radiation, 84° 6 on 9th, p.m. } Range,
Lowest point of Terrestrial Radiation, 22°·4 on 19th, a.m. } 62°·2.
Aurora observed on 5 nights: viz. 2nd, 12th, 17th, 18th and 23rd.
Possible to see Aurora on 20 nights.
Impossible to see Aurora on 11 nights.
Raining on 15 days. Raining 45·3 hours; depth, 1·495 inches.
Particles of Snow fell on 16th, 17th and 18th—quantity inappreciable.
First Snow of the Season observed on the 16th.
No Thunder Storms recorded this month.
Sheet Lightning occurred on the 10th, 17th and 24th.

The weather during the week ending 28th was mild and pleasant, and partook in some measure of the character of Indian Summer.

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

North.	West.	South.	East.
1446·18	1409·73	636·20	1781·99

Mean direction of the Wind, N 25° E.
Mean velocity of the Wind, 4·60 miles per hour.
Maximum velocity, 26·1 miles per hour, from 9 to 10 a. m. on 4th.
Most windy day, the 14th; mean velocity, 13 41 miles per hour.
Least windy day, the 27th; mean velocity, 0·43 " "

During the gale on Saturday the 14th, the velocity of the wind from 3 to 4 p.m. was 25·5 miles, and the mean velocity from noon to 6 p.m. equalled 22·17 miles per hour.

2nd, 10·17 p.m. A large Meteor appeared about 25° S. of zenith, and passing due W. burst in its flight, throwing out a great number of sparks, and left a train of light behind it.

24th, 8·26 p.m. Very large mass of nebulous light (undefined meteor,) appeared near γ Draconis, and, passing between γ & β Urs. Maj., emitted a very strong light and disappeared behind a mass of clouds on N. horizon.

October, 1854, was the warmest on the records of the Observatory; and has been remarkable for sudden changes of temperature; the mean temperature of the 19th was 8° colder than the mean normal temperature of that day, and that of the 30th was 17° 7 warmer than its mean normal temperature. The amount of Rain was small, being the least but two (October, 1841, and 1853) on the list for the last 15 years; it was, in short, a warm, dry month.

Comparative Table for October.

YEAR.	Temperature.					Rain.		Snow.		Wind. Mean Velocity.	
	Mean.	Dif. from Av'ge.	Max. obs'vd	Min. obs'vd	Range	D's.	Inch.	D's.	Inch.		
	°	°	°	°	°						
1840	44·4	—0·8	68·5	23·9	44·6	13	1·860	3	...	...	
1841	41·6	—3·6	58·3	20·3	38·0	6	1·360	2	...	0·41	lb.
1842	45·1	—0·1	68·5	30·0	38·5	8	5·175	0	...	0·35	lb.
1843	41·8	—3·4	65·7	24·5	41·2	12	3·790	4	2·5	0·54	lb.
1844	43·3	—1 9	69·6	17·8	51·8	7	Impf	4	12·0	0·43	lb.
1845	46·4	+1·2	62·7	20·0	42·7	11	1·760	1	Inap.	0·26	lb.
1846	44·6	—0·6	69·7	20·7	49·0	14	4·180	2	Inap.	0·44	lb.
1847	44·0	—1·2	65·0	20·3	44·7	13	4 390	2	Inap.	0·19	lb.
1848	46·3	+1·1	62·2	26·4	35·8	11	1·550	0	None	4·60	Miles.
1849	45·3	+0·1	59·2	25·5	33·7	13	5·965	1	Inap.	4·76	Miles.
1850	45·4	+0·2	66·6	24·8	41·8	10	2·085	0	None	5·30	Miles.
1851	47·4	+2·2	66·1	25·0	41·1	10	1·680	2	0·3	4·39	Miles.
1852	48·0	+2·8	70·7	29·8	40·9	12	5·280	0	None	4·47	Miles.
1853	44·4	—0·8	64·7	25·5	39·2	10	0·875	2	Inap.	4·72	Miles.
1854	49·5	+4·3	74·2	29·8	44·4	15	1.495	3	Inap.	4·60	Miles.
										0·37	lbs.
M'n.	45·17		66·11	24·29	41·83	11·0	2·960	1·7	1·2	4·69	Miles.

Monthly Meteorological Register, St. Martin, Isle Jesus, Canada East.—October, 1854.

NINE MILES WEST OF MONTREAL.

BY CHARLES SMALLWOOD, M.D.

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

Day.	Barom. corrected and reduced to 32° Fahr.			Temp. of the Air.			Tension of Vapor.			Humidity of Air.			Direction of Wind.			Velocity in Miles per Hour.			Rain in 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	29·803	9·346	29·417	46·5	53·0	50·2	·262	·361	·379	·80	·87	·99	S S W	S W	S W b S	0·02	2·50	1·50	0.116	Cum. Str. 10.	Slight Rain.	Rain.
2	·603	·679	·705	44·6	60·6	49·4	261	330	290	85	63	80	W b N	W b N	W b S	18·30	16·28	0·95	0. 0	Clear.	Cum. Str. 4.	Clear.
3	·620	·246	·209	45·0	59·0	54·2	292	478	373	93	94	87	W b S	S W b S	S E b S	6·75	6·62	14·51	0.433	Do.	Rain.	Cir. Str. 9.
4	·300	·390	·678	51·6	58·0	45·1	337	437	253	87	89	80	S S W	N W	N N W	12·50	17·48	12·51	0·400	Cir. C. Str. 8.	Cum. Str. 8.	Do. do. 8.
5	·989	30·123	30·165	40·6	47·6	36·7	210	252	192	83	74	83	N b W	N b W	N b W	11·43	1·57	3·65	...	Clear.	Do. 4.	Clear.
6	30·122	30·114	30·130	40·7	64·8	54·1	245	425	326	92	71	76	S W	S S W	S S W	0·27	1·04	1·51	...	Do.	Do. 4.	Do.
7	30·074	29·916	30·106	49·0	75·0	65·0	336	428	499	93	50	80	S S W	W b S	W b S	17·62	7·70	1·75	...	Do.	Do. 2.	Cum. Str. 4.
8	30·196	30·146	30·118	48·8	53·1	48·7	242	293	242	71	70	72	N E	E N E	N E b E	5·55	4·38	1·17	...	Str. 10.	Do. 8.	Do. 7.
9	29·979	29·816	29·896	41·8	47·6	44·0	253	291	282	92	86	92	N N E	W N W	W b N	3·55	0·62	2·28	0.874	Rain.	Do. 9.	Do. 6.
10	30·104	30·106	30·117	35·6	67·2	39·7	203	506	214	91	76	84	N W	W S W	W S W	0·95	0·37	0·17	...	Clear.	Clear.	Clear.
11	29·930	29·729	29·842	34·8	68·9	63·3	208	541	461	93	73	79	W S W	W S W	W S W	0·05	4·81	3·73	...	Do.	C. Cum. Str. 4.	Str. 4.
12	·788	·724	·742	60·1	66·4	60·1	494	516	494	94	80	94	W S W	W S W	W S W	3·43	8·88	0·70	0·116	Cir. Str.	Showers.	Cum. Str. 8.
13	·870	30·017	30·084	38·6	49·6	37·4	189	233	218	76	64	91	N N E	E b N	E b N	12.49	2·20	0·42	...	Clear.	Cum. 4.	Clear.
14	·862	29·435	29·476	33·0	42·8	43·9	207	284	300	1·00	99	98	E N E	E b N	W	0·11	4·66	5·02	1.073	Fog.	Rain.	Rain.
15	·498	·446	·496	38·0	45·0	40·9	209	241	210	85	76	79	W b N	N W b N	W N W	15·52	9·14	10·66	0·100	Cum. Str. 10.	Rain.	Cir. Str. 10.
16	·379	·480	·600	33·1	42·0	37·7	187	189	199	90	66	83	W	W N W	W b S	20·00	17·98	6·80	...	Do. do. 2.	Clear.	Do. 9.
17	·795	·869	·898	34·0	42·1	36·0	195	179	199	92	65	85	N W	W b N	N	2·77	0·88	Inap.	...	Do. do. 4.	Cir. Cum. Str. 8.	Do. 4.
18	·901	·703	·966	29·5	46·9	36·1	166	194	199	90	89	85	W S W	N E	N E b E	Inap.	0·83	0·81	...	Clear.	Do. 8.	Do. 2. Aur. Bor.
19	30·200	30·242	30·280	31·0	42·0	32·0	178	198	191	92	70	95	W b S	W b S	W b S	0·03	5·88	8·43	...	Do.	Clear.	Clear.
20	30·371	30·351	30·346	25·0	44·2	41·3	148	241	235	96	80	85	W b S	S S E	S W b S	0·44	0·22	0·39	...	Do.	Cum. Str. 8.	Slight Rain.
21	30·359	30·330	30·332	39·1	54·0	38·0	242	285	207	94	69	84	S b W	S S W	S S W	1·23	0·10	0·62	0.233	Cum. Str. 4.	Clear.	Clear.
22	30·296	30·265	30·299	27·8	60·6	40·0	167	467	227	1·00	89	85	S b W	S W b W	W S W	Calm	Calm	Calm	...	Clear.	Do.	Do.
23	30·381	30·316	30·313	37·0	52·2	43·7	199	283	233	83	70	79	N E b E	N E b E	N E b N	4·68	7·93	4·47	...	Cum. Str. 4.	Do.	Str. 10.
24	30·289	30·219	30·252	36·3	60.3	52·0	210	330	315	91	63	81	N E b N	S W b W	W	3·39	0·22	Inap.	...	Str. 2.	Cir. Cum. Str. 4	Do. 9.
25	30·340	30·220	30·310	49·7	66·1	46 6	312	384	282	86	60	86	N W	W b N	E b N	0·27	1·50	1·12	...	Do. 8.	Clear.	Clear, Aur. Bor.
26	30·321	30·271	30·277	46·2	57·8	49·0	303	376	320	93	79	87	W S W	W S W	W S W	1·33	1·11	2·33	...	Clear.	Cum. Str. 10.	Do.
27	30·268	30·241	30·230	44·0	60·6	51·0	282	393	351	92	75	89	S W	S W	S W b S	1·00	Calm	1·51	...	Do.	Clear.	Do.
28	30·244	30·178	30·140	41·1	71·0	54·1	273	542	373	99	71	87	W b N	W S W	N E b E	Inap.	Calm	0·20	...	Fog.	Cum. Str. 9.	Str. 10.
29	30·118	30·031	30·005	40·0	60·5	54·7	260	441	440	98	84	99	N E b E	N E b N	N E	0·23	0·60	1·50	0.306	Str. 8.	Str. 6.	Do. 5.
30	29·982	29·952	29·944	54·0	73·6	61·9	416	515	528	96	64	94	E N E	E N E	N E b E	0·22	0·70	1·16	...	Do. 6.	Do. 8.	Do. 3.
31	·937	·561	·468	58·0	67·3	57·6	498	626	422	1·00	94	89	E N E	S S E	S W b W	5·00	2·81	7·50	1.14	Rain.	Cir. Cum. Str. 5	Do. 2.

Barometer	Highest, the 20th day	30·371
	Lowest, the 3rd day	29·209
	Monthly Mean	29·919
	" Range	1·162
Thermometer.	Highest, the 30th day	79°·7
	Lowest, the 20th day	24°·2
	Monthly Mean	48°·40
	" Range	55°·5
	Mean Humidity	·874
Greatest Intensity of the Sun's Rays		118°·4

Amount of Evaporation, 1·49 inches.
Rain fell on 11 days, amounting to 4·844 inches. Raining 32 hours, 55 minutes.
First Snow fell on 15th day, 3·10 inches.
Most prevalent Wind, W.S W. Least prevalent Wind, N.
Most Windy Day, the 16th day; mean miles per hour, 14·92.
Least Windy Day, the 22nd day; mean miles per hour, 0.
Aurora Borealis visible on 2 nights. Might have been seen on 12 nights.
Electrical Apparatus put in order on the 7th day; since which time the Electrical State of the Atmosphere has been marked by moderate intensity.

Monthly Meteorological Register, Quebec, Canada East, October, 1854.

BY LIEUT. A. NOBLE, R.A., AND MR. W. CAMPBELL.

Latitude. 46 deg. 40·2 min. North; Longitude, 71 deg. 16 min. West. Elevation above the level of the Sea,—Feet.

Date.	Barometer corrected and reduced to 32 degrees, Fahr.				Temperature of Air.				Elasticity of Air.				Humidity of Air.				Direction of Wind.			Velocity of Miles.			Rain in Inch.	Snow in Inch.	REMARKS.
	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M.	2 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.			
					°	°	°	°																	
1	29·821	29·542	29·264	29·542	40·9	48.1	47·9	45·6	0·184	0·268	0·326	0·259	73	80	99	81	S W	S W	Calm.	3·8	3·8	0·0	1.00	...	
2	·262	·430	·470	·387	45·4	55·8	47·8	49·7	·230	·147	·210	·196	77	30	61	57	W	W	W	6·2	10·1	8·0	...	...	2nd. Faint Auroral Light, visible at 11, p.m.
3	·489	·426	·217	·377	41·0	60·3	50·1	50·5	·204	·245	·334	·261	80	48	94	74	Calm.	S W	S W	0·0	11·3	12·4	1·12	...	
4	·113	·200	·320	·211	52·0	57·4	47·0	52·2	·359	·380	·271	·337	94	83	85	87	S	S b W	S b W	7·2	11·3	12·4	·11	...	
5	·587	·760	·921	·756	39·3	45·2	36·5	40·3	·178	·151	·151	·160	75	51	71	66	W	W N W	N W	7·2	15·2	8·0	...	...	
6	·921	·846	·848	·371	35·8	59·0	51·5	48·8	·188	·266	·281	·245	90	54	[illegible]	73	Calm.	W	W	0·0	6·2	3·8	...	...	6th. Lunar Halo, 30°. in diameter, visible at 10, p.m.
7	·833	·730	·834	·799	47·8	63·5	58·4	56·7	·278	·337	·332	·316	85	59	69	71	Calm.	W	Calm.	0·0	7·2	0·0	...	...	
8	·967	·924	·890	·927	44·5	54·3	48·0	48·9	·175	·172	·225	·191	60	41	68	56	N W	E b N	E b N	2·0	3·8	2·0	·01	...	
9	·797	·609	·577	·661	42·4	46·1	44·0	43·8	·198	·228	·236	·221	74	76	83	78	N E	N E	N E	13·4	10·1	10·1	...	...	
10	·784	·812	·895	·830	43·5	52·5	42·0	46·0	·138	·160	·173	·157	49	42	66	52	N E	S	S	12·4	10·1	2·0	...	...	
11	·785	·566	·541	·631	35·6	53·0	52·4	47·0	·159	·308	·360	·276	76	79	94	80	Calm.	W	Calm.	0·0	8·0	0·0	·50	...	11th. Hoar Frost, 6, a.m.
12	·549	·487	·513	·516	52·1	45·6	41·4	46·4	·383	·284	·239	·302	100	94	93	96	S E	N E	N E	3·8	20·2	16·0	1·10	...	12th. Higher stratum of cl'ds moving from West. Lower stratum moving with the wind.
13	·783	·889	·850	·841	40·4	42·5	38·6	40·5	·256	·162	·204	·207	91	60	87	79	S W	N E	S W	3·8	11·3	13·4	·01	...	
14	·714	·528	·309	·517	39·3	44·5	43·6	42·5	·223	·250	·260	·244	94	86	93	91	E N E	E N E	E N E	10·1	11·3	12·4	·64	...	
15	·248	·205	·118	·190	41·0	41·8	41·5	41·4	·231	·236	·228	·232	91	90	88	90	E N E	E N E	E N E	13·9	16·9	3·8	·37	...	
16	28·982	28·072	·305	·086	40·7	38·5	36·5	38·5	·246	·205	·192	·214	98	88	89	92	W S W	W S W	W	8·0	10·1	10·1	·09	Inap	16th. Snowed during 2 hours.
17	29·462	29·522	·635	·540	35·2	41·0	38·0	38·1	·160	·181	·206	·182	79	71	91	80	W	Calm.	W	6·2	0·0	7·2	...	...	
18	·742	·634	·725	·700	38·5	42·6	35·9	39·0	·178	·177	·135	·163	77	66	65	79	Calm.	S W	W N W	0·0	2·0	2·0	...	...	18th. A fine display of Aur.
19	·832	·912	30·008	·917	32·5	43·5	35·8	37·3	·128	·160	·193	·160	70	57	92	73	N W	W	W	10·1	10·1	10·2	...	Inap	19th. Snowing 2.5 hours.
20	30·066	30·107	30·096	30·090	32·4	40·8	39·3	37·5	·164	·181	·179	·175	90	72	74	79	W	W	Calm.	6·2	8·0	0·0	·04	...	
21	30·092	30·116	30·100	30·102	39·2	44·3	42·7	42·1	·226	·234	·232	·231	95	81	86	87	Calm.	Calm.	Calm.	0·0	0·0	0·0	...	...	
22	30·072	30·012	30·101	30·062	39·9	52·4	42·3	45·0	·218	·238	·196	·217	89	62	74	75	S W	S S W	W	2·0	3·8	3.8	...	...	
23	30·195	30·183	30·169	30·182	36·2	41·4	40·0	39·2	·169	·145	·168	·161	94	56	69	73	N E	E	E	12·4	10·0	10·0	...	...	
24	30·109	30·030	30·020	30·053	40·3	50·4	48·6	46·4	·199	·189	·212	·200	81	52	63	65	Calm.	Calm.	Calm.	0·0	0·0	0·0	...	...	
25	30·073	30·110	30·107	30·097	46·6	55·1	47·1	49·6	·252	·270	·243	·255	80	64	76	73	Calm.	S W	Calm.	0·0	2·0	0·0	...	...	25th. A well defined Auroral arch visible at 8, p.m.
26	30·143	30·049	29·994	30·062	42·4	49·1	50·2	47·2	·218	·278	·293	·263	82	81	81	81	N E	S S E	S S E	3·8	3·8	5·2	...	...	
27	30·050	30·012	30·000	30.021	45·6	53·6	51·3	50·2	·288	·233	·340	·287	95	33	91	76	N W	S	Calm.	6·2	3·8	0·0	...	...	
28	30·033	30·003	29·974	30·003	45·8	62·3	52·6	53·6	·304	·414	·303	·340	100	76	78	85	W S W	W S W	W	8·0	6·2	2·0	...	...	
29	29·931	29·876	·805	29·872	47·0	64·2	55·6	55·6	·264	·391	·398	·351	83	67	92	81	Calm.	W S W	Calm.	0·0	2·0	0·0	·75	...	
30	·805	818	·813	·812	56·1	55·6	54·3	55·3	·428	·427	·393	·416	97	99	95	97	Calm.	N E	N E	0·0	3·8	11·5	·44	...	
31	·687	·482	·253	·474	47·9	51·7	58·6	52·7	·329	·352	·470	·384	100	94	97	97	N E	Calm.	S W	11·6	0·0	12·4	·80	...	
	29·772	29·735	29·731	29·746	42·17	50·16	45·79	46·05	0·231	0·247	0·258	0·245	84	68	82	78				5·10	7·21	5·76	6·98	Inap.	

Maximum Barometer, 6 a.m. of 23rd	30·195
Minimum Barometer, 2 p.m. of 16th	28·972
Monthly Range	1·223
Monthly Mean	29·746
Maximum Thermometer on the 7th	64°.7
Minimum Thermometer on the 18th	31°·6
Monthly Range	33·1
Mean Maximum Thermometer	51·6
Mean Minimum Thermometer	39·1
Mean Daily Range	12·5
Mean Monthly Temperature	46·05

Greatest Daily Range of Thermometer on 6th	23°·1
Least Daily Range of Thermomter on 15th	2°·0
Warmest Day, 7th. Mean Temperature	56·7
Coldest Day, 19th. Mean Temperature	37·3
Climatic Difference	19·4

Possible to see Aurora on 9 Nights.
Aurora visible on 8 Nights.
Total quantity of Rain, 6·98 inches.
Total quantity of Snow, inap.
Rain fell on 14 days.
Snow fell on 2 days.