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Vol. VIII.—Page	225,	line 19,	(from top,)	for *secondary* read *transition.*	
"	228,	" 28 & 29,	"	after *Porcelain Clay* and *rose-red Quartz*, for *at do.* read *at Bristol.*	
"	230,	The *Carbonate of Iron*, *Amethyst*, *Quartz*, and *Idocrase.* should be credited to Messrs. S. Taylor and T. H. Webb.			
"	396,	line 9,	(from top,)	for *truncations* read *terminations.*	
Vol. IX.— "	2,	" 2,	(from bottom,)	for *by-valves* read *bivalves.*	
"	6,	" 5,	"	for *emerge* read *converge.*	
"	8,	" 16,	(from top,)	for *there* read *then.*	
"	10,	" 2,	"	after *metal* dele ,	
"	15,	" 5,	"	for *flattened* read *scattered.*	
"	15,	" 6,	(from bottom,)	for *Disdown* read *Diodorus.*	
"	25,	" 10,	(from top,)	for *arte he* read *are the*	
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"	97,	" 7,	(from bottom,)	dele *in a great measure.*	
"	101,	" 2,	"	for *généraîlces* read *génératrices.*	
"	329,	" 12,	(from top,)	for S. F. DANA read J. F. Dana.	

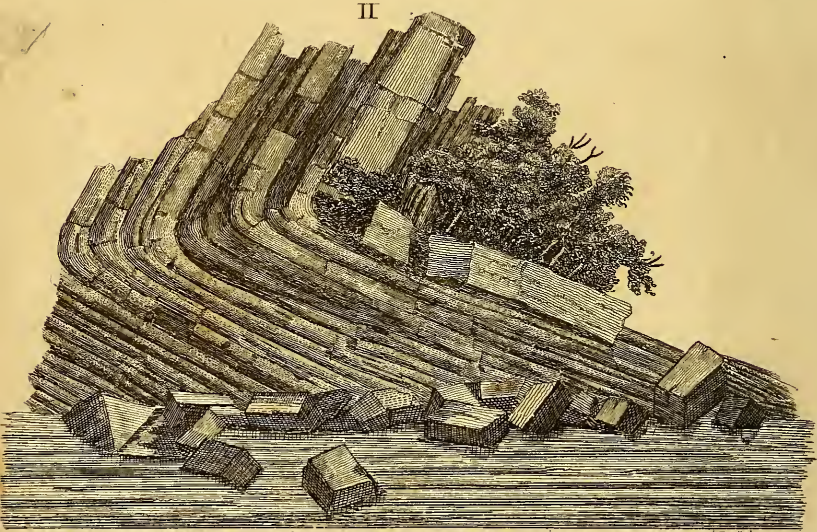
In No. II. of this Vol. Articles X and XI, and also those succeeding XIV, are incorrectly numbered; they may be corrected by referring to the cover.

In No. I. Plate IV, Fig. 6.—In the delineation of the balance beam, the weight D is entirely left out; it should have been suspended at the bottom of the slide E, or what is preferable, a small scale-pan should be suspended there, in which the counterbalancing weights may be placed, without disturbing the adjustment.

I

Snake Hill in Saratoga Lake.

II



A. Doolittle sc.

Section of Snake Hill.

H. Hutchinson

THE

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GEOLOGY, MINERALOGY, TOPOGRAPHY, &c.

Art. I.—*Notice of Snake Hill and Saratoga Lake and its Environs;* by Dr. J. H. Steele of Saratoga Springs.

TO PROFESSOR SILLIMAN.

Sir—

I SEND you, enclosed, a couple of drawings, taken with a view to illustrate the very singular arrangement of the rock formation which composes the strata of Snake Hill, in this vicinity; it is possible you may think them entitled to a place in your Journal of Science. If so, you may accompany them with the following description of the place which they are intended to represent.

Saratoga lake is situated between the towns of Saratoga, Saratoga Springs, Stillwater and Malta, in the county of Saratoga and state of New-York; its length is computed at about nine miles and its breadth at from one to three, it is from six to eight miles west from the Hudson river with which it communicates by the Fish Creek, and it is about four miles distant from the celebrated watering place at Saratoga.

The country, around the lake, rises gradually into elevated ridges, which overlook it in all directions, producing the appearance of a vast amphitheatre and presenting a picturesque and romantic landscape, highly embellished by the efforts of cultivation and the abodes of rural life.

It was on the elevated land, which separates the valley of the Hudson from that of the lake, at a place called Bemus' heights about three miles distant, in a south-east direction, where the ever memorable battles of the 19th of September, and the 7th of October, 1777, which terminated so gloriously for the cause of freedom, were fought, and it is the continuation of this ridge, twelve miles southerly, which forms the falls of the Mohawk commonly called the Cahoos falls.

The country around the lake is transition and is included in the extensive tract of transition formation which extends along the course of the Hudson, from Baker's falls on the north, to the highlands, below Newburgh, on the south. The borders of the lake are composed principally of argillaceous slate, which extends back to the more elevated ridges, where, in many places, it is overlaid by gray-wacke or gray-wacke slate, and in some places evidently alternates with them.

On the eastern shore of the Lake, three miles from its southern termination, there is a singular and interesting stratification of these rocks, at a place called Snake Hill. This hill projects into the lake for some distance, and rises abruptly more than two hundred feet above the level of the water, presenting a naked and almost perpendicular front, which looks to the west and south-west, where the different strata are as regular and well defined as though they were painted on a wall. They rise from the water in regular succession along the southern part of this front and pursue an elevation of from 13 to 15° to the north-west, in straight and parallel lines, until they arrive towards the northern termination of this promontory; here they make an abrupt curve and pass up the mountain in an oblique direction, to its summit, producing a declination exactly in an opposite direction. The curve made by the strata, taking an opposite course, is the segment of a circle, the diameter of which would not exceed 20 or 30 inches. The strata are of different dimensions, varying from half an inch to two feet in thickness and consist of alternate layers of argillaceous slate and gray-wacke or gray-wacke slate. The gray-wacke contains impressions of shells in great abundance, they consist principally of byvalves, and both the formations effervesce with acids.

The plate, marked I. is a full view of the hill with its curved strata as they appear from the water; the back ground is the elevated ridge which separates the lake from the Hudson on the east.

That marked II. is a section of the hill, shewing more distinctly the arrangement, elevation and curve of the different strata. The dark lines may be supposed to represent the argillite, and those of a lighter shade, the gray-wacke.

It is impossible to examine this locality without being strongly impressed with the belief that the position which the strata here assume could not have been effected in any other way than by a power operating from beneath upwards and at the same time possessing a progressive force; something analogous to what takes place in the breaking up of the ice of large rivers. The continued swelling of the stream first overcomes the resistance of its frozen surface and having elevated it to a certain extent, it is forced into a vertical position, or thrown over upon the unbroken stratum behind, by the progressive power of the current.

If it can be admitted that the operation of such a power did produce the effect here represented, it must have taken place before the materials, of which the formation is composed, had passed into an indurated state, as most of the strata remain unbroken, and, where the argillite has crumbled away, the curved part of the gray-wacke may be taken out entire, and some of them, which I now have in my possession, exhibit indentations and protuberances, particularly on their curved surfaces, evidently the result of friction while in a plastic state.

It is likewise pretty evident that the operation was limited in its extent and that its effects ceased at the very spot where this curvature occurs, as the stratified rocks on the east and west, and likewise to the south, do not appear to have suffered any derangement in their general declination. On the north and north-west, the direction from which the operation of the power, whatever it might have been, must have commenced, there are no intervening rocks discoverable until we arrive at the Palmertown mountains, which are entirely primitive, the space between these mountains and the hill being occupied by five or six miles of the lake, and then a sandy alluvium which extends quite to the base of the mountain, the distance of six or seven miles further; but, on the elevated ridge, to the north-east, which extends as far north as the Fish-creek, a distance of five or six miles, the stratification seems to correspond with that of Snake Hill, consisting of alternating strata of graywacke and argillaceous slate, the direction of which is either vertical, or inclining to the south-east, evincing a derangement, the effect of a process similar to that which elevated those I have already described.

The utmost extent, then, of the operation of the power could not have exceeded the distance of three or four miles from east to west, and, in the direction from north-west to south-east, it might have been thirteen miles, admitting that it commenced at the termination of the primitive mountains; but why may not the effects, above described, be imputed to the continuation of the power which elevated the primitive rocks themselves? I have no inclination to discuss this question; I have merely stated the facts, together with such reflections as must, unavoidably, follow from a careful examination of the spot.

Yours very sincerely,

JOHN H. STEEL.

Saratoga Springs, State of N. Y., Oct. 28, 1824.

P. S. I take the liberty to forward you a specimen of *oolite*, an extensive formation of which has lately been discovered in this vicinity, presuming it would be peculiarly interesting to you, as hitherto, it has been supposed not to occur in situ in North America, unless perhaps at the locality on the Ohio, mentioned by Mr. Jessup. I shall endeavour to furnish you with a particular account* of it for your next No. of the Journal of Science. J. H. S.

REMARK BY THE EDITOR.

This Oolite is composed of black grains included in a grayish basis—is is very distinctly characterised.

* The account here promised, came to hand just as this form was going to the press.—It will appear in this No.

Art. II.—*On the Gold Mines of North Carolina ;* By Denison Olmsted, *Professor of Chemistry and Mineralogy in the University of North Carolina.*

The gold mines of North Carolina, which have recently become an object of much inquiry both at home and abroad, are situated between the 35th and 36th degrees of N. latitude, and between the 80th and 81st degrees of W. longitude from London. They are on the southern side of the State, not far from the borders of South Carolina, and somewhat westward of the centre. Through the gold country flows the river Pedee, receiving, within the same district, the Uwharre from the north, and Rocky River from the south, both considerable streams. Above the junction with the Uwharre, the Pedee bears the name of Yadkin.

The gold country is spread over a space of not less than 1000 square miles With a map of N. Carolina one may easily trace its boundaries, so far as they have been hitherto observed. From a point taken eight miles west by south of the mouth of the Uwharre, with a radius of eighteen miles, describe a circle,—it will include the greatest part of the county of Montgomery, the northern part of Anson, the north-eastern corner of Mulenberg, Cabarrus, a little beyond Concord on the west, and a corner of Rowan and of Randolph. In almost any part of this region, gold may be found, in greater or less abundance, at or near the surface of the ground. Its true bed, however, is a thin stratum of gravel enclosed in a dense mud, usually of a pale blue, but sometimes of a yellow colour. On ground that is elevated and exposed to be washed by rains, this stratum frequently appears at the surface ; and in low grounds, where the alluvial earth has been accumulated by the same agent, it is found to the depth of eight feet : where no cause operates to alter its original depth, it lies about three feet below the surface. Rocky river and its small tributaries which cut through this stratum, have hitherto proved the most fruitful localities of the precious metal.

The prevailing rock in the gold country is Argillite. This belongs to an extensive formation of the same, which crosses the State in numerous beds, forming a zone more than twenty miles in width, and embracing, among many less important varieties of slate, several extensive beds of novaculite, or whetstone slate, and also beds of petrosiliceous porphyry and of greenstone. These last lie over the argillite, either in detached blocks, or in strata that are inclined at a lower angle than that. This ample field of slate, I had supposed to be the peculiar repository of the gold ; but a personal examination discovered that the precious metal, embosomed in the same peculiar stratum of mud and gravel, extends beyond the slate on the west, spreading, in the vicinity of Concord, over a region of granite and gneiss.

A geographical description of the gold country, would present little that is interesting. The soil is generally barren, and the inhabitants are mostly poor and ignorant. The traveller passes the day without meeting with a single striking or beautiful object, either of nature or of art, to vary the tiresome monotony of forests and sandhills, and ridges of gravelly quartz. Here and there a log hut or cabin, surrounded by a few acres of corn and cotton, marks the little improvement which has been made by man, in a region singularly endowed by nature. The road is generally conducted along the ridges, which slope on either hand into vallies of moderate depth, consisting chiefly of fragments of quartz, either strewed coarsely over the ground, or so comminuted as to form gravel ; these ridges have an appearance of great natural sterility, which, moreover, is greatly aggravated by the ruinous practice of frequently burning over the forests, so as to consume all the leaves and under-growth, giving to the forest the aspect of an artificial grove.

The principal mines are three—the Anson mine, Reed's mine, and Parker's mine.

The Anson Mine is situated in the county of the same name, on the waters of Richardson's creek, a branch of Rocky river. This locality was discovered only two years since by a "gold hunter,"—one of an order of people, that begin already to be accounted a distinct race. A rivulet winds from north to south between two gently sloping hills that emerge towards the south. The bed of the stream, entirely covered with gravel, is left almost naked during the dry season, which period is usually selected by the miners for their operations. On digging from three to six feet into this bed, the workman comes to that peculiar stratum of gravel and tenacious blue clay, which is at once recognized as the repository of the gold. The stream itself usually gives the first indication of the richness of the bed through which it passes. by disclosing large pieces of the precious metal shining among its pebbles and sands—such was the first hint afforded to the discoverer of the Anson mine. Unusually large pieces were found by those who first examined the place, and the highest hopes were inspired. On inquiry it was ascertained that part of the land was not held by a good title, and parcels of it were immediately *entered*,* but it has since been a subject of constant litigation, which has retarded the working of the mine.

Reed's Mine in Cabarrus is the one which was first wrought; and at this place, indeed, were obtained the first specimens of gold that were found in the formation. A large piece was found in the bed ef a small creek, which attracted attention by its lustre and specific gravity, but it was retained, for a long time after its discovery, in the hands of the proprietor, through ignorance whether it were gold or not. This mine occupies the bed of Meadow creek, (a branch of Rocky River,) and exhibits a level between two hillocks, which rise on either side of the creek, affording a space between from fifty to one hundred yards in breadth. This space has been nearly all dug over, and exhibits at present numerous small pits for the distance of one fourth of a mile on both sides of the stream. The surface of the ground and the bed of the creek are occupied by quartz and by sharp angular rocks of the greenstone family. The first glance is sufficient to convince the spectator that the business of searching for gold is conducted under numerous disadvantages, without the least regard to system, and with very little aid from mechanical contrivances. The process is as follows. During the dry season, when the greatest part of the level above described is left bare, and the creek shrinks to a small rivulet, the workman selects a spot at random and commences digging a pit with a spade and mattock. At first he penetrates through three

* A piece of land is said not to be *entered* when it remains the property of the public, without taxation. Any one is at liberty to enter on the state books whatever land he can find in this situation, the land being secured to him on his becoming responsible for the taxes.

or four feet of dark coloured mud, full of stones in angular fragments. At this depth he meets with that peculiar stratum of gravel and clay, which he recognizes as the matrix of the gold. If the mud be very dense and tenacious he accounts it a good sign ; and if stains or streaks of yellow occasionally appear on the blue mud, it is a fortunate symptom. Sometimes he penetrates through a stratum of the ferruginous oxide of manganese, in a rotten friable state. This he denominates "cinders," and regards it also as a favorable omen. Having arrived at the proper stratum, which is only a few inches thick, he removes it with a spade into the "cradle." This is a semi-cylinder laid on its side, (like a barrel bisected longitudinally and laid flat-wise,) and made to rock like a cradle on two parallel poles of wood. The cradle being half filled with the rubbish, water is there laded in, so as nearly to fill the vessel. The cradle is now set to rocking, the gravel being occasionally stirred with an iron rake, until the coarse stones are entirely freed from the blue mud,—a part of the process which is the more difficult, on account of the dense adhesive quality of the mud. By rocking the cradle rapidly, the water is thrown overboard, loaded with as much mud as it is capable of suspending. The coarser stones are then picked out by hand, more water is added, and the same process is repeated. On pouring out the water a second time, (which is done by inclining the cradle on one side,) a layer of coarse gravel appears on the top, which is scraped off by hand. At the close of each washing, a similar layer of gravel appears on the top, which appears more and more comminuted until it graduates into fine sand, covering the bottom of the cradle. At length this residuum is transferred to an iron dish, which is dipped horizontally into a pool of water, and subjected to a rotary motion. All the remaining earthy matter goes overboard, and nothing remains but a fine sand, chiefly ferruginous, and the particles of gold for which the whole labour has been performed. These are frequently no larger than a pin's head, but vary in size from mere dust to pieces weighing one or two pennyweights. Large pieces, when they occur, are usually picked out at a previous stage of the process.

Large pieces of gold are found in this region, although their occurrence is somewhat rare. Masses weighing four five, and six hundred penny-weights, are occasionally met with, and one mass was found that weighed, *in its crude state*, 28 lbs. avoirdupoise. This was dug up by a negro at Reed's mine, within a few inches of the surface of the ground. Marvellous stories are told respecting this rich mass; as that it had been seen by gold hunters at night, reflecting so brilliant a light, when they drew near to it, with torches, as to make them believe it was some supernatural appearance, and to deter them from farther examination. But all stories of this kind, as I was assured by Mr. Reed the old proprietor, are mere fables. No unusual circumstances were connected with the discovery of this mass, except its being nearer the surface than common. It was melted down and cast into bars soon after its discovery. The spot where it was found has been since subjected to the severest scrutiny, but without any similar harvest. Another mass weighing 600 pwts. was found on the surface of a ploughed field in the vicinity of the Yadkin, twenty miles or more north of Reed's mine. Specimens of great elegance, as I should infer from the descriptions of the miners, are occasionally found, but for want of mineralogists to reserve them for cabinets, they have always been thrown into the common stock and melted into bars. Mr. Reed found a mass of quartz, having a projecting point of gold, of the size of a large pin's head. On breaking it open, a brilliant display of green and yellow colours was presented, which he described as exceedingly beautiful. The gold weighed 12 pwts. The mineralogist may perhaps recognize in this description, a congeries of fine crystals, but on that point the proprietor could not inform me. Although fragments of greenstone and of several argillaceous minerals, occur among the gravel of the gold-stratum, yet, in the opinion of the miners, the precious metal is never found attached to any other mineral than quartz. Indeed it is rarely attached to any substance, but is commonly scattered promiscuously among the gravel. Its colour is generally yellow with a reddish tinge, though the surface is not unfrequently obscured by a partial incrustation of iron or manganese, or by adhering particles of sand. The masses are flattened and vesicular having angles rounded with evident marks of attrition. The rounded angles and vesicular structure lead to the opinion, which is very general, that the metal, has undergone *fusion ;* but any one who inspects the specimens narrowly, will be convinced that their worn and rounded appearance is owing to attrition, and that the cavities are produced by the indentation of sand and gravel, the exact impress of which may be observed, and particles of them may still frequently be seen imbedded. The gravel, moreover, which is separated by washing, bears evident marks of attrition, of *a limited duration,* sufficient to round its edges and angles, but not sufficient to destroy them : the fragments are not ovoidal like the pebbles of rivers, but are still flat, retaining their original form, except that their edges are dull and their angles blunted. In short, the whole appearance is such, as would naturally result from so soft a substance as virgin gold, being knocked about among such stern associates as quartz and greenstone.

The appearance of fusion, supposed to be exhibited by the gold has inspired the idea among the miners that the small pieces which they obtain have been melted out from some *ore* that lies disguised somewhere in the vicinity. This idea has frequently made them the dupes of imposition. The Mineral Rod, charms, and other follies, have had their reign here, and the first is still held in some estimation. The common rocks and stones of the country, have been tortured by a new race of alchymists, who have imagined them to be the ore of gold, veiling, under some disguise, the characters of the precious metal. A great degree of eagerness also pervades the country on the subject of the metals in general. The minerals thrown out in excavating pits in search of gold, consist chiefly of quartz, greenstone, and hornblende mixed with chlorite, and afford little that is interesting to the collector of specimens. Almost the only substance which I met with, that was worth preserving merely as a specimen, was *Pyritous Copper.* Of this I saw some elegant fragments. It occurs in a gangue of quartz, and resembles that found at Lane's Mine at Huntington, Con. (Amer. Journal of Science, Vol. I. p. 316) A vein of it occurs in slaty clay, six miles east of Concord, in Cabarrus county. This ore had been subjected to numerous experiments, on account of the belief that it was the "ore of gold," above mentioned; and, although the experiments did not lead to the discovery of gold, yet a "German miner and mineralogist" had, it was said, detected PLATINA in it. On searching into the evidence of so unexpected a result, I was informed that a white metal was produced from this ore, which was not lead, nor tin, nor silver, but answered perfectly to the description of platina, although, as they acknowledged, it was easily fused, and burned with a blue flame. I suspected it to be *metallic antimony*, but still could perceive no signs of that metal in the ore. I requested a minute account of the process.—"The materials, namely, the ore, charcoal, borax, &c. were put into a crucible—Emetic tartar, in considerable quantity, was added to make the ore "spew out" the metal. Ipecacuanha was afterwards tried with the same view, but was not found to be strong enough "to make the ore vomit." After the account of the process, it was not difficult to account for the production of antimony, it being obviously derived from the Emetic Tartar.

At Concord near the western limit of the gold country, the metal is found in small grains in the streets and gullies, after every rain; and the gullies frequently disclose the stratum of gravel and mud, well known as the repository of the gold. Washings on a more limited scale are conducted here. The clay is not so dense at this place as at Reed's Mine, but more ferruginous and full of spangles of golden-coloured mica. This stratum rests on *gneiss*: those before described were over the Slate formation.

Parker's mine is situated on a small stream four miles south of the river Yadkin. As in the instances already mentioned, excavations were numerous in the low grounds adjacent to the stream; but, at the time of my visit, the earth for washing, (which was of a snuff colour,) was transported from a ploughed field in the neighbourhood, that was elevated about fifty or sixty feet above the stream. The earth at this place which contained the gold was of a deeper red than that at either of the other mines. The gold found here is chiefly in flakes and grains. Occasionally however pieces are met with which weigh 100 pwts. and upwards; and very recently a mass has been discovered that weighed four pounds and eleven ounces. This is said to have been found at the depth of ten feet, which is a lower level than any I had heard of before. The idea of an aqueous deposit, which is apt to be impressed upon us whenever we either inspect the formation or reflect upon its origin, would lead us to expect, on account of the great specific gravity of gold, that the largest masses would be found at the lowest depths. But I am not aware that any uniformity exists in this respect. The largest mass hitherto discovered was, as has been mentioned already, found within a few inches of the surface. It is evident that the thin stratum which contains the metal, will be buried at different depths, by variable quantities of alluvial earth, that are accumulated over it by causes still in operation; and consequently, that the depth at which the stratum happens to be met with in any given place, is no criterion of its richness. Nor does the fact that this fortunate discovery was made at a lower level than ordinary, afford any encouragement to work lower than the usual depth. It might interest geological curiosity, however, to learn the nature of the strata below the gold deposit, although I do not know that the existence of this furnishes any reasonable grounds for supposing that there are other similar deposits below it. I could not find that any search had been made with such an expectation except in a single instance. Near the spot where the largest mass was found, the earth was penetrated a few feet below the gold bed. Immediately beneath this was a thin layer of green sand, and next a similar layer of a bright yellow sand. These had a very handsome appearance, but neither of them seemed to contain any thing more precious than mica.

The *terms* on which the proprietors of the mines permit them to be worked, vary with the productiveness of the earth which is worked. Some of the miners rent for a *fourth* of the gold found; some for a third, and others claim half, which is the highest premium hitherto paid. The average product at Reed's mine was not more than sixty cents a day to each labourer; but the undertakers are buoyed up with the hope of some splendid discovery, like those which have occasionally been made.

The mines have given some peculiarities to the state of society in the neighbouring country. The precious metal is a most favourite acquisition, and constitutes the common currency. Almost every man carries about with him a goose quill or two of it, and a small pair of scales in a box like a spectacle case. The value as in patriarchal times, is ascertained by weight, which, from the dexterity acquired by practice, is a less troublesome mode of counting money than one would imagine. I saw a pint of whiskey paid for by weighing off three and a half grains of gold.

The greatest part of the gold collected at these mines is bought up by the country merchants at 90 or 91 cents a pennyweight. They carry it to the market towns, as Fayetteville, Cheraw, Charleston, and New-York. Much of this is bought up by jewellers; some remains in the banks; and a considerable quantity has been received at the mint of the United States. Hence it is not easy to ascertain the precise amount which the mines have afforded. The value of that portion received at the mint before the year 1820, was 43,689 dollars. It is alloyed with a small portion of silver and copper, but is still purer than standard gold, being 23 carats fine. (Bruce, Mineral. Jour. I—125.)

It will probably appear evident to geologists, from the foregoing statements, that the gold of N. Carolina occurs in a *diluvial* formation. Such indeed seems to be its usual bed; and, in this respect, it resembles the gold countries of South America, of England, of Scotland, of Ireland, and of Africa. (Buckland, Rel. Diluv. 218—20.)

I have already adverted to an impression entertained by the inhabitants of our gold country, that the precious metal exists somewhere in the vicinity in an ample bed or vein, from which the pieces found are derived. It may not be uninteresting to inquire, whether we can obtain any light respecting its origin.

1. *Is it brought down from the sources of the rivers?*

That this is not the case is evident, because it is not found merely in the beds of the rivers, but also in the neighbouring grounds, and that too whether the ground be plain or hilly. The formation in fact, crosses over hill and dale, and frequently the earth which is obtained on the hill side, or on the summits of an elevation of one or two hundred feet above the beds of the streams, is rich in metal. It is found on both sides of the Yadkin, and in the bed and throughout all the branches of Rocky River. It is evident, then, that the rivers do not bring down the gold from their sources, but that they cut through a stratum containing it, which covers like a mantle, an extensive tract of the country through which they flow, and that they bring the precious metal to view by separating it from its stony matrix.

2. *Did the present lumps and grains ever form parts of large masses in a continued bed or vein?*

It has been already remarked that the present aspect of these pieces is such as would naturally result from collision among the siliceous fragments that accompany them. Impressions of sand and gravel, or even imbedded sand, might, it is true, be the result of fusion in a bed of sand; but the appearance is not that which arises from fusion under such circumstances, the cavities being *superficial*, forming impressions or indentations, while there is no appearance in any specimen that I have seen of a grain of sand *enveloped* by the mass.* But if the present appearance of these lumps and grains be owing to attrition, and the formation be, as we have supposed, a deposit from water, then we must regard them as the remains of larger pieces, reduced in size by collision with the accompanying minerals, but not as parts of very large masses which have been torn up and broken into fragments. The same cause that would be sufficient to break up into fragments the accompanying gravel would not break up large masses of Gold into smaller pieces, since gold is soft and malleable, and not brittle and unyielding like quartz. The effect of running water and dashing rocks would be to *wear down* the pieces of gold and compress them, but not to *break them*. The fine flakes and dust of gold may be conceived to have been produced in this manner; and the relative quantity of dust may afford some means of judging of the original size of the lumps and grains from which it was derived. In the gold of this formation, but little dust, comparatively, is saved, although more, I believe, might be saved by a more improved process of working. At present the greater part collected is in the state of grains, or small scattered

* Vide Kirwan's Geological Essays, 402.

lumps. The inference is, that this gold existed originally, that is, before its removal to its present position, in pieces somewhat larger than those found at present, but still of a moderate size. Whether these pieces lay contiguous to one another in a large vein, or whether they were flattened abroad in individual masses, it is, perhaps, impossible to decide. The fact that small veins have been found, traversing quartz, favours the idea that this was the original mode of existence.

There are some circumstances which induce the belief, that the materials of the deposit itself were derived from the great Slate formation before mentioned. The green mud may be supposed to have been formed out of the Chlorite and argillaceous rock, with which the formation abounds; the greenstone pebbles correspond with a class of ròcks of the same formation; and the quartzose fragments answer well in appearance to the larger fragments, that are profusely scattered over the ridges of the slate country. Moreover, two masses of gold, each weighing several pwts. have been found in the county of Orange, over the same formation, 60 or 70 miles north of the gold region. Hence might be derived some faint hopes of finding the gold in native veins or beds; but still these may have been in the "fountains of the great deep" that were broken up.

If we suppose that gold dust is universally derived from diluvial action on lumps of the same metal, it will account for two well known facts;—first, the very general diffusion of particles of gold among the the sands of all countries; and, secondly, the circumstance of many rivers that were anciently auriferous, having now ceased to be so; as the Tagus, Po, and Pactolus (Kirwan, Geological Essays, 402.) This author also adds, that it appears by the testimony of Disdown that some of the rivers of France were much more abundantly auriferous in former ages than they are at present. The dust derived from diluvial action may be conceived to be exhausted or washed out in the course of ages, while there is now no process going forward for supplying the waste.

ART. III.—*A Description of the Oolitic Formation lately discovered in the county of Saratoga, and state of New-York; communicated by* DR. JOHN H. STEELE.

BEING, about a year ago, in the shop of Mr. Lyman B. Langworthy, an ingenious mechanic at Ballston-Spa, he shewed me a small specimen which was evidently *Oolite;* he was unable, however, to designate the spot from whence it came, but believed that it had been found in the vicinity of that place. Some time after, a farmer brought me a specimen, as large as a man's hand, which he said he had picked up on his farm, and that it contained "*petrified mustard-seed.*" I was, until recently, unable to discover the place of its origin. Being in company with Dr. Childs, an intelligent physician, in the neighbouring town of Milton, he informed me that the formation in question occurred on the farm of Mr. Benjamin Rose, an uncle of his, in the town of Greenfield. I soon after visited the place, and found the object of my search evidently *in situ* in several places on that and the adjoining farms; and I have subsequently been able to trace its connection, in different places, for several miles in nearly an east and west direction, along the southern line of the town—its extent north and south is probably not so great.

The easternmost point, where this formation discovers itself, is about two miles from the village of Saratoga Springs, and within half a mile of the primitive rocks which terminate the southernmost point of the Palmertown mountain; from this spot it stretches across the valley which separates the Palmertown from the Kayadarosseras mountain, and probably may yet be traced around the termination of the latter mountain, to that of the Sacandaga, and, possibly, along the whole extent of these primitive spurs of what professor Eaton calls "the McComb's mountains."*

* Professor Eaton, to whom I gave a specimen of the Oolite here described says, "There is nothing analogous to it in the secondary formation of the Canal district, west of Utica, though some of the western rocks, which lie above the iron formation, resemble the European rocks which are there contiguous to the Oolite. But I think the Oolite may yet be found in connection with what I have called calciferous slate, between the spurs of gneiss, which extend down from the McComb's mountains. I

The calcareous concretions, which characterize and identify this formation, are, for the most part, arranged in successive layers throughout the strata in which they appear; they are globular, of the size of mustard seed, possess a shining black color, and are evidently composed of concentric layers. They are united in the mass by a calcareous cement, more or less granular, combined with fine siliceous sand.

More than one half of the whole mass of some of the strata, which constitute the series of this formation, consists of these globular concretions; in others they are more sparingly diffused, and some of the strata appear to be composed altogether of a calcareo-siliceous sand, without the intervention of a single globule, these are mostly of a darkish grey cast, but they are in some places, rendered brown by the intervention of ferruginous particles; they strongly resemble some varieties of graywacke, and, without a close inspection, might easily be mistaken for it.

In and near the road, which leads from Greenfield to Ballston-spa, by the way of Rowland's mills, on the farm of Deacon Wood, there is a bank composed of a series of horizontal strata where the peculiar characteristic features of this formation are well defined and may be readily examined.

One of the strata, which compose the series at this place, presents a very singular appearance, and one which, if it occurs elsewhere, has never been noticed, so far as I am able to learn, by any writer. The surface of this stratum is fairly exposed for a number of rods both to the north and south of the bank beneath which it evidently passes, it is about two feet in thickness and has imbedded, throughout its substance, great quantities of calcareous concretions of a most singular structure; they are mostly hemispherical, but many of them are globular and vary in size from half an inch to that of two feet in diameter; they are obviously composed of a series of successive layers, nearly parallel and perfectly concentric; these layers have a com-

infer this from the fact, that your locality holds the same relative position, and from the peculiar character of that rock. In addition to this, I have seen in connection with it, the same calcareous grit, (as the English authors call it,) which you shewed me as being connected with the Saratoga Oolite."

pact texture, are of a dark blue or nearly black colour, and are united by intervening layers of a lighter coloured calcareous substance, either stalactical or granular, they are very thin, and I have counted more than an hundred in one series. By breaking the matrix in which they are imbedded, they drop out entire, and may be readily reduced to any smaller size, by merely throwing them upon the rock—the concentric layers easily separate, leaving the form exactly the same.

These interesting concretions appear to be confined solely to one stratum of the series, and this stratum evidently accompanies the Oolite in its whole extent, and is undoubtedly a variety of the same series, the best characterized Oolite lying beneath, while those of a less definitive character are regularly piled above it.

I have endeavoured to represent the appearance of this singular stratum in the small sketch which accompanies this communication;* it comprises a section of the rock as it presents itself in the road, near the bank above mentioned, and is intended to display a view of its edge and surface, together with the superincumbent strata, as they appear in the bank above, their union being obscured by the falling in of the earth, which likewise covers a part of the surface of the projecting rock.

I have carefully examined the different formations in the vicinity of this series, and, although the connection is extremely broken and rendered rather ambiguous by the intervention of diluvial deposits, I have come to the conclusion that the Oolitic formation, rests on the metalliferous or mountain-lime rock, and that this last overlies the calcareous sand-rock, both these formations occurring in such situations as to induce the belief of their being thus connected, although I could find no place where their actual union appeared.

If what professor Eaton calls *calciferous slate* has any connection with this series, it is itself Oolitic; I found a formation which answers tolerably well to his description of that rock, situated above the well defined Oolite, but it contained a number of the small concretions which distinguish that rock from all others. The strata still higher are

* See the figure in plate II.

composed of a kind of quartzose sand, of a gray or reddish gray colour, and is possibly a variety of the *mill-stone grit* of the canal district. Shell lime rock occurs in great abundance in the vicinity of the Oolitic series, but its relative position, in reference to this formation, I am not at present able to determine.

Since writing the above communication, I have been highly gratified by an interview with Mr. Schoolcraft, who informs me that Oolite actually occurs in Munroe township, Gallatin county, Illinois, near the Ohio, four miles west of Cave in the Rock, in detached masses, and, descending into some of the old diggings, made for the purpose of procuring lead, he found it in situ, regularly stratified. Mr. Schoolcraft thinks, from all the observations which he was able to make, that this Oolite rests on calcareous sand rock and is overlaid by shell limestone.

Saratoga Springs, Nov. 25th, 1824.

Art. IV.—*Notice of a Singular conformation of Limestone, by* Prof. Dewey.

In blasting the rocks near the College, a singular conformation of limestone has been exposed to view. It belongs to the bed of limestone, which contains a considerable proportion of siliceous earth, and whose seams are lined with talc, and appears to have been covered by the strata of limestone lying parallel to those still remaining. The figure accompanying this paper, is a perpendicular section of the rock. The general inclination of the strata, shown by the line A B, (see plate II.) is about 40° and the dip is towards the east. The section shown on the plate, is nearly at right angles to the direction of the strata, so that E W lies nearly east and west. The strata, which lie upon A B, are divided by natural seams into large blocks, which are above, and below, and eastward of B. Commencing on these are several strata from one to eight inches thick, which are curved in the manner represented between B and W. The outer strata have a larger curvature; but the inner finally come to a point, as at C and D, the two parts forming the angle being clearly defined but closely compacted into a solid mass. At E is another large curvature within which the strata have less curvature to the middle of the rock at F. The length of the strata from E beyond G is more than eight feet, a part only being shown on the plate, and the perpendicular depth from G to the surface at H exceeds four feet. The strata above E G are much longer. The upper stratum E W can be traced more than fourteen feet southward of the perpendicular section. As a part of E W and some others of the higher strata have been broken off, these strata below E W are seen to continue parallel to E W. The part of the rock which lay north of the perpendicular section, has been broken up and removed. It was found to be composed of concentric strata resembling those from D to F. I have a specimen of one of the curvatures, whose span is only nine inches, while the height of segment is three inches.

Though the curvatures and tortuosities of many parts of this bed of limestone, present very curious appearances, I have seen none so large and singular as that described above. Whether it resembles at all the *globular* masses of rock mentioned by Bakewell and others, I am not able to say. But it seems to me that the formation of this mass is not easily accounted for by either the Wernerian or Huttonian hypothesis. May it not be the result of a tendency to crystallization, rather than the effect of pressure from any cause?

Williams' College, Nov. 17th, 1824.

Art. V.—*Notice of several localities of minerals in Massachusetts, by* Rev. Edward Hitchcock.

Spodumene.

The mineral described in Vol. VI, p. 225, and more particularly Vol. VII, p. 30, of the Journal of Science, as white augite, turns out to be Spodumene It exists. not merely in the locality described in the above references, but in various other parts of Goshen, especially in the northern part, scattered in great abundance in bowlders over the surface; so that there is no danger that the locality will ever be exhausted. It has a threefold cleavage, is brittle, more or less translucent, and its chemical characters answer to spodumene. But its general colour is brownish white, sometimes clove brown; and in this respect it does not agree precisely with the Swedish mineral. Yet not unfrequently it is beautifully tinged with green, and cannot be distinguished from the European specimens. It exists in laminated masses in coarse granite, sometimes three or four inches across and from 12 to 18 inches in length; though it is not easy to detach specimens of this magnitude entire. I cannot state positively the geognostic relations of this mineral, as it has hitherto been noticed only in bowlders. Yet at its principal locality, those bowlders are so piled upon one another, and so few of them are rounded, that it is obvious to any one acquainted with the position of the granite in the vicinity, that they constitute the upper portion of an enormous vein, or bed, or protruding mass of granite in mica-slate.

Pyrophysalite.

Dr. Wright of Goshen pointed out to me a mineral at the locality of indicolite, green tourmaline, rose mica, &c. in that town, which he informed me was denominated by Mr. Nuttall, the variety of topaz described by mineralogists under the above name. Its colour is white, tinged with green, and on hot iron it phosphoresces very distinctly, with a yellowish green light, and loses its colour. It is opaque, or only slightly translucent. It is distinctly crystallized; but from the few specimens I obtained, I could not determine the form.

The principal locality of the well known Goshen minerals, indicolite, green tourmaline, &c. is about three miles north west of the meeting-house, on what is called the Week's farm. They occur, as nearly as I could ascertain, in a huge vein of granite in mica-slate—although it is only from the loose bowlders that they have hitherto been obtained. Here we find promiscuously blended, the green and black tourmalines, indicolite, spodumene, green and rose and silver coloured mica, pyrophysalite, beryl, and foliated and granular cleavelandite. I noticed also some specimens of beautiful white talc, which I believe has not been credited to this locality.

Oxide of Manganese.

The siliceous oxide of manganese exists in Cummington in immense quantity lying in bowlders in the stone walls, half a mile west of the congregational meeting-house, on the farm of Mr. Packard. The masses vary from a few inches to several feet in diameter, and are uniformly of a coal black on their surface, being covered with the compact oxide of manganese, from a mere line to two or three inches in thickness. On breaking open these unsightly masses, the interior is disclosed of a beautiful rose red, sometimes imperfectly, sometimes distinctly, foliated, and much resembling rose quartz, except in being of a deeper colour. I doubt not it would be an easy matter to collect at this locality fifty tons of this mineral; so that there is no danger of its being exhausted. I could not find the ores in place, though from the appearance of some specimens I have little doubt they form a bed in mica-slate.

Is not the fact that the masses of this siliceous oxide of manganese, at this locality, are always covered with a coating of the compact oxide, worthy of the notice of the mineralogist? Does it not lead to the conclusion, that the latter is produced by the action of the atmosphere upon the former? Veins of the compact oxide do indeed penetrate to the centre of the masses; but they appear uniformly to follow cracks, or interstices, into which the air had penetrated. Mr. Bryant, who lives near the spot, pointed out to me a specimen, which had been broken a year or two since, and which, by simple exposure to the weather since that time, had already become coated by a thin pellicle of the black oxide.

Carbonate of Iron.

This mineral, as might be expected, occurs at the same locality; but I did not notice much of it. Its colours are pale yellow, passing to brown, reddish brown, and even blackish brown. It occurs in laminated masses, not large, and perhaps passes into brown spar. Carbonate of Iron is found also in abundance in Plymouth, Vermont.

Sparry Iron ore, found in Plymouth Vermont, is stated by Mr. S. F. Clarke, to occur in a vein two or three feet wide near the meeting-house.

I am not aware that Saratoga Springs have ever been noticed in the Journal of Science as a locality of Spodumene. It occurs there, I am told, in abundance; and in colour more nearly resembles the Swedish mineral than that of Goshen.*

Art. VI.—*Geological and Miscellaneous Observations, by M. Boué, in a letter to* Dr. J. W. Webster.†

I have lately visited the whole chain of the Pyrenees, and my results are not quite the same as those of Charpentier in 1810, and now he nearly agrees with me as to their geological structure. The *diabase* or ophite of the Pyrenees are veins, very much resembling those in the transition schistose rocks, and are of the same age with the sienite. The granite is not stratified, nor in beds, but in *bed like* veins, in veins and in columns in the transition slate rocks, which they have altered so much as to render them (convert them into) gneiss and mica-slate. The primitive granular limestone of Charpentier is nothing else than a transition limestone altered by granite, and the minerals tremolite, garnet, amphibole, macle, &c. have been produced in it in the same way. (See my memoir in the Annales des Sciences naturales, which takes the place of the Journal de Physique, which is discontinued.)

I have also visited the whole of the South of France. The Garonne and Adour basins are surrounded by Juratic dolomite, oolite and compact Jura limestone, with green sand

* The writer of this notice would be glad to exchange specimens of the spodumene and manganese mentioned above, (and he could add several other of the interesting minerals in the vicinity,) for native or foreign minerals, and especially for geological specimens.

† Extract of a Letter from Dr. Webster to the Editor, dated Boston Nov. 26th, 1824.

Dear Sir,

I send you an extract from a letter I have just received from Dr. Boué, believing that the occasional obscurity arising from his writing in a language and chalk, nearly like the deposit of the Parisian tertiary basin, except the accidental gypsum of Mont Martre. Yet there are many points of difference.

After this I visited the south of Germany, and saw the salt deposit of Wirtemberg under the Muschelkalk in the red marl. Thence I passed to the German Alps, and from Switzerland to Hungary. I found that the limestone Alps contain Zechstein, red marl with salt, muschelkalk, green sand, and hard chalk,—iron pyrites occurs in the green sand. The red marl is often very different from that of Germany, and like a calcareous grauwacké alternating with blackish or grayish marls, and indurated marls with impressions of ferns. (See my memoir in the Journal des Mines.) This deposit forms a great part of the Carpathians, and of the salt formation of Transylvania. In this last country I remained four months, where I saw the old transition porphyry with small veins of gold &c. at Kapnick, Naggag, &c. Every where marks of elevation and alteration of rocks like grauwacké. At Vorospatak grauwacké impregnated with gold, not only around gold porphyries, but also supported and elevated by porphyry with which it is intermixed. I found gold in carbonized wood in recent grauwacke!

From the Bukowina to Carlstadt is a great trachytic conglomerate district with many interesting tertiary deposits in the southern plain at the foot of the Wallachian chain, &c. This winter I expect to complete a geological map of this district, and hope to throw some light on many interesting points which have been, not at all, or but ill described. In the Bannat, sienite forms in the transition rocks, ganglion like dykes, and at the contact of this sienite with beds of limestone, the latter is granular, containing copper and iron with garnet, amphibole, tafelspar &c. which have been generated between the limestone and the sienite.

Being desirous of going into Sclavonia, I was compelled to stop having had the misfortune to be poisoned by my servant and coachman with the datura stramonium. On recovering my reason, I found that I had been robbed of

not so familiar to him as the French, will be overlooked in the interesting results it contains, and the indefatigable ardor it evinces.

Yours &c. J. W. WEBSTER.

every thing. Without a single letter, I found myself in a wretched solitary inn on the limits of Wallachia, in the midst of a woody country. Happily I found the means to escape from that place; the roads were covered with soldiers, as great numbers of robbers infested the immense forests.

In my work on Transylvania you will see and learn what a country this is, once over the Transylvanian hills you are no longer in Europe, and I suppose that the impenetrable woods of some parts of the country, must resemble those of America, where the bears and the snakes arte he only inhabitants. At Vienna, which I at length reached, I was detained by a nervous fever that continued forty days.

This year I have revisited Italy and the south part of the Alps where all the secondary formations exist, and often in a single hill. You see there old schistose crystalline greenstone ?* with supporting grauwacké, clay slate and transition metalliferous limestone, as at Bleyberg, then, above, a red conglomerate, next a marly limestone formation or zechstein, then marls and sand stone (variegated) with gypsum, roggenstein, shelly calcareous sandstone, which is red marl as in Germany. Above the red marl is a greyish limestone formation, muschelkalk, then a reddish sandstone formation on quadersandstein, then juratic cavernous dolomite in strata, with shells, notwithstanding what Von Buch says. To these succeed oolite and compact jura limestone, and against the plain of Lombardy, green sand, chalk with chlorite, corals and mummulites, chalky limestone, and hard chalk with flints. This coral limestone is the same which is so abundant in Hungary and Austria, and which contains the mastodonte, and bones of an animal allied to the genus Ibis. (Cuvier's theory is against this.) Above the chalk is coarse tertiary limestone with fossils, short beds of blue clay with shells. To these probably belongs the blue shelly clay of the sub-Appenine hills. The upper part of the coarse limestone contains bituminous beds with fishes.

The Appenines seem to be composed of older transition rocks, grauwacké and limestone, red marl, like that of the Carpathians, and muschelkalk? of juratic dolomite, compact limestone, green sand, coral limestone, hard chalk, and

*In the original this word is so obscure that I have been unable to decypher it satisfactorily.—J. W. W.

at the bottom blue clay with shells and sulphur covered with sand and limestone with marine shells, and here and there fresh water deposits.

The basalt, or trap, forms in the Vicentin *bed like* veins, and veins in the recent talcose schists, and in zechstein and red marl. These last are altered in a most singular way at their contact. The same rocks cut all the secondary formation; the former (the basalt) in true beds or *coulées* between the green sand and the chalk, and alternates as well as the shelly tuffas from two to six times with the coarse tertiary limestone. But the most singular fact is that of Predazzo in the Tyrol, where an immense projection of dolerite and granite passes through and rests upon the secondary rock; the juratic dolomite forms higher hills but yet does not cover this igneous protuberance; and at the contact the dolomite is changed to granular primitive limestone, and minerals have been produced here which are in the undermost limestones.

The dolerite passes gradually into granite, and a coarse granite with schorl or with coccolite forms dykes in the porphyritic fine dolerite. This was discovered by Marzari. Von Buch is wrong in deriving the magnesia (of the dolomite) from the porphyry, the dolomite is an original deposit. This same augitic and porphyritic deposit forms in the Vicentin dykes in the chalk, and covers also in part the chalk, and yet there are mines of galena and blende in small veins! All the Fassa trap beds in Zechstein are nothing but this tertiary igneous rock, and are like beds, or in columns in the juratic limestone. It is astonishing that the errors on this point should so long have been overlooked.

In Switzerland there are two *molasses*, one is like the red marl, like the Carpathic, what Beudant calls his Gres houiller; and the other is tertiary, and is divided into inferior *molasse* with lignite, and superior with marine shells.

—Baron Ferussac's journal is going on with great success. Humboldt is soon to publish a second edition of his geognostical Essay. Beudant is printing a system of Mineralogy. Maraschini has published a most excellent work on the Vicentin.

Art. VII.—*Notice of a Rocking Stone, in Savoy, Massachusetts, with a drawing, by* Dr. J. Porter. (Communicated to the Berkshire Lyceum.)

In a late excursion from Plainfield, a little before reaching the village in Savoy, we turned to the south nearly opposite a school-house, and after riding about a mile over a very rough and disagreeable road, the rocking stone, which was the object of our excursion, appeared in a very conspicuous situation on the right.

It is of granite, and venerable with the mosses and lichens common in this part of the country. It may be moved with ease, so as to describe an arc of about five inches, by the hands, or a shoulder, or by standing on its summit, and leaning the weight of the body on one foot and the other alternately. When the ground around it was first cleared, it was, as I am credibly informed, moved by the wind, and very probably this may be the case at present, though it is supposed to weigh ten or twelve tons. The noise that it makes in moving, is so little as to be scarcely noticed. The rock on which it lies, is a coarse grained granite curiously contorted and apparently stratified, the strata leaning to the west at an angle of about 45 degrees. The rocking stone lies on the very summit of this ledge, and appears to touch it in three points nearly in a right line across the strata.

This rock, so far as I can learn, has hitherto excited very little attention I did not hear of it until about a fortnight since. Scarcely any attempt has been made to overturn it, and fortunately the present owner, Mr. Enos Dean, sets so high a value on it, that nothing of the kind would be permitted.

Postscript.

Since the preceding account was written, I have visited a very remarkable rock in the south-west part of Lanesborough. It is of limestone, and lies on another rock of the same kind. It is about 26 feet in length, and about 18 in breadth touching the rock, on which it lies for about $2\frac{1}{2}$ feet, having no support at either end, and appearing ready to slide off and crush the beholder. To the eye, therefore, it has every appearance of a most magnificent rocking stone; but it is immoveable. This very singular rock is on the land of Ebenezer Squire, and 4½ miles from Pittsfield village. It is in the woods, and is beautifully and romantically shaded.

There is, if I am correctly informed, a rocking stone in the south parish of New-Marlborough in Berkshire county.

Art. VIII.—*On Bowlders and Rolled Stones.*

July 20th, 1823.

TO PROFESSOR SILLIMAN.

Sir—

I have communicated for your journal a few observations on the appearance of the face of the earth, in one or two of the northern states.

Inclination, business, and amusement in my younger days, and since, often led me over the mountains, and through the valleys, generally near Connecticut river. I soon began to enquire why or how, so many rocks of such various sizes, should have become so perfectly rounded; why they should be found on the highest mountains, as well as in every valley; why piled in such immense ridges; as well where no stream of water was ever known to flow, or according to every appearance, ever had or could have flowed, as well as in those places, where larger and smaller streams still existed. I enquired why every where on the face of the earth, when an excavation is made by nature or by man, do we see incontestible evidence, that the whole has been modified by the mechanical agency of water; why do the uncovered faces and angles of the granite and other rocks, bear the same marks of having been worn and ground as the rounded rocks? An answer was suggested to me by the following observations. Being at Newport, R. I. I went down to the sea shore after a storm and found the mighty process still going on. While I stood on the elevated bank, the waves followed each other in quick succession, and I could distinctly hear the motion of the larger and smaller rocks, brought in and carried back, as I thought, more than one hundred yards by every wave, and I could sensibly feel the earth tremble under my feet from the quantity and great weight of some of them. I considered that the whole country must once, and for a great length of time have been covered to a great depth with this now retired ocean. If we know not what has become of the waters, yet surely when we see their effects on every hill, in every valley and on every plain, and can distinctly follow their retiring footsteps, from the highest mountain to this very spot, where the same cause is still in active operation, producing the same result, we must yield to the conviction that the cause of all these effects is one and the same. Every subsequent observation has confirmed this conclusion. I always observe in the outlet of a deep valley between two mountains, masses of larger and smaller rounded rocks deposited, the quantity of which bears a very just proportion to the length and depth of the valley. Streams of water where any have flowed out of these valleys after the sea retired, have cut channels through this deposited gravel, but seldom if ever could have had any effect in rounding it. On both sides of the great valley of Connecticut river, as elsewhere, there is an immense deposit of clay, loam and sand to the depth of more than one hundred feet. The river has carried away much of this deposit, and in such a manner as to leave no doubt as to its depth, or what has become of it. This valley, it would seem, was once empty, or occupied only by water, for logs have been found in digging for water from fourteen to forty-five feet below the surface of the ground. This deposit must evidently have resulted from the grinding and rounding of the rocks on the mountains and hills, and in the vallies on the two sides of Connecticut river, and this *detritus* being brought down as the water retired, was here deposited. Since that period, the river has been occupied in wearing away rocks, deepening its channel between mountains and removing much of the deposited earth. Let us for proof, examine a single route to the sea shore—for convenience, we will take the Grafton Turnpike road, although many others would be equally satisfactory. Granite in place is first found about three miles from the meeting-house in Lyme, and about thirteen miles from Dartmouth College After that, it is every where seen in blocks, in rounded rocks, as well as very often in place. As you travel eastward, the land rises pretty rapidly, and at every step there are certain marks of mechanical agency. excepting of course the rocks in place. On leaving a considerable branch of the Mascomy river in the Eastern part of Canaan, the road between two mountains leads up a very small stream whose source is in the western part of Grafton In following up this little brook you observe large hills of gravel and of sand, apparently the residuum of what once filled this valley to the depth of seventy or eighty feet. When you arrive at the source of this stream, you have to ascend a steep hill of perfectly rounded gravel to the height of from sixty to eighty feet and then pass on a level. about 30 feet to a smooth coarse grained granite in place.

Here is the height of land between the Connecticut and Merrimack rivers, and it is probably more than one thousand feet higher than those rivers. On either side and close by, are two mountains running still parallel with the road, which are from five to eleven hundred feet higher than the height of land already mentioned. In ascending this hill of gravel, and passing on to this evidently smooth water-worn surface of granite, there was such a perfect resemblance between this deposite of gravel behind the rock and what I had often known in streams, that I was at once fully impressed with the belief that this gravel must have been deposited by a current of water. The rocks exhibited every appearance of having been much worn by water, the corners of those in place being perfectly rounded, and all the low places between the rocks for about two hundred yards were full of gravel, and no more than full. About forty or fifty feet from the surface of this smooth rock, the waters from this side flow rapidly to the Merrimack river Still I could not doubt that the very gravel which I saw on the west side, as well as that which filled all the low places on the rocks had been rounded on the rock or near it, and that the rocks by the same process had been much worn. I concluded that nothing but the movement of the ocean itself through this valley could ever have produced these effects.

On this height the gravel is rounded almost as perfectly as that on the present sea shore. After some research I discovered by the side of the road, among the weeds and bushes, a cavity in the rock, similar to those known to be worn by a rapid current of water, aided by the attrition of gravel. Nearly one half the cavity at top was very plain, distinct, and about three feet in diameter. The other part of the rock had been probably removed by the water. I soon found two other cavities, not ten feet from the path, one about two feet in diameter was perfectly circular a little below the top. I could not ascertain the depth of any of them, owing to their being in part filled with mud and decayed vegetables. Probably at bottom they are still filled in part with the same gravel that had contributed to their excavation. The other cavity was much longer and not so perfect These three cavities are nearly in a direct line, and not more than 20 or 30 feet apart. The whole rock east of these for 40 or 50 feet in width has every appearance of having been actually worn away to the depth of between 15 or 20 feet.

Among many other proofs of this fact, I may mention another worn cavity. Eight or ten feet higher than the others, and a little back of the middle one; this cavity is very perfect, it is plainly to be seen to the depth of six or seven feet, it is about three feet in diameter at top, apparently perfectly round, and like other cavities, known to be formed by the action of gravel and water, its diameter (as would naturally be the case) increases very regularly and gradually as it grows deeper; and what makes it still more certain (if possible) that it is the effect of gravel and water is, that about 3 or 4 feet from the top, on one side of the cavity, the rock projects into the hole three or four inches, exactly as those rocks do that are known to be worn by gravel and water where a part of the rock is harder than the rest, which clearly is the case here, as that part of the rock appears of a more compact texture and is of a different color. Many more similarly worn cavities might doubtless be found here, were it worth the trouble to make the examination. The gradual recession of the ocean from this extreme height, and in some measure its course and progress, can, I think, be clearly and distinctly traced by indications still distinctly visible, through Grafton to the westerly part of Danbury, where we leave the apparent course of the ocean current, and pass over rising ground to the head waters of a small branch of Black River, where there is a great deposit of Breccia both in place and in loose blocks, some of the pieces of which are partially rounded. The little fragments of the rock are very white, and their angles almost invariably quite perfect, and what perhaps is singular, they are cemented by granite;* the two rocks alternate with each other in place, a fact which is also seen sometimes in the rounded rocks. As you descend the stream and valley, they are plainly more and more rounded, and at Black River, about four miles, there is hardly a rock of any other kind; some are of many tons weight, and from that down to small gravel, and even the sand and gravel of remaining hills or ridges, sixty or seventy feet high, are composed almost entirely of this kind of rock The rivulet that descends into this valley is but a small mill stream at its junction with Black River in Andover, and never could have had any agency in rounding, carrying down and depositing such an immense mass of rocks, gravel, and sand. In the course of Black River for a mile or two, nearly all the sand banks and hedges and the gravel and rounded rocks continue of the same kind. They then begin to diminish, and the fine gravel and sand soon disappear, but the rounded rocks are seen more or less every where on the ground and in the banks. In passing over Salisbury Hills, from five to ten miles below (which are from one to two hundred feet higher than Black River) these rocks well rounded at first, compose nearly one half of the stone fences, and are every where seen in the Hills although sensibly and gradually lessening in proportion to other rocks, so that before leaving Salisbury, the stone walls are composed of only about $\frac{1}{5}$ or $\frac{1}{6}$ of them. Quitting these hills, the traveller descends to the extensive plain of sand in Boscawen and Concord where few rocks are to be seen, and those are generally granite. After leaving these plains in Pembroke, on the opposite side of Merrimack River, we still find rounded rocks of the same kind, but so few that only one occurs in two or three rods of stone wall, this is about thirty miles from their original situation. In taking here the London-

* Perhaps by a re-aggregation of its constituent minerals, quartz, feldspar and mica.—Ed.

derry turnpike, we pass over a pretty hilly country for nearly thirty miles. the whole of which is a mechanical deposit (except much granite in place) composed almost exclusively of granite in blocks (some of which are of a great size, more or less rounded) and of all sizes down to that of sand. This granite in place, as well as the bowlders, resembles exactly those large blocks so extensively worked on the opposite side of the Merrimack river to which place it is possible they were transported by the sea—again approaching the Merrimack at Methuen in Massachusetts, you will find now and then the stone walls (but very rarely perceive rounded masses of rocks of this kind) and in Andover about fifteen miles from the sea, I observed scarcely one to a mile. How could these blocks become detached from their natural bed in Danbury in New-Hampshire—how become so perfectly rounded and that in immense quantities in the course of three or four miles, affording at the same time by their attrition, in that short distance, hills of coarse and finer sand? How could they become deposited in alluvial hills, gradually diminishing in quantity as they recede from their natural bed, at the same time becoming evidently more and more perfectly rounded—how could all this have been effected and much more but by a slowly retiring ocean?—May not the ocean be still retiring although more slowly than heretofore? It may now probably be nearly stationary, still diminishing. It would seem that the diminution must be equal in volume at least to the whole quantity of earth and sand carried into the bed of the sea, and there deposited by all the rivers and streams in the world—equal also to all the timber and vegetables floated in and there deposited—to the immense growth of mountains, &c. by marine formation—to the sand perpetually carried thither by the wind from a large portion of the face of the earth—to the thousands of hills and banks of sand and gravel perpetually washing away, similar to those of your neighbourhood in Long Island Sound—and to the upfillings produced by thousands of men who are perpetually at work directly or indirectly in this manner. It would seem that the water must diminish in a proportion equal at least to all these effects; otherwise I know not why it would not be perpetually rising. If the ocean has now the appearance of having become stationary it may be that the diminution may just equal the filling up, and this may remain a permanent fact. Does not this arise clearly from the arrangement of infinite wisdom? What has become of the water? There may be as you justly observe, (Review of Dr Hayden's book,) for ought we know, room enough in the earth for caverns of requisite dimensions from which the air or gas with which they were originally filled has been gradually absorbed or expelled a to which the waters as gradually retired. There would be nothing unnatural or extraordinary in this supposition; the least perfect organized being is a greater wonder. The waters appear to have been the great agent to prepare the earth for the reception of man. It would therefore seem necessary that they should retire slowly in order to effect the benevolent purposes of Infinite Goodness.

Possibly the process may hereafter be reversed; the waters may be drawn out to assist in preserving, or in continuing the earth in its present limits during the will of the Creator, but if we cannot show what has become of the water, we can show where it has been, and what it has effected. But it is said the Scriptures mean to contradict the idea of the waters having covered the Earth for a long time—I think not,—"In the beginning, &c."—that undoubtedly is going far back, and that "the Earth was without form," meaning no doubt without that form designed it by the Creator for the reception of man—still later "God said let the waters under the heavens be gathered together unto one place and let the dry land appear." In God's works we see only wisdom and goodness, omnipotence, works unseen by man and animated nature generally. Those probably were the materials collected which have formed those immense beds of mineral coal already so essential to man. Clay and Lime, so necessary to the formation of a good and productive soil, to the comfort and convenience of man, might then have been produced. It is not easy to see by what agency except the gradual retiring of the ocean, the different earths could have been so mixed and blended together as to form a good soil. Every hill and mountain within my knowledge is covered with an alluvial or diluvial deposit In this country, the rocks, chiefly granite, have been ground to dust, making of itself, in the fine powder to which it is reduced, a warm and genial soil for this cold climate:

When mixed as it generally is with a little clay, lime, and vegetable mould, it forms a very productive soil, on every hill, on every mountain, where there is room for the plough or hoe. Had it not been for this very benevolent process of grinding the granite and other rocks to powder, to dust, and preparing the soil in that way, New-England, (which now with proper cultivation is very productive,) could not probably have been inhabited, and indeed but a small, if any, part of the earth. For, undoubtedly, the rich meadows and extensive valleys, owe their present form so convenient to man for tillage, as well as the richness of the soil, in a great measure to the same cause. The fact being once established that the earth was long covered with water, it would seem to account at once for those rounded, and other rocks found every where in ascending streams and hills, although no similar rocks should be found in the higher situations immediately contiguous. Those blocks perhaps were detached by ice from their native beds, and being rounded and transported by the currents, might be deposited any where at random. Floating ice at the present day, often transports large and small fragments of rocks from remote regions, and deposits them in more southern latitudes, and they often become rounded by subsequent attrition. The waters appear to have formed also the cavities of ponds in every stream where there is a fall of water into sand or loose earth, the water heaving up the sand at the spot where it strikes, then carries it forward, and the sand of course grows more and more shallow. Exactly in the same manner the earth appears to have been excavated to form the basins of ponds. No waters but those of the ocean could in most cases have been the cause of these excavations.

I have already remarked that the vallies that shoot up between mountains have invariably, at their outlet, a deposit of gravel, a fact which I will illustrate by a single example. This valley lies between two hills which are six or seven hundred feet high on the west side of Fairlee Pond. From the sand up this valley, it is but a little over a mile to a swamp from which the waters descend easterly down this valley to the pond, northerly and to Wait's River. The waters that flowed easterly, and passed between two hills over a ridge of rocks that was more than one hundred feet higher than the bottom of the valley, now is west of this ridge. It is composed chiefly of clay slate in a vertical position, and it was at top more than one hundred feet across, and twice that at bottom. Through this ridge the water and gravel had cut a channel nearly one hundred feet deep—I say the water and gravel, for the two sides of the section are rounded off in such a manner as to leave no doubt of their having been thus worn. But this is not all—as this channel was in the act of wearing down, it was constantly depositing gravel and sand on the east and opposite side from this valley, on which side the ridge of rocks was nearly perpendicular. This gravel has been spread out so as to be almost a thousand feet wide on the side of the ridge, and nearly two hundred high on the eastern side, reaching out four or five hundred feet from the ledge. The mass is very nearly of a semi-circular form, and the eastern side of it was deposited in that upright position, which banks of sand, or sand and gravel always assume when deposited in still water, thus indicating, like thousands of other similar instances, that in those days there was little or no wind to agitate the ocean. Since the ocean has ceased to flow up this valley, the brook, a small stream, has a channel through this slate ridge still deeper, at the same time removing the gravel also through the centre of the bank quite down to the solid rock at bottom. The ruins thus removed, have been carried forward and deposited in the pond, forming a point of land, or rather gravel, four or five hundred feet in extent, when the water was forty feet deep. This brook, since the sea flowed up this valley, has not only deepened its bed through the centre of this bank to the bottom, but it has also cut itself a channel more than one hundred feet deep in a slate ledge. The appearances on the two sides determine with great precision the relative effects of water and gravel, and of water alone. When they were united, the remaining rocks below those acted by water only are all worn or rounded off, the channel is much narrower. and the sides are left nearly in a vertical position; although the chasm is one hundred feet deep, the projecting rocks still retain in a great measure their sharp edges. Now this great deposit of rounded rocks, gravel and sand, must have had their present form given in this short valley and as the waters returned, were brought out and here deposited. It could come from no other source, for the bank of gravel on the two sides that are yet entire reaches to the pond shore, which is here about a mile wide. These materials too must have been originally brought from some distance and deposited in this valley, for they are composed almost exclusively of a light grey granite rock or gneiss. There is no rock of the kind in place in any part of this region, and particularly for miles, or any where to the west. But on the east side of Connecticut river, they are every where found and in place. In Orford at the distance of from two to four and six miles they are in great abundance and apparently exactly of the same kind. It is difficult to think of any other means by which these blocks could have been brought here and deposited but by the ice. In return a particular rock that contains a great proportion of carbonate of lime is every where found on the east side of Connecticut river, with other rounded rocks, although none of that kind to my knowledge are seen east of the river in place, but west of it after a few miles they are in abundance and in place. A stream of water recently turned over one of those remaining banks for the purpose of making a slip,* has washed it away to the depth of nearly one hundred feet, and to a similar width, and for two or three hundred feet in length.

Every foot of the exposed surface or bank proves it to have been deposited by water, and from the opening through the ledge. It seems to prove too, that at that time there was no growth of timber in the country, for there is not the least appearance in all this bank of a fragment of wood having ever been deposited. Had the wood disappeared, still the cavity would have been seen. It is singular that although such a great body of slate stone had been removed in opening the channel through this ridge and notwithstanding that the banks of the valley, for some way to the west are formed entirely of that kind of stone,

* Slips as they are called here (but in your Journal "*slides*,") have been formed around this pond for about twenty years for running the Pine Timber into and out of the pond from the mountains around it. Most of the way here they are made by excavating the earth—depending generally on the frost and snow for preparing them for running the timber. Pine trees large enough to make two or three thousand feet of boards, have been known to run a mile in a minute. They have made the pine timber, that was and would have been of little or no value without them, extremely valuable.

yet scarcely a single fragment has been seen in any part of the bank that has been removed. What has become of it? Has it not in the course of time been ground to atoms, (it being of a softer texture) and mixed with the powder of the granite and other rocks, contributing to the richness and fertility of the extensive plains in the valley of the Connecticut river. We seldom if ever, find rounded slate stones, although they compose many of the hills near the Connecticut. This, probably, is in some measure owing to their natural structure, but all the other kinds existing in this region are found more or less abundantly, some kinds never very far from those of the same kind in place, such for instance as the soapstone. May not the detritus of these rocks have been deposited in part in the great depths of still water below, and again in time have recomposed other rocks of the same kind or by different composition of different kinds. Valleys in a great measure similar to the one above described, are seen every where, always presenting the same indisputable evidence that similar causes have produced similar effects. This will account for the cavities mentioned in your tour to Quebec, in limestone rock at the head of Lake George. My impression is that these cavities could not be traced, as the result of any natural stream. There is a narrow and short valley at the north end of Fairlee pond running between two high mountains to Bradford. On the highest ground in this valley, where the waters divide and run northerly to Connecticut River at Bradford and southerly to Fairlee pond which is proba- 150 feet above the level of Connecticut River, there are cavities (I am told) worn in the solid rock. It was evidently a greatly compressed body of water passing through this narrow space that made the excavation of Fairlee pond. That body of water at that time must have reached much of the way to Lake Champlain through the valleys of Onion and Wait's rivers, by which route I understand there is no perceptible rise of ground between the waters of the Lake and those of Connecticut River. Again, mountains at and near the Connecticut river often present precipices of naked, perpendicular rocks, sometimes of the full height of the mountain, unless where loose rocks pulled off by the ice, by the roots of trees, or fallen by natural decay, are piled up against their sides. In time they will probably reach the summit and be covered by a growth of trees. There is an instance of one near Oxford Bridge estimated by Capt. Partridge to be about 500 feet in height. The rocks have the appearance of granite at a little distance, but on examination, are found to contain carbonate of lime. Rocks that have fallen from this mountain in "old time" now form a good soil, while those known to have fallen fifty years ago, scarcely begin to change their color. A gradually retiring sea will explain to us (and I know of no other way to account for the fact) why channels were cut deeper by streams, in rocks on high lands, than in those lower down, as mentioned by Mr. Maclure in your Journal for January last, notwithstanding that the rocks are harder and the accumulation of water, as well as of gravel and sand, greater below.

Yours with esteem,

N.

Art. IX.—*Notices of Miscellaneous Localities of Minerals.*

1. By Dr. Joseph Barratt.

TO PROFESSOR SILLIMAN.

Sir—

I have forwarded for publication in the American Journal of Science, a list of the minerals discovered in Philipstown, Highlands of N. Y. Specimens of the most interesting minerals herein mentioned, have already been plentifully sent away and are to be found in many of the mineralogical cabinets of this country; a desire to render the list more complete has occasioned a delay in publishing for the last three years.

In Philipstown, Putnam County, New-York.

1. *Hard white Marble,* in blocks, its texture is very compact.
2. *Precious Serpentine,* in loose pieces, and variously mixed with the marble; some of the serpentine is very beautiful.

3. *Amianthus* in seams, traversing the serpentine.
4. *Radiated Tremolite.*
5. *Sphene* imbedded in Tremolite. 6. *Lamellar Talc.*
7. *Asbestos*, intermixed with marble.
8. *Rhombic Carbonate of Lime*, pale flesh colour.
9. *Mica*, in six sided crystals. in do.
10. *Diopside*, a variety of pyroxene, colour light green, structure lamellar, with a glistening surface.
11. *White Coccolite*, in grains, the size of large shot, easily separable. colour clear white; the cavities contain crystals of white pyroxene, eight sided, the terminations irregular, mica is sometimes associated with it. This new variety is found in blocks and masses, in considerable quantity, associated with marble, and serpentine.

It was discovered by the writer, with the above mention-minerals in 1820. The white coccolite is a new variety, not mentioned in works on mineralogy; it has already been noticed in the American Journal of Science, Vol. 7, No. I, page 171.

12. *Rose coloured Coccolite*, same locality, associated with Diopside, or a variety of Pyroxene, it has been found but in small quantities.
13. *Green Coccolite.*
14. *Magnetic Iron Ore*, in marble intermixed with asbestos.
15. *Pyrites.*

This interesting locality is on the declivity of a small hill, principally composed of marble. serpentine, and white coccolite, on the farm of Mr. Joseph Hustis. These minerals extend little more than a hundred yards; the hill slopes to the east, its foot is washed by a small stream, and its opposite bank is an abrupt granite precipice, in which hornblende, green pyroxene and green coccolite occur.

In Philipstown Continued.

16. *Compact Feldspar.*
17. *Pyroxene* in several localities, green and also grayish white.
18. *Green Coccolite*, in several localities.
19. *Carinthin Hornblende.* 20. *Lamellar Hornblende.*

21. *Magnetic Iron Ore*, abundant.

22. *Green Actynolite*, occasionally occurs in the iron ore.

23. *Stilbite*, in grouped crystals, resembling a fan, colour wax yellow, intermixed with Laumonite in a cellular feldspar.

24. *Laumonite*, distinct masses of crystals of this remarkable mineral are found in the same vein, with the stilbite, the crystals are white, very small, and form a jelly with nitric acid.

Dr. Torrey has accurately described the crystals of these minerals. Amer. Journal, Vol. VI, No. 2.

The stilbite and Laumonite with its matrix, form a vein about three feet wide, in gneiss, and it can be seen as it presents itself to the surface, nearly thirty feet.

25. *Graphite*, in hexagonal laminæ in greyish white Pyroxene.

At Cold Spring.

26. *Lamellar green Pyroxene*, with a metallic lustre, abundant, accompanied with beautiful feldspar.

27. *Sphene*, in distinct crystals, and massive, in Pyroxene.

28. **Zircon*, scarce, in an aggregate of quartz and Pyroxene.

29. *Rhomboidal Black Mica*.

30. *Mica*, in six sided tables. 31. *Lamellar Hornblende*.

32. *Granular Hornblende*.

33. *Hornblende slate*, in gneiss.

34. *Rhombic Carbonate of Lime*, with green Coccolite, intermixed.

35. *Scapolite*, massive, associated with feldspar and green Pyroxene.

36. *Radiated Stilbite*, in the fissures of Pyroxene.

37. *Chabasie*, the form of the crystal is an obtuse rhomb, and is associated with the stilbite.

38. *Basanite*, with anthracite in loose pieces on the banks of the Hudson.

39. *Tremolite*, scarce. 40. *Green Coccolite*. 41. *Epidote*.

42 *Iron Sand*, on the banks of the Hudson.

* American Journal, Vol. VI, No. 2.

Note.—In the American Journal of Science, Vol. VII, No. 1, p. 57, Precious Serpentine—Putnam County is there mentioned as the locality. It should have been Philipstown; the writer of that article had only seen specimens, and was not aware of the serpentine locality, having a number of interesting minerals. The gentleman whose name is there mentioned as the discoverer, with characteristic candour first pointed out to me the error as there stated.

Dr. Troost in his valuable paper, on Pyroxene. (Journal of the Academy of Natural Sciences, Philadelphia, Vol. III, Part I, page 122,) has by mistake, stated Newburgh, New-York, as the locality of white coccolite—his specimen was from Philipstown.

These remarks are made with no other intention than to prevent confusion respecting localities.

Norwich Military Academy, Oct. 28, 1824.

2. By Mr. Charles A. Lee.*

The following Minerals occur in Pittsfield.

1. *Red Oxide of Titanium*, abundant in the S. E. part of the town, in green quartz.
2. *Manganese*, the compact brown oxide, in considerable masses.
3. *Iron*, specular, hematitic, magnetic sulphuret and the compact brown oxide. The magnetic occurs in octaedrons in mica-slate.
4. *Marl*, on the borders of a pond.
5. *Schorl*, In mica-slate, in the S. E. part of the town, near Washington.

* *To the Editor*,

I take the liberty of sending you the following localities of minerals,—some of them may have been published before in your Journal, but not having the former numbers at hand, I am not able to ascertain. Should this be the case, I wish they may not appear in the Journal.

With high respect, yours,
CHARLES A. LEE.

Remark.—I am not able to say, from recollection, whether any of these localities have already been published, and I am not now at leisure to examine.—Editor.

6. *Augite.*
7. *Calcareous Spar*, lenticular crystals of carb. lime.
8. *Jasper.* 9. *Talc* of different colours. 10. *Mica*, do.
11. *Puddingstone.*
12. *Quartz crystals*, *ferruginous* quartz massive and crystallized.
13. *Hornstone.* 14. *Agate.*

At Dalton.

15. Very large *Agates* occur in masses of hornstone and jaspery quartz and jasper.
16. *Opal*, do. 17. *Hyalite*, do.
18. *Hornstone*, approaching chalcedony.
19. *Siliceous Sinter*, in stalactical concretions.
20. *Cacholong.* 21. *Red Oxide Titanium*, in quartz.
22. *Breccia*, with a cement of brown oxide hematite, and *carburet* of *iron*,—interstices lined with minute quartz crystals.
23. *Serpentine*, contàining *asbestos*, in the east part of the town.
24. *Epidote.* 25. *Hornblende.*
26. *Augite*, principally massive.
27. *Ferruginous Quartz*, in yellow crystals.
28. *Schorl.* 29. *Bog Iron Ore.*

30. *Galena*, in small quantities at Canaan and Chatham, N. Y.
31. *Carbonate of Copper*, Chatham, N. Y.

32. *Zoisite*, at Zoar. *Cummingtonite*, do.
33. *Asbestos*, in serpentine, do.
34. *Magnetic Oxide of Iron*, in large octaedral crystals, do.

35. *Graphite*, in great abundance at New Marlborough.
36. *Augite*, do. 37. *Red Oxide Titanium*, do
38. *Arenaceous Quartz*, with dendritic impressions of oxide of manganese, do.

At Schaghticoke near Hoosac River, N. Y.

39. *Quartz Crystals*, in great perfection and beauty.
40. *Chlorite.* 41. *Massive Garnet.* 42. *Rhomb Spar.*
43. *Sulphate of Alumine.* 44. *Sulphate of Iron.*
45 *Graphite.* 46 *Aluminous Slate.* 47 *Breccia.*
48 *Hornstone.* 49. *Hornblende.* 50. *Graywacke.*

51. *Puddingstone*, abundant, at Great Barrington.
52. *Oxide of Manganese*, do.

In addition to the minerals found at Salisbury, Con. and described in the 2nd No. of the 8th Vol. of this Journal, the following have since come under my notice.

1. *Cummingtonite*, of Dewey, this mineral first found in Cummington by Doct. Porter, and considered a variety of epidote, has since been discovered in various places, but no where has it been found in such beauty as at Salisbury. It is associated with augite in a ledge of mica-slate, of a glassy lustre, the fibres radiating from a centre and six or eight inches in length.

2. *Phosphate of Iron*, occurs with the brown oxide of iron, in a newly opened bed, and is of a white colour when newly dug. On exposure to the air it changes to green. It is very abundant and lies in a diluvial hill, which has been penetrated to a small distance, and is associated with,

3 *Gibbsite?* This presents a somewhat different form from that found in Richmond and Lenox, being less *hard*, and of a much whiter colour. Composed of granular and botryoidal concretions.

4. *Idocrase.*—This occurs in abundance in oblique four sided prisms truncated on all the edges, also in octaedral crystals and massive. They are mostly of an irregular form, variously grouped, and associated with hornblende, epidote and calcareous spar. It presents various colors, from a reddish brown, to light yellowish white, resembles that found at Worcester and so accurately described by Doct. Meade in a former No. of the Journal.

I am indebted to Doct. E. W. Cleveland, for many of the above localities.

Pittsfield, Nov. 1, 1824.

3. By Geo. W. Carpenter.

1. *Manganesian Garnet*—this mineral is of a brownish red colour, of a compact texture and occurs massive, imbedded in the soil between Germantown turnpike, and Roxborough township line road, six and a half miles from Philadelphia, abundant.

2. *Actynolite*, in compressed acicular crystals, traversing a granular mass, occurring on the township line road six miles from Philadelphia.

3. *Schorl*, of a beautiful velvet black, in cylindrical crystals more or less aggregated, occurring in granite rock on the old York road, five miles from Philadelphia, abundant, in this same rock occurs the *white Beryl* described in Vol. 8 of this Journal, page 236.

4. *Limpid Quartz*, crystallized in six sided prisms, terminated by six sided pyramids, with some modifications, occurring loose in a ploughed field between Germantown and the old York road, five miles from Philadelphia.

5. *Actynolite*, of the glassy variety, in talcose rock, of a fine green colour, in irregularly grouped acicular crystals, eleven miles from Philadelphia on the Wisahicon creek.

6. *Chromate of Iron* at the same locality (abundant.)

7. *Pseudomorphous Quartz*—these imperfect or false crystals are generally opaque, surface dull and of a variety of forms; it is sometimes also in small globular or reniform masses radiated from the centre and in botryoidal clusters, occurring in an old quarry between Germantown and York road, five miles from Philadelphia (abundant.)

8. *Crystals of Mica*, imbedded in granite, in rhomboidal and six sided tables and prisms, on the township line road six miles from Philadelphia.

9. *Staurotide*, in mica-slate, Wisahicon creek, six miles from Philadelphia.

10. *Zircon*, in reddish brown, four sided prisms from $\frac{1}{3}$ to $\frac{1}{2}$ inch in length at Schooley's mountains about 100 yards from Belmont Hall, in sienitic rock detached.

11. *Phosphate of Lime*, in long slender six sided prisms of a pale green colour in granite rock at Germantown six and a half miles from Philadelphia.

Philadelphia, No. 294 *Market-street, Oct.* 14, 1824.

In Rhode-Island.

4. By J. G. and J. B. Anthony.

1. *Fluor Spar*, crystallized and massive in quartz, traversing granite about two miles east of Cooke's tavern in Cumberland, colour white, smoky, purple, and violet. When placed on hot coals, it phosphoresces with an intense emerald-green light—a quantity might be obtained at this place with but little trouble.

2. *Smoky Quartz*, at do. associated with fluor spar.

3. *Common Jasper*, green, blue, gray, white and spotted at Diamond Hill.

4. *Agate*, is found in great abundance at Diamond Hill and its vicinity, it is composed of quartz, jasper, chalcedony and hornstone variously disposed in stripes, spots or irregular figures, is susceptible of a fine polish and frequently combines a beautiful assemblage of colours.

5. *Radiated Quartz*, frequently ferruginous, is associated with jasper and agate on Diamond Hill.

6. *Smoky Quartz*, at Smithfield in amorphous masses of considerable size.

7. *Limpid do.* at do. in crystals and crystalline masses.

8. *Feldspar*, massive, and in large crystals at do.

9. *Beryl*, at do. it occurs crystallized in veins of granite traversing gneiss and rarely, in the contiguous gneiss—colour, pale yellowish and bluish green—the granite is composed of quartz and feldspar only, or with a very minute portion of mica, crystals of one and a quarter inches in diameter have been obtained from this place, they are from the veins on the surface and are seldom regularly terminated—were the rocks in the neighbourhood blasted, it is probable that large and perfect crystals might be procured.

10. *Graphic Granite*, at do. associated with beryl.

11. *Ligniform Asbestos*, at do.

12. *Schorl*, in brilliant and perfect crystals in a fine grained granite at do.

13. *Garnets*, in gneiss, do.

14. *Mica*, of a yellowish green colour in six sided tables attached to the sides of cavities in the gneiss which contains beryl.

15. *Specular Oxide of Iron*, associated with Quartz ta Cranston.

16. *Impressions on Shale*, at Valley Falls about two and a half miles north of Pawtucket.

17. *Tremolite*, at North Providence.

5. By Charles W. Shepard.

Cambridge, *Oct.* 8th, 1824.

Sir—

I have discovered a new locality of the green mineral, of which a notice was published in the last number of your journal. It is in Amherst. This mass is much larger than the one first found, and differs from it in being more uniformly coloured, not having whitish or yellowish spots distributed through it, and, likewise, in being of a deeper color. I have noticed, likewise, that, in a single place, it passes into common quartz. From the appearance of this mass, I think there is no doubt of its being the *hornstein eccailleux* of Brochant, which he describes as sometimes bordering on chalcedony.

In Belchertown, I have found very handsome *Amethyst*, contained in a rounded mass, about 18 inches in diameter, composed of imperfect, prismatic crystals of an extraordinary size, which shoot out from a quartzy gangue, containing galena, blende and copper pyrites. Many of these crystals terminate in regular pyramids at the surface. But just previous to their termination, the amethyst passes through them in a vein from one to two inches in width; and below the vein, are zigzag striae of milky quartz, which render many of the crystals very beautiful.

In the town of Oakham, fine specimens of *Adaluria* may be obtained in great abundance. It is sometimes found in six-sided prisms, which are several inches in diameter.

1. *Scapolite*, at Littleton, (Mass.) in a lime-quarry, owned by Mr. Wheeler. It is very abundant, and occasionally, finely crystallized.

2. *Vitreous Black Ox. Iron*, at the South Hampton Lead Mine. It is usually found investing carb. lead. It possesses a high vitreous lustre. It does not melt before the blow pipe; but immediately becomes strongly magnetic.

3. *Purple Copper*, at Chesterfield, (Mass.) It occurs in small quantities in the same rock with the green feldspar.

4. *Pinite*, beautiful specimens of this mineral have recently been found in Lancaster, (Mass.) by Mr. Charles Stedman of that place. It occurred imbedded in quartz, at one spot, and at another, in porphoritic granite. It is crystallized in six-sided prisms, terminated by planes. The solid angles, and the terminal edges of these crystals are often replaced by planes; and the lateral edges in some instances, from numerous truncations, are entirely effaced, the crystals becoming cylindrical. Their predominating aspect, however, is a four-sided, rectangular prism, owing to an undue extension of four sides of the primitive form. These crystals, although easily broken in almost any direction, separate best in directions parallel to their bases. They vary in magnitude, from two inches to three fourths of an inch in length, and from one to one third of an inch in diameter. They present several colors. Those of a dark brown, tinged with green, and the red are the most abundant. Their lustre is likewise very various. Some are almost dull, while others are quite glimmering. The dark colored crystals are opaque, but the lighter are translucent. When reduced to a powder, and moistened by the breath, they emit a strong argillaceous odour.

6. *Notice of Pebbles from Cape Horn.*

By Steuben Taylor.

New-Hartford, October, 1824.

Prof. Silliman,

Sir—I have for a number of years been gradually making a collection of pebbles. I have long believed that they would eventually be deemed as curiosities, and receive a place in the cabinets of those devoted to the study of natural science. I have recently obtained between five and six hundred which were gathered on the shores of Cape Horn. They present a truly interesting appearance. They have all a smooth surface, even those which are of a coarse texture; and some of them exhibit almost as fine a polish as if they had come from the hands of a lapidary. So far as I have examined them, they appear to consist of granite, gneiss, sienite, sandstone, porphyry, flinty slate, quartz, flint, chalcedony, jasper, agate and onyx. They of course exhibit a variety of colours; white, red, black, green, blue and yellow are the most common. They also present a variety of forms, such as globular, spheroidal, oval, lenticular, cylindrical, conical, &c. The surface of many of them is richly variegated. Some are striped, some are spotted, some are banded, and some of them are covered with various irregular and imitative figures. Most of them are opake; some are translucent; and some of them are semi-transparent.

7. By Dr. Samuel Robinson.

[*Remark.*—Specimens of the following minerals have been forwarded by Dr. Robinson, and we publish his list entire, although some of the localities have been already noticed in this Journal.—Editor.]

1. *Amethystine Quartz*,* Bristol.
2. *Augite*, in talcose slate, Middletown, R. I.
3. *Basanite*, Newport. 4. *Serpentine*, do.
5. *Shale*, with vegetable impressions, Popasquash Island.
6. *Staurotide*, in mica slate. Cannonicut Island. Jamestown.
7. *Garnets*, in talcose slate.
8. *Rhomb Spar*, *Green Talc*, *Fibrous Talc*, and *Quartz*, Smithfield.
9. *Macle*, Sterling, Mass.
10. *Yenite*, Cumberland.

* Other very fine specimens have been received, from the Franklin Society of Providence; they are from the same locality and are remarkable both for their size and the depth and richness of their colour. One piece cut, polished, and set in gold by Mr. George Baker, Jeweller, (No. 61, opposite the Baptist meeting house,) Providence, bears an advantageous comparison with the finest foreign specimens. Mr. Baker is, evidently, worthy of encouragement and patronage, from the friends of this elegant department of the arts.—*Editor.*

Rock Specimens for the American Geological Society.

1. *Talcose Slate*, containing common augite. This rock in ledges forms the western shore of Sechuest Point, S. E. part of Middletown.

2. *Gray Wacke*, or Puddingstone. It forms a mural precipice of seventy to eighty feet in height, in some places along the western part of Sechuest beach, in the S. E. part of Middletown, about two miles from Newport. This is the grandest exhibition of this formation which I have ever seen. It is composed of oval siliceous pebbles, which vary in size, from the smallest grains to five feet in length ; all of them much compressed and pointing N. and S. Colour, light bluish gray. This rock has transverse seams which are straight and perpendicular. Between two of these seams, perhaps five feet apart, at the highest part of the cliff, the rock is broken out and washed away by the surf, for thirty or forty yards from the shore, and forms what is called "Purgatory." This rock rests upon

3. *Argillite.*

4. *Granite*, Newport, a vein of which commences about 20 rods E. of the bed of serpentine and continues in a S. S. E. direction about 1¾ miles to the shore at Coggeshall's Ledge, passing under Coggeshall's pond, and is perhaps less than ¼ of a mile wide. E. of this granite is argillite, 3.

5. *Argillite*, forming the S. shore of Newport harbour, immediately N. of the bed of serpentine.

6. *Serpentine*, commencing one mile in a direct line S. W. from the Episcopal church, on Brenton's Neck, at a place called "Willow grove," on Thos. Hazard's land, S. of the rocks of *Limestone* in the S. part of the harbour, in an extensive bed, extending perhaps ¼ of a mile to the shore on the west.

7. *A Siliceous Slate* lies west of the granite ridge and

8. *Basanite*, is imbedded in the foregoing in different places, and more abundant 2¼ miles in a direct line S. W. by S. from the Episcopal Church, on the W. side of Price's creek, 60 rods from its mouth.

9. *Shining Argillite*, forming the shore of Cannonicut Island, N. of the light house, and near the ferry landing &c. &c. Jamestown.

10. *Granite*, at the amethyst locality, Mount Hope Bay, Bristol.

11. *Gray Wacke Slate*, forming a ridge on Popasquash Island, W. of Bristol.

12. *Gray Wacke*, forming the shore near Patuxet Village.

13. *Gray Wacke*, containing (Chlorophane) fluor spar, Providence. This rock, of a peculiar structure is frequent in this vicinity, and in Seekonk, Johnson, and Cumberland, where it is frequently traversed by veins of quartz, containing fluor spar; it sometimes contains small masses of various simple and compound minerals. It emits an argillaceous odour when moistened.

14. *Gray Wacke* slate, Johnson, 3 miles from Providence. Some of the *Gray Wacke* of this vicinity, about 3 miles below Providence, has straight seams, which in quarrying, give one good face to the stone. Those buildings, erected from this stone in the town, precisely resemble in color &c. those built of greenstone in New-Haven, and at a little distance, and without examination would easily be mistaken for the same.

15. *Limestone*, from a bed formerly quarried. Johnson, 3½ miles from Providence.

16. and 17. *Granite*, Johnson, four to six miles from Providence, lately quarried to a considerable extent, and adding beauty and durability to the new buildings in Providence.

18. *Gneiss*, Scituate, about 17 miles from Providence, extensively quarried, specimens of which may be seen in most of the new buildings, and in flag stones in Providence, which perhaps may boast of having the handsomest side-walks of any town in the U. States—laid with gneiss and mica-slate from Connecticut.

19. *Serpentine*, in a granitic hill, five miles from Providence, on the left of the Smithfield turnpike, on 'Jenke's Hill,' Smithfield.

20, 21, 22, and 23. Varieties of the limestone, at the Harris lime rock, Smithfield, about eight miles W. of N. from Providence. What is called "*the Harris Lime Rock*," forms three hills, about 200 yards from each other, situated in a kind of basin, surrounded by hills. The southern, or first has not yet been quarried. At the base of this, issue several springs of pure limpid water from caverns of perhaps two feet diameter, and unknown extent. The Middle hill is N. of the first, and the 3d is N. W. of the middle hill, between which a small brook meanders through a small patch of meadow. This latter hill furnishes the rhomb spar, and silvery talc, and lime of the best quality, called "Jointa," because it has frequent seams which divide the rock into irregular segments with a smooth face—when burnt the lime does not "air slack," so soon as most other lime, but continues in lumps. Adjacent to the W. side of this rock is a ledge of argillite, dipping at a very acute angle.

24. *Greenstone*, a vein about eight inches wide running nearly N. and S. through the middle lime rock, dipping E. apparently about forty-five degrees; another similar vein exists about fifteen feet E. of this, two and a half to three feet wide.

25. The principal rock in the hills and in the vicinity of the lime rocks.

26. *Slate*, forming a vein three to five feet wide, running E. and W. through the middle of "*the Dexter Lime Rock*," having an acute dip to the E. Some of it contains sulphuret of iron.

The Dexter Lime Rock, of much the same appearance and quality of the *Harris Lime Rock*, is situated a little more than a mile S. E. from the latter, and about ½ a mile W. of Blackstone river on the W. side of a basin, which is considerably elevated above the Blackstone, surrounded by hills of argillite.

60,000 casks of lime have been burnt in one year, from the Harris and Dexter rocks. It is said this lime will admit considerably more sand than most other lime and form as good cement.

27 and 28. *Sandstone Slate*, or micaceous sandstone, fair specimens of the formation of "Woonsocket Hill," about a mile S. of W. from Woonsocket village. *Smithfield.*

29. *Micaceous Sandstone*, or whetstone slate, a vein commencing about ½ a mile N. E. of Woonsocket Village and running S. W. about a mile. Some years from six to eight thousand dozen whetstones have been quarried in this place. but the average number for ten years past is

perhaps three to four thousand dozen, which are disposed of in New-England, New-York and Philadelphia—75 cents a dozen are obtained for them.

30. *Mica Slate*, Branch Factory, one mile N. W. from Woonsocket Village.

31. *Basalt*, found in two dikes or walls crossing the *Branch* of the Blackstone, at the Branch Factory, a few yards from and parallel to each other, nearly two feet wide, running about N. E. and S. W. consisting of columns of various sizes and figures in mica-slate.

32 and 33. *Sandstone*, overlying argillite, in immense ledges near the Blackstone, in Cumberland and Smithfield, some of it is traversed by perpendicular veins of white quartz.

34. *Argillite*, on the banks and near the Blackstone un derlying the sandstone. Cumberland and Smithfield.

35. *Granite*, Cumberland, a ridge running N. and S. between Cumberland Hill and Diamond Hill.

36. N. W. from Diamond Hill and E. of the granite.

37 and 38. *Quartz*, fair specimens of the formation of "Diamond Hill."

39. *Anthracite*, Cumberland.

40. *Anthracite*, North Providence.

41 and 42. *Shale*, do. at Valley Falls.

43. *Limestone*, and

44. The *Argillite*, which accompanies it. North Providence.

45, 46, 47, and 48. A suit of the *Gray Wacke slate* of *Pawtucket* Falls and village.

49 and 50. *Magnetic Iron stone*. This singular stone is very abundant in rounded masses, scattered over the surface about Cumberland Hill, Providence, and in Foster.

I intended to have added to the foregoing specimens a more detailed and correct sketch of the Geology &c. of this state, which for want of leisure and better health, I must postpone.

Providence, July 31, 1824.

* 8. By Jacob Porter.

1 *Blue Quartz*, of a good colour, in amorphous masses, Plainfield.

2. *Radiated Quartz*, in considerable quantity, Shelburne.

3. *Quartz*, a singular variety, Williamsburg. "This mineral," says a writer in the Hampshire Gazette for July 14th, 1824, "has the form of the hogtooth spar, incrusted with very minute crystals of quartz, but on breaking it is found to be hollow with larger crystals at its base, or in some few instances it is entirely filled up with semi-crystallized quartz."

4. *Prismatic Mica*, beautiful, Bellows Falls.

5. *Scapolite*,† very abundant by the road side, about a mile east of Hall's tavern, Charlemont.

6. *Epidote*, Rowe and Windsor. Wells—also at Plainfield, both crystallized and granular ; and at Williamsburg in quartz, remarkably beautiful.

7. *Cummingtonite*, of Dewey, Plainfield, in considerable quantities. It is perfectly well characterized, many of the specimens being elegant and even superb. This interesting mineral has also been discovered at Salisbury, Connecticut, by Charles A. Lee. It is well characterized, although less beautiful than that, which is found at Cummington and Plainfield.

8. *Ligniform Asbestos*, in serpentine, Zoar. H. M. Wells.

9. *Fasciculite*, of Hitchcock, Charlemont. H. M. Wells.

10. *Actynolite*, in large and beautiful crystals, associated with talc, at Rowe. H. M. Wells.

11. *Steatite*, Rowe, H. M. Wells.

12. *Magnetic Oxide of Iron*, in beautiful octaedral crystals, in chlorite at Rowe, also at Zoar. H. M. Wells. Also in octaedral crystals in chlorite with actynolite, at Windsor, also in similar crystals at Hawley.

13. *Carbonate of Iron*, Plainfield. It is beautifully crystallized in rhombs, which are nearly white, have a shining surface, and are frequently curved or undulated.

* Communicated for the Berkshire Lyceum.

† For my knowledge of this and several of the following localities I am indebted to Doctor Hezekiah M. Wells of Windsor.

14. *Siliceous Oxide of Manganese*, at Cummington, and Plainfield, at the latter place in considerable plenty. It is of a light but very lively rose red color with some lustre, has a structure somewhat granular, is translucent at the edges, and takes a fine polish. It is associated with the gray oxide; and around both the black oxide generally forms an envelope.

15. *Red Oxide of Titanium*, in quartz, at Whitingham, Vermont. H. M. Wells.

15. *Kyanite*, in small quantities at Cummington. The crystals are large and well defined, the color lively and delicate. It occurs in mica-slate, and is associated with quartz, garnets and black mica.

16. *Red Oxide of Titanium*, in good crystals is found at the same place, and sometimes in the same rock.

17. *Actynolite*, in the north part of Windsor. The crystals, which are large and elegant, occur in fascicular or radiated groups, or are confusedly intermixed. They are of a deep green colour with shining surfaces. The actynolite at this place is often associated with chlorite.

18. *Sulphuret of Iron*, finely crystallized in Quartz at Windsor and Savoy.

Magnetic Oxide of Iron, at Cummington.

19. *Red Oxide of Titanium*, well crystallized, at Plainfield.

20. *Siliceous Breccia*, uncommonly beautiful, at Cummington. It is composed of well cemented angular fragments of quartz, varying much in size and often with cavities between them.

21. *Fluate of Lime* and *Rubellite*, have been discovered at Bellows Falls, by Dr. H. M. Wells, and

22. *Sulphate of Iron*, at Adams, by Henry P. Phillips.

23. *Molybdena*, in a granite rock, Goshen, Mass.

Correction.—The white augite mentioned page 233, Vol. VIII, is, I believe, spodumene.

BOTANY.

Art. X.—*Physiology of the Gyropodium coccineum;* by the Rev. Edward Hitchcock.

The Gyropodium coccineum is a new genus and species of fungus recently established by the Rev. L. Schweinitz. I am not aware that it has been found any where except near Connecticut River in Massachusetts, where it was first noticed by Dr. Cooley, in Deerfield. That locality, however, was soon exhausted; but in Oct. 1822, I found it in abundance in Whately, an adjoining town, and noticed with much interest its peculiar and striking physiology. As severe frosts had occurred, however, previous to that time, I thought it possible there might be some deception in the case, and determined to wait till I could re-examine the plant under different circumstances. But it was not till the present year, (1824) that I was able again to visit the spot. I gathered it this year in September, before the occurrence of frosts; and found all my former observations verified, and was able to extend them still farther.

In the following remarks, it is not my intention, any farther than is necessary, to use botanical, but common *language*.* For if I mistake not, the facts are such as to interest, not only those acquainted with botanical phraseology, but likewise all, who love to trace the marks of divine wisdom in the works of creation.

It is one singularity in this fungus, that it is composed almost entirely of a substance scarcely to be distinguished from common gelatine obtained from animals, varying in consistency from the softest jelly to quite hard glue. The drawings accompanying this paper, represent the plant in its natural size. Its first appearance, on bursting from the soil, is given at A. It is then enclosed in a gelatinous en-

*If Mr. Schweinitz has published a description of this fungus, I have not seen it.

velope, like the *Phallus foetidus*, nearly a quarter of an inch in thickness. This immediately bursts, even before the whole body of the fungus has risen above the ground, and the exterior part of it falls upon the soil around the fungus in the form of a viscid jelly, and is ere long absorbed in the earth. The inner part of this envelope, however, which is of greater consistency than the outer part, still covers and conceals for a time the interior organization. At length it gradually dissolves, especially about the top, and discovers firmly attached to its inner side, a second thin covering of the head of the fungus, having its interior side of the brightest scarlet colour, and rather rough. A specimen dissected in a young state exhibits this envelope, covering every part of the spherical head, with no seam discernible in it. But ere long, it opens at the top and gives the fungus the appearance represented at B, beginning to separate into numerous divisions, or rays, like the opening calyx or petals of a common flower. Several valves on the top of the plant, opening into its head, are thus disclosed; whose particular costruction will be more explicitly described hereafter. A portion of the jelly, often $\frac{1}{10}$ of an inch thick, adheres to these calyx like divisions of the envelope now under consideration; and as the inner part of it is very tender, they rarely become more expanded than is represented at C, before they begin to coil inwards, and breaking off at the base, merely from their weight, they drop to the ground; or, as is more usual, adhere to the footstalk, as is shown at D. This footstalk is wholly composed of a harder kind of jelly, penetrated nearly to its centre by numerous irregular grooves and cavities, appearing on dissection, like strings of glue confusedly twisted together, and a softer jelly, in a partially dissolving state, covers it externally, which causes the falling pieces to adhere to it.

We have now reached the third and principal envelope of the head of the fungus. It consists of a leathery sack, nearly spherical, considerably tough, and when dry, as hard as glue. At its top, are several valves, (usually five to eight,) closing against one another with great exactness, and opening into the centre of the head. On penetrating this third envelope, or sack, we meet with a fourth, of a yellowish colour, very thin and delicate, occupying the whole of the cavity, but not attached to the sack containing it, except at the upper part, around the mouth or opening formed by the valves. This innermost sack is filled with a white pulpy mass, which, as the fungus advances to maturity, becomes a yellowish powder, very fine and light. There can be no doubt but this constitutes the seed; and the manner in which this is defended and discharged, is the most striking peculiarity in the fungus. The interior sack, containing this powder, or seed, although thin and tender, is quite elastic, considerably resembling deer's leather. The valves open directly into this sack, and when the seed is ripe, the sack gradually contracts, and thus forces open the valves and sends forth the powder; the envelope immediately enclosing it, not being compressed, or affected. This contraction of the inner sack, will, of course, produce a vacuum in the lower part of the outer one, or between the two, and draw up that containing the powder towards the mouth: for they are so firmly fastened together around the mouth that no air can pass into the cavity between the sacks. E is a vertical section of the head of the fungus, taken from a specimen in which the inner sack had so much contracted, that about half its contents were discharged. Whether the vacuum between the sacks is filled with atmospheric air, finding its way through some imperceptible interstice, or with a gas generated by the processes going on in the plant, are questions which I could not settle; though disposed to adopt the latter supposition. I am inclined also, to believe, that the air which fills this cavity, exerts an influence in forcing the contents of the inner sack through the valves. For, in some specimens, in an advanced state, I observed the inmost sack itself forced out of the mouth of the fungus, so as to turn it *inside outwards*, as is represented at D. And I can conceive of no way in which this could be effected, but by the pressure of the air beneath; and as the outermost of the two inner sacks is gelatinous, it contracts when beginning to dry, and this would produce the effect mentioned above of forcing out the inner sack. By a slight and rather sudden pressure upon a specimen half exhausted of its powder, I have often seen the powder thrown out in profusion to the distance of six or eight, and even twelve inches, and then it floated in the air, having nearly the same specific gravity.

There is a mechanism worthy of notice in the construction of the valves. It was necessary that these should close in such a manner as effectually to exclude moisture, since this would destroy the seeds, or prevent them from being thrown out of their receptacle. A single valve, forming a part of the sphere containing the powder, would hardly afford sufficient security in this respect; and the hinge would not possess strength and elasticity enough, to cause the valve to shut down close after several successive openings. The same difficulty would exist, had two valves been so placed on the top of the fungus as to close against each other, like the jaws of an animal.

But there was another object to be effected, which could not be attained simply by a double valve of the kind last mentioned. It was necessary that the opening for the escape of the powder should be of considerable magnitude, and the nearer it should approach the circular form, it is obvious, the greater would be the facilities for this process: and two valves, closing against each other, could not produce such an aperture. But as the valves to this fungus are actually constructed, they not only secure the contents of the inner sack from the access of moisture, but on opening present an aperture of a polygonal form. At F, on the plate, is a view of three sets of valves, taken from three specimens; the eye being placed directly above the centre of the plant, and looking down upon the edges of the valves when closed. It will be seen that these valves are all somewhat irregularly curved outwards, so that their convex sides are brought into contact; and yet they are so fitted to one another, that there is no interstice between them, when closed. This construction will also render the aperture somewhat polygonal, when the valves open; or rather it will be a *spherical polygon.* By this construction too, if I mistake not, a greater degree of strength and elasticity, will be imparted to the valves: for from their centre, or greatest height above the surface of the sphere constituting the head of the fungus, there is a gradual slope towards their extremities; which, as already remarked, curve outwards; and hence when they are pressed asunder, it is not merely on a line connecting those extremities that they yield, but also along all that part of the envelope between this line and the curve of the valve, and likewise in the valves themselves along their slopes. Are there not cases in practical mechanics, in which a construction similar to this might be adopted with advantage?

Thus, if I am not mistaken, (and I have taken much pains to attain the truth on the subject,) we find in this mere fungus, which, to the passing traveller appears to be a disgusting mass of half decayed vegetable matter, such evidence of contrivance and design, as is calculated to lead the thoughts irresistibly to a Great First Cause. How pleasant to meet with such mementos of Divine Wisdom where least expected! They remind the naturalist, that however far removed in his excursions from human society, he is still within the circle of Omniscience.

ART. XI.—*Caricography*; (continued;) by PROFESSOR C. DEWEY, *Williams College.*

[Communicated to the Lyceum of Natural History of the Berkshire Medical Institution.]

24. Carex *multiflora.* Muh.
Muh., Pursh, Eaton, Persoon No. 74.
Schk. tab. Lll. fig. 144.
C. *microsperma.* Wahl. No. 30, and Rees' Cyc. No. 54.

Spicis alternis approximatis bracteatis sessilibus; spiculis superne masculis ovato-oblongis obtusis bracteatis conglomeratis, fructibus ovatis acuminatis compressis dense imbricatis bifidis trinervósis divergentibus, squama ovato-cuspidata paulo minoribus.

Culm erect, 16—24 inches high, scabrous above, rather obtusely triangular, nearly round and leafy towards the base; leaves narrow, linear, channelled, shorter than the culm, sheathed towards the base; sheaths transversely rugose opposite the leaf; spike decompound, often more than two inches long; spikelets many, clustered into several larger spikelets, growing yellow; bracts long, leafy, scabrous and filiform under the spikes, and short, setaceous under the spikelets; stigmas two; fruit ovate, acuminate, bifid, scabrous on the margin, rather small, distinctly three nerved, very compact, and much diverging in maturity; pistillate scale ovate, somewhat ovate-lanceolate, awned, tawney with a green keel, shorter than the fruit, and its awn often projecting a little beyond the fruit.

Flowers in May—grows in moist meadows.

This is a variable species. The common variety is excellently figured by Schk., who has given three different forms of the fruit. There is much difference also in the magnitude and aggregation of the spikelets. I have never seen one specimen, however, whose spike would correspond to the character given by Pursh to this species: "spicis anguste paniculatis,"—the spike is not a *panicle*, and very rarely is supra-decompound. The fruit is much less compressed and less acuminate on some specimens. It would seem that a specimen of this kind was described by Wahl. under the name of C. microsperma in the following terms.

"Spiculis apice masculis in clavam supradecompositam crassiusculam conglomeratis, squamis cuspidatis, capsulis minutis ventricoso-ovalibus acuminato-subrostratis acutis-angulis subdivergentibus; foliis angustis."

25. C. *setacea.* (Mihi.)

Spicis sessilibus alternis approximatis bracteatis; spiculis apice masculis ovatis obtusis conglomeratis bracteatis; fructibus ovato-lanceolatis acuminatis compressis bifidis subdivergentibus, squama ovato-lanceolata aristata subæqualibus.

This new species has probably been confounded with C. multiflora. In its general appearance and in several characters it is very different from it, and from any species hitherto described. It appears to be intermediate between C. multiflora and C. stipata: its culm and leaves much resemble the latter, as well as its fruit, except that it is much more compressed, and its decompound spike and aggregation of spikelets are much like those of the former. Its fruit however is less ovate, longer and more compressed than that of C. multiflora. Its general characters are the following.

Culm 18—30 inches high, *acutely triangular*, very scabrous above, *furrowed* and striate on the sides, leafy; leaves linear, three lines broad, channelled, striate, nearly as long as the culm, shorter below; sheath glabrous, striate, white and membranous on the side of the stipule; stipule ovate, acute; spike decompound, two inches long; spikelets many, aggregated into several approximate spikes, ovate-cylindric, obtuse, becoming tawney, all bracted, staminate above; bracts rather long and narrow and scabrous under the spikes, short and setaceous under the spikelets, and giving to the spike a *bristly* appearance; fruit ovate-lanceolate, acuminate, bifid, slightly plano-convex, often slightly 3—5 nerved, growing yellow, scabrous on the margin, rather loose, and somewhat diverging; pistillate scale ovate-lanceolate, tawney, green on the keel, and with its awn about the length of the fruit.

Flowers in June and July—matures its fruit in August—grows in clusters in wet upland meadows with C. multiflora and C. stipata; but is a later plant than either.

NOTE.—In both the preceding species, as well as some others, the awn or cuspidate part of the scale is very liable to be broken off before the fruit is matured; and the examination of this part requires much care and caution.

26. C. *Deweyana*. Schw.*

Spiculis subternis sessilibus ovatis alternis subdistantibus apice femineis, suprema ebracteata; fructibus oblongo-lanceolatis rostratis acuminatis bifurcatis plano-convexis margine subscabris, squama oblongo-lanceolata breve aristata hyalina paulo longioribus.

Culm 1—4 feet high, slender, weak, subprocumbent, triangular, scabrous above, leafy; leaves subradical, flat, linear-lanceolate, striate, shorter than the culm, glabrous;

* See the "Analytical Table of Carices," by the Rev. L. D. De-Schweinitz, in the "Annals of the Lyceum of Natural History of New-York," Vol. I.—to which the reader is referred for the names of the new species of Mr. Schweinitz.

sheaths striate, glabrous, white on the side of the stipule; spikelets 2—4, generally 3, staminate below, ovate, often approximate, but commonly rather remote, 3—5 flowered and loosely imbricated, all bracted except the highest; bracts long, slender, filiform, the lowest often surpassing the culm; stigmas two; fruit oblong-lanceolate, convex on the upper, and flat on the lower side, acuminate, beaked, forked, subscabrous on the margin; pistillate scale oblong, lanceolate, white, and transparent with a green keel, awned, and a little shorter than the the fruit. The colour of the whole plant is yellowish green.

Flowers in June—grows on the borders of moist rocky woods on hills, never in clusters. In Williamstown on the east side of Stone Hill, one mile from the College. Also in Plainfield.

The pistillate scale is somewhat variable, being sometimes more ovate and shorter, and at other times more lanceolate and very nearly as long as the fruit.

This species resembles C. *remotiuscula*, Wahl., but differs from his description in the number of the spikelets, and in the pistillate scale and fruit. From his C. *tenuiflora* it differs in its spikelets, fruit, and leaves, and is clearly different from this species as given by Schk. tab. Eeee fig. 187. It differs from C. disperma, Vol. VIII. p. 266, of this Journal, in the position of its staminate florets, and in its fruit and scale. From the following species it differs in several important characters.

27. C. *trisperma*. (Mihi.)

Spiculis ternis remotis alternis sessilibus ovatis apice femineis, suprema ebracteata; fructibus oblongis acutis vel breve rostratis plano-convexis ore integerrimis multinervosis apice subscabris sub-divergentibus, squama oblonga acuta hyalina longioribus.

Culm 18—24 inches high, slender, prostrate, filiform, triangular, glabrous, leafy; leaves very narrow, linear, shorter than the culm; sheaths striate, glabrous; spikelets 3, staminate below, ovate, remote, often an inch apart, 2—4-fruited, but very generally 3-fruited, the two lower supported by filiform, scabrous bracts surpassing the culm; stigmas two; fruit oblong, convex above and plain below, slightly many-nerved, acute or shortly beaked, entire at the orifice, and slightly scabrous near the apex; pistillate scale oblong, acute, or ovate rather long acute, white and hyaline with a green keel, and about two-thirds as long as the fruit. The colour of the whole plant is light green.

Flowers in June—grows in the form of bogs in sphagnous places among hills—Williamstown—Deerfield.

Though related to C. tenuiflora, this species is manifestly different from the fig. in Schk. It differs from C. disperma in having the stamens below, as well as in the fruit of its scale. It differs considerably from the fig. of C. loliacea, L. in Schk. tab. Pp. fig. 104. It seems proper to give a new name to our plant in the present state of uncertainty respecting this European species. It is evident however, from the language of both Schk. and Wahl. that C. loliacea is a somewhat variable species, and ours may ultimately be considered a variety of it. To aid in the examination, it may be proper to subjoin the following description from Wahl.

"C. *loliacea*: spiculis basi masculis subdistantibus ternis paucifloris, squamis brevibus, capsulis subovali-ellipticis utrinque convexiusculis obtusis obtusangulis divaricatis ore integerrimo, bracteolis setigeris: foliis angustissimis. C. *loliacea* Linn. confer Schkuhr tab. Pp. fig. 104? *Hab.* in pratis paludosis Sueciæ rarius."—Wahl. no. 47.

It scarcely needs remark that the characters of the fruit and scale of C. loliacea in this description are materially different from those of C. trisperma as already given. The obtuseness of the fruit is as distinctly marked in the figure of Schk. as in this description of Wahl. C. *trisperma* is the species which Sprengel, in a letter, is believed to have named C. *quaternaria*.

28. C. *novæangliæ*. Schw.*

Spicis distinctis distigmaticis; spica staminifera breve solitaria tenue ex eadem basi cum suprema fructifera; spicis fructiferis binis vel ternis subremotis sessilibus ovatis alternis paucifloris bracteatis; fructibus ovali-subtriquetris

* "Analytical Table of Carices," already referred to.

subventricosis costatis rostratis minutè pubescentibus, squama ovata mucronata paulo longioribus.

Culm 6—8 inches high, slender, subdecumbent, triangular, leafy, and reddish towards the base; leaves linear-lanceolate, soft, slender, glabrous, shorter than the culm; stigmas two; staminate spike single, erect, slender, and its scale oblong, rather obtuse, and reddish, with a white edge; pistillate spikes 2—3, ovate, sessile, about 4-flowered, erect, and supported by long, leafy, scabrous bracts about equalling the culm; fruit oval, or somewhat obovate, a little inflated, small, somewhat 3-sided, beaked, slightly 2-toothed, sub-pubescent when young, scarcely pubescent in maturity, distinctly ribbed; pistillate scale ovate, mucronate, yellowish-red on the edges, and green on the keel, a little shorter than the fruit; root creeping.

Flowers in June and July—grows in rather open woods on Saddle Mountain, at an elevation of nearly 3000 feet above the sea;—this is the only known locality—here it is abundant.

This species is related to C. varia and C. marginata, but differs more from either than they do from each other; and is with propriety considered by Mr. Schweinitz as a new species.

29. C. *flava*. L.
Pursh, Mx. Eaton, Ree's Cyc. Pers. No. 126
Schk. tab. H. fig. 36.
C. *flava?* Wahl. No. 61.

Spicis distinctis tristigmaticis; spica staminifera solitaria subtriquetra ex eadem basi cum suprema fructifera et breve pedunculata; spicis fructiferis ternis ovato-oblongis approximatis incluse pedunculatis; fructibus ovatis dense imbricatis bidentatis costatis cum rostro curvato reflexis, squama ovato-lanceolata majoribus.

Culm 12—20 inches high, rather obtusely triangular, scabrous above, leafy; leaves linear-lanceolate, flat, rather narrow, striate, longer than the culm, shorter below; sheaths striate, stigmas three; staminate spike single, short-peduncled, with a brownish-red, oblong-lanceolate scale; pistillate spikes 2—4, usually 3, ovate or short oblong, cylindric, densely fruited, and short peduncled;

bracts long, leafy, surpassing the culm, with short sheaths wholly inclosing the peduncles; fruit ovate, sub-inflated, beaked, ribbed, reflexed, with the beak a little curved; pistillate scale ovate-lanceolate, brownish-red, green on the keel, and about two-thirds the length of the fruit; the whole plant glabrous and of a yellowish colour.

Flowers in May—grows in wet upland meadows about hills—abundant in Stockbridge and Lenox in this county, and in Pownal, Vt. Also in Plainfield. Found in the northern parts of Canada according to Mx. Also at Phillipston, N. Y.—Dr. Barrett.

This species appears not to have been found by Muh. and Ph. does not give any definite locality. Though it seems to be a larger plant than the European, yet it exactly resembles the fig. in Schk. and the European specimens with which I have compared it.

30. C. *scabrata*. Schw.*

Spicis distinctis tristigmaticis; spica stamenifera solitaria triquetra pedunculata; spicis fructiferis subquinis subremotis exserte pedunculatis cylindraceis alternis suberectis cum longis foliaceis bracteis instructis; fructibus ovato-oblongis rostratis subventricosis subbifidis scabris, squama ovato-lanceolata acuminata margine subciliata apice scabra longioribus.

Culm 1—2 feet high, acutely 3-sided, striate, scabrous above, leafy; leaves linear lanceolate, rather broad, scabrous on the edges and upper side, nearly the length of the culm, striate; staminate spike single, shortly pedunculate with its scale lanceolate, brown with a green keel; stigmas three; pistillate spikes 3—5, cylindric, upper one nearly sessile, the others pedunculate, the lowest often very distant and long pedunculate, a little nodding, rather remote but sometimes pretty near; bracts long, broad, leafy, the lower ones much surpassing the culm, upper ones with short sheaths, and all the sheaths shorter than the peduncles; fruit ovate-oblong, beaked, acuminate, subventricose, shortly 2-toothed, somewhat two-edged by means of two opposite nerves or ribs forming obtuse sides, covered with a scabrous adhesive pubescence in it younger state, and in maturity scabrous; pistillate scale ovate-lanceolate, with a scabrous point, brown, white and sub-ciliate on the edge and green on the keel and about two thirds as long as the fruit ; the whole plant rough, very glabrous, and its colour a deep green.

Flowers in May—grows in wet situations at the foot of hills, and in tufts along brooks.

This plant is abundant in Berkshire Co., and was considered an undescribed species before it was sent to Mr. Schweinitz, who gave it the above name in the "Synoptical Table of Carices." It has been thought by some to be a variety of C. pellita, Muh.—but it is so different from that species in a great many characters that there can be no doubt that it is made a new species with the utmost propriety. The *roughness* of its fruit is a very peculiar character.

31. C. *retrorsa*. Schw.

Spicis distinctis, tristigmaticis ; spicis staminiferis subternis, suprema longa pedunculata tenue, ceteris brevibus parvis sæpe basi fructiferis sessilibus ; spicis fructiferis subquinis oblongis cylindraceis approximatis subfasciculatis cum bracteis foliaceis incluse pedunculatis, infima sæpe perremota longe et incluse pedunculata ; fructibus ovatis inflatis rostratis bifurcatis nervosis reflexis, squama lanceolata duplo longioribus.

Culm 18 — 30 inches high, obtusely triangular, scabrous above, large and leafy ; leaves linear-lanceolate, scabrous on the edges and midrib above, nerved, puncticulate or knotted, longer than the culm, flat and rather broad ; staminate spikes about 3, rarely one, the highest long, slender and pedunculate, the others short, sessile, and often pistillate at the base ; staminate scale oblong, rather obtuse, brownish ; stigmas 3 ; pistillate spikes 4—6, often clustered at the apex into a kind of fascicle, and closely imbricate, upper one sessile, others short-pedunculate and their peduncles nearly inclosed in the sheaths of the bracts, the lowest one often quite remote with a long inclosed peduncle ; bracts leafy, scabrous, much longer than the culm ; fruit ovate, inflated, with a long, acuminate, bifurcate beak, glabrous, nerved and bent backwards ; pistillate scale lanceolate, brown with a green keel, extending scarcely to the beak or about half the length of the fruit; the whole plant glabrous, large, and its colour yellowish green. The lower pistillate spikes are sometimes branched, having one or two spikelets attached to them.

Flowers in May; grows in clusters about pools of standing water—abundant.

This species is clearly different from C. lupulina, Muh., the C. lurida, Wahl. It more nearly resembles C. gigantea, Muh., but differs from it in several obvious characters.

32. C. *Schweinitzii.* (Mihi.)

Spicis distinctis, tristigmaticis; spicis staminiferis binis, suprema longa gracile pedunculata; spicis fructiferis quaternis oblongis cylindraceis subapproximatis incluse pedunculatis subpendulis cum bracteis longis poliaceis; fructibus ovato-oblongis supra attenuatis rostratis inflatis bifurcatis nervosis glabris, squama lanceolata subulata subsetacea longioribus.

Culm 6—12 inches high, triangular, scabrous above, very *leafy;* leaves linear lanceolate, nearly flat, seabrous on their edges, with striate sheaths; staminate spikes two, sometimes one, the highest long, slender and pedunculate, the other short, sessile, and sometimes pistillate below with a slender, filiform, scabrous bract long as the spike; staminate scale oblong-lanceolate, brownish, white on the edges; stigmas 3; pistillate spikes 3—5, usually 4, long, cylindric, rather near, somewhat pendulous, rather loose flowered, upper one sessile, the middle ones shortly and exsertly pedunculate, the lowest often rather remote and pretty long—exsertly pedunculate; bracts long, leafy, flat, scabrous on their edges, surpassing the culm, with rather short, striate sheathes; fruit ovate-oblong, attenuated above, beaked, ventricose, nerved, glabrous, 2-forked, pistillate scale lanceolate, subulate, somewhat bristle form, subscabrous, and about two thirds as long as the fruit; the whole plant glabrous, sub-decumbent, and its colour yellowish.

Flowers in June—grows in wet, sandy soil, at the foot of the descent to the alluvial of the Hoosick in this place, and Pownal, Vt.—abundant.

This plant is very different from any species in Schk., and was named after that distinguished examiner of the genus to which it belongs, the Rev. L. D. de Schweinitz, by whom it was announced in his " Analytical Table of Carices" in the *Annals of the Lyceum* of New-York, Vol. I.

33. C. *pyriformis*. Schw.

Spicis staminiferis et fructiferis distinctis; spica staminifera solitaria abbreviata pedunculata ebracteata; spicis fructiferis ternis *distigmaticis* oblongis laxifloris subpendulis exserte pedunculatis sub-approximatis bracteatis; fructibus obovatis vel pyriformibus obtusis nervosis sub-ventricosis ore integris, squama ovata acuta vel breve mucronata longioribus.

Culm about 6 inches high, triangular, somewhat procumbent, scabrous above, leafy; leaves subradical, narrow, striate, with striate sheathes and concave stipules; staminate spike single, short and pedunculate, with a tawney, oblong, obtuse scale; stigmas two; pistillate spikes three, oblong, loose-flowered, upper one nearly sessile, two highest rather near, the lowest rather remote and often long and exsertly pedunculate; bracts leafy, much surpassing the culm, with short sheaths and shorter than the peduncles; fruit obovate or pear-shaped, sometimes nearly spheroidal, ventricose, obtuse, nerved, sometimes with a very short beak or projection, glaucous when young, yellowish when mature; pistillate scale rather various, ovate and acutish, sometimes ovate-obtuse and shortly mucronate, reddish brown, white on the border and greenish white on the keel, from half to nearly the length of the fruit; plant small, suberect, and partially glaucous.

Flowers in May—June—grows in cold wet soil—not uncommon in Berkshire Co.—plenty near the College.

To the specimens forwarded to M. Schweinitz, he gave the above specific name from the common form of the fruit. This species seems to be nearly related to C. aurea, Nutt.; but differs in having only *two* stigmas, and in the common form of the fruit. It seems too to resemble some varieties of C. tetanica, but does not agree with the description of that species.

34. C. *pellita.* Muh.
Muh. Ph. Eaton, Pers. No. 189.
Schk. tab. Nnn fig. 149 and 150.
C. *striata.* Mx.

Spicis staminiferis et fructiferis distinctis; spicis staminiferis binis oblongis inferiore sessili et bracteata; spicis fructiferis tristigmaticis binis vel ternis cylindraceis erectis; fructibus ovatis breve rostratis bicuspidatis subtriquetris pilosis, squama ovato-lanceolata aristata subæqualibus.

Culm 18—24 inches high, triangular and scabrous above, nearly round below, leafy; leaves linear-lanceolate, nearly *flat*, scabrous on their edges, striate; sheaths striate, with a concave stipule; staminate spikes about 2, or 2—4 according to Muh., cylindric, highest pedunculate, others sessile and shorter, with an ovate or oblong rather obtuse scale and dark brown on the edge and light coloured on the keel; stigmas three; pistillate spikes 2—3, oblong, cylindric, erect, long or short, the highest often sessile, the lowest sometimes long-pedunculate; bracts long, leafy, scabrous on their edges, surpassing the culm, with short sheaths; fruit ovate, striate, partially 3-sided, little ventricose, densely pubescent, acuminated into a short bicuspidate beak; pistillate scale lanceolate or ovate-lanceolate, awned, dark coloured on the edge and light coloured on the keel, nerved and glabrous, sometimes longer or shorter than the fruit; plant, except the spikes, glabrous and green.

Flowers in May—grows on the wet alluvial of the Hudson opposite Troy—in a marshy upland meadow just east of Poughkeepsie—rather rare.

There can be little doubt that this species is the C. *striata,* Mx., or that C. *lanuginosa* Mx. is the C. *filiformis,* Goodn., which has been so often mistaken for C. *pellita.* C. *filiformis* however has *involute* leaves, and a different scale, and is altogether a more rigid plant in its appearance. C. *pellita* cannot be mistaken for C. *trichocarpa,* as the fruit of the latter is more *remote* and much *inflated* at the base, as well as of a different shape.

There are two varieties of C. *pellita,* both of which are figured by Schk., and Muh. has remarked some other varieties in the spikes. I have rarely seen a specimen with more than two staminate spikes, and have never found a pistillate spike which was staminate below on this species.

35. C. *bullata.* Schk.
Pursh, Eaton, Persoon No. 205.
Schk. tab. Uuu fig. 166.

Spicis staminiferis et fructiferis distinctis; spicis staminiferis ternis longiusculis, suprema pedunculata, infima bracteata; spicis fructiferis tristigmaticis binis exserte pedunculatis oblongis cylindraceis subnutantibus; fructibus ovatis globosis inflatis erectis glabris costatis cum rostro sub-hispido bifurcato,squama lanceolata duplo longioribus.

Culm 20--30 inches high, rather slender, triangular, scabrous above, leafy; leaves linear-lanceolate, scabrous on the edges, rather stiff, striate, longer than the culm, shorter below; sheaths striate; staminate spikes 2—3, highest pedunculate and long and slender, the lower shorter and sessile and the lowest bracted; stigmas 3; pistillate spikes 2--3, oblong, cylindric, rather erect, with peduncles longer than the sheaths; bracts with shortish sheaths, leafy, scabrous, surpassing the culm, narrow; fruit ovate, globose, much inflated, ribbed or strongly nerved, glabrous, with a scabrous or subhispid and bifurcate beak; pistillate scale rather broad-lanceolate, reddish brown on the edge and green on the keel, and about half the length of the fruit; plant glabrous and light green. One of the staminate spikes is sometimes androgynous.

Flowers in May—grows in marshy places or among bogs. I have found it only in a meadow nearly a mile south of the Meeting-house in Sheffield in this County; Deerfield—Rev. Mr. Hitchcock; Penn. by M. Schweintz. Though Pursh says it is *common*, it has rarely been found. This species is finely drawn by Schk, and is readily distinguished from the other species in Ph. and Eaton.

36. C. *pseudo-cyperus*, L.
Muh., Ph., Eaton, Agh., Rees' Cyc, No. 140, Pers. No 169.
Schk. tab. Mm fig. 102.

Spicis staminiferis et fructiferis distinctis; spica staminifera solitaria pedunculata; spicis fructiferis tristigmaticis pedunculatis cylindraceis crassis pendulis, bracteis subamplectentibus longe foliaceis subapproximatis; squamis setaceis; fructibus oblongis acuminato-rostratis reflexis triquetris nervosis bicuspidatis. Wahl. No. 117.

This description, taken chiefly from Wahl., is applicable to both the European and American specimens. No difference between ours and the foreign specimens is observable, so far as I have compared them, except in the length of the pistillate scale which is shorter than the fruit on the American plant. In other respects the resemblance is complete. C. *pseudo-cyperus* is readily ascertained in its mature state. It has very little resemblance to our other species, and to none in Schk. except C. *recurva*, Schk, the C. *Forsteri*, Wahl. a native of New-Zealand. Muh. remarked its resemblance to this species; but besides other particulars, C. *Fosteri* always has staminate florets at the base of the pistillate spikes. There is no sufficient reason for considering our plant to be different from the European C. *pseudo-cyperus*.

The following are the general characters of our plant.

Culm 2—3 feet high, large, acutely triangular, rough and stiff, scabrous on the angles, leafy; leaves linear-lanceolate, rough, striate and knotted, about the length of the culm; staminate spike single, (sometimes two according to Muh.) long, rather slender, pedunculate, sometimes with a bract; staminate scale lanceolate, mucronate, and yellowish; stigmas 3; pistillate spikes, rather long and large, close-fruited, cylindric, recurved, pendulous, rather near, with filiform, scabrous, rather flattened peduncles; sheaths scarcely any, but long, large, leafy bracts much surpassing the culm and rough; fruit oblong-lanceolate, acuminate, reflexed, nerved, glabrous, with a slender, widely forked beak; pistillate scale lanceolate, mucronate, bristly, scabrous, and about two-thirds as long as the fruit; plant glabrous, and of a yellowish green.

Flowers in May—June,—grows in clusters on the borders of ponds.

Muh. observes that the two upper pistillate spikes originate from the same bract, and Agardh has seen instances of the same in Sweden; in all the specimens I have observed here or seen from Europe, each spike has its own bract.

37. C. *castanea.* Wahl.

Spicis staminiferis et fructiferis distinctis; spicis staminiferis solitaria; spicis fructiferis tristigmaticis crassiusculis brevibus subdensifloris, pedunculis longe exsertis retrocurvis, bracteis laxe vaginantibus foliolatis distantibus, squamis brevibus; fructibus oblongis attenuatis patenti-divergentibus ore unilobo; foliis hirsutis. Wahl. No. 90.

This species, which appears to be very distinct, is credited by Wahl. to N. America. Being different from any species I have seen, I have given the description from Wahl., in the hope that the plant may be detected by some fortunate botanist and be known by its proper name.

38. C. *pubescens.* Muh.
Muh., Pursh, Eaton, Pers. No. 151.
Schk. tab. Eee fig. 126.

Spicis distinctis; spica staminifera solitaria triquetra subsessili; spicis fructiferis tristigmaticis ternis oblongis sublaxifloris erectis bracteatis, infima pedunculata; fructibus ovata-triquetris rostratis ore sub-integro pubescentibus, squama ovato-oblonga mucronata carinata paulo majoribus; foliis culmoque pubescentibus.

Culm 10—20 inches high, rather slender, rather procumbent; leaves linear-lanceolate, rather flat, striate, shorter than the culm; staminate spike single, about sessile, with a whitish, oblong, rather obtuse scale green on the keel; stigmas 3; pistillate spikes 3, oblong, erect, loose-flowered, rather near, two upper nearly or quite sessile, the lowest pedunculate; bracts leafy, nearly equal to the culm above, with scarcely any sheaths; fruit ovate or oval, 3-sided, acuminated into a shortish beak with the orifice very shortly 2-toothed, covered with pubescence; pistillate scale ovate-oblong, mucronate, whitish, green on the keel, and scarcely long as the fruit; plant of rather a deep green, and culm, leaves, sheaths, bracts and fruit pubescent.

Flowers in May—grows in moist meadows, and along the borders of woods.

Art. XII.—*List of the Rarer Plants found in Alabama*; by Melines C. Leavenworth, M. D. (Communicated in a letter to Charles Hooker, M. D.)

Dear Sir,

Agreeably to your request I have made out a list of the rarer plants which I have observed in Alabama, not mentioning the few new species described by me, in the 7th Vol. of the Am. Journ. of Science. This list is made out from recollection, and I know it does not include all the the rare plants which I have seen in that state.

Justicia brachiata, (on the banks of the Alabama at Cahawba)
Ixia cælestina, (prairies in the neighborhood of Demopolis)
Obolaria virginica, (Cahawba)
Dodecatheon media, (Demopolis)
Villarsia cordata, (Coneucah County)
Narthecium americanum, (Demopolis)
Phalangium esculentum, (do.)
Anemone bulbosa, (do.)
Æsculus macrostachya, (Monroe)
Vaccinium album, (Tuscaloosa)
Hydrangea nivea
Gillenia stipulacea
Talinum teretifolium
Cyamus pentapetalus, (Mobile)
Vallisneria americana, (do.)
Gerardia cuneifolia? (This plant which grows in the prairies of Green County, is probably new and undescribed. I mention it to direct the attention of Botanists to it.)
Seymeria pectinata, (do.)
Illicium floridanum, (Tuscaloosa)
Cardamine uniflora, (Jefferson County)
Dalea alopecuroides, (prairies)
Petalostemum violaceum, (do.)
Polygala corymbosa
Cacalia tuberosa, (Demopolis)
Acacia glandulosa, (Green County)
Silphium gummosum, E. (Perry County)
Mikania glutinosa, E. (Perry County)
Pogonia ophioglossoides, (Cahawba)
Triphora pendula, (Perry County)
Tragia macrocarpa, (do.)
Melothria pendula, (do.)
Podostemum ceratophyllum
Cyamus nelumbium, (Tombigby below Demopolis)
Panax quinquefolia, (Tuscaloosa)
Polemonium reptans, (do.)

New-York, Dec. 25th, 1824.

ZOOLOGY.

Art. XIII.—*On Hybernation;* by Isaac Lea of Philadelphia.

This is a subject that has excited much and peculiar interest. My object is not to enter into the minutiæ of the subject but to take a general view and relate some of the most interesting facts which I have been able to collect with regard to it.

There may be said to be four species of hybernation—i. e. in the case of those animals that change their covering—of those that lay up food—of those that migrate, and of those that remain torpid during the winter months.

Dr. Reeve has described hybernation as a continuance of life under the appearance of death, a loss of sensibility, and of voluntary motion, a suspension of those functions most essential to the preservation of the animal economy; "these constitute," he continues, one of the most singular problems in the whole range of natural philosophy."

When we look upon this subject with a philosophic eye, the mind is struck with astonishment at the wonderful compensation made those animals which have not the power of locomotion, and which are so situated as to be deprived of food by the approach of severe cold. Their adaptation to this situation, is beyond the power of the human mind to explain, as we find so many cases which seem to prove an opposite principle. It would appear from the general idea we have of the subject that cold was a necessary cause to induce this state; but this is not always the case. The Tanric Caudatus, an inhabitant of India and Madagascar, becomes torpid and continues so nearly six months. The Dipus Sagitta is equally torpid in Siberia and in Egypt; but nature is not always true in this respect, for we are told by Dr. Barton that many animals that become torpid in Pennsylvania are not so in the Carolinas, so that this repose is not absolutely necessary, as some authors on this subject have supposed. It is not therefore requisite to the animal economy, as in sleep, to prepare it for further exertions.

The number of animals that hybernate, is much greater than we generally imagine. Dr. Reeve says "the number of hybernating animals is greater than that of those which remain unaffected by cold." p. 5. When the thermometer sinks to about 50°, animals that hybernate retire to their hiding places, in trees, rocks, and the earth, where they will be most secure from their enemies. Here they roll themselves up, exposing the least possible surface to the action of the air, and remain in a quiescent state until the return of a more vertical sun warms them into life. Dr. Reeve's ideas on the influence of cold on the system are so good I quote them at length.

"The cessation of muscular action seems owing to the lowered temperature of the muscles themselves, because, when the transmission of nervous influence is prevented by dividing the nerve and destroying the brain, the irritability is suspended and recovered exactly in the same manner by the operation of cold as in the ordinary state of torpid animals. The loss of motion and sensation, therefore, is owing to the diminished irritability of the muscular fibres, and that again is caused by the action of cold, and by suspended respiration; the capillaries of the vascular system appear to become contracted by the loss of animal heat; and this diminution always begins at the surface of the body and gradually increases to the centre, as observed in examples of numbness from cold, and in applying the thermometer to different parts of animals whilst they are gradually becoming torpid. We see these animals resist the propensity to torpor, until by the gradual diminution of their heat and the want of a supply from the absorption of oxygen at their lungs, and at the surface of their bodies, the irritability is so far lessened that it becomes itself a cause of its own deficiency, by arresting the respiration, and consequently depriving the heart of its supply, which is furnished by the coronary arteries."—Reeve, p. 55.

Spallanzani never found the temperature of torpid animals below 36° although exposed to a much greater degree of cold. In this situation, the action of the digestive and respiratory organs ceases. He could perceive no motion with a microscope, in the flanks of a bat when the thermometer was at 43°. Sir John Hunter introduced worms &c. into the stomachs of lizards, and on examination during the winter found the food unchanged; those that were kept until spring voided it unchanged, thus clearly proving the total suspension of the digestive functions.

In this state all sensation appears to be lost, and one function of life alone seems to remain, that is, circulation. Limbs have been broken, and wounds made in animals with every appearance of insensibility. It has been proved that a confined circulation is carried on through the heart and the larger veins and arteries.

Mr. Carlisle states "that all hybernating mammalia possess a peculiar structure of the heart and its principal veins; the superior cava divides into two trunks, the left passing over the left auricle of the heart opens into the inferior part of the right auricle."

Spallanzani says—

"I have often opened Newts, Frogs, Toads, and Lizards, when torpid from cold, and apparently dead; and I have found that the blood did not circulate in the limbs, while it continued to circulate in the large vessels, although the circulation was languid. If a greater degree of cold has penetrated the solids, if it has coagulated the blood, then it is certain the animals perish."—Spallanzani, p. 269.

While examining this subject it is necessary for us to guard against the similarity of suspended animation and hybernation. Spallanzani resuscitated animalculæ after having been in a dry state for 27 years, by adding water to them. In this case air was not essential, nor in hybernation do we find it absolutely so. Spallanzani found that torpid bats lived seven minutes in an exhausted receiver, while another bat died in three minutes. In another experiment a bird and rat did not live one minute in carbonic acid gas, yet a torpid marmot remained an hour, and then recovered on being exposed to the warm air.

Gen. Davis in the Lin. Soc. Transactions, has given us a description of a torpid Dipus Canadensis, which was completely deprived of the benefit of air; he says,

"It was discovered enclosed in a ball of clay, about the size of a cricket-ball, nearly an inch in thickness, perfectly smooth within, and about twenty inches under ground. The man who first discovered it, not knowing what it was, struck the ball with his spade, by which means it was broken to pieces, or the ball also would have been presented to me. How long it had been under ground it is impossible to say; but as I never could observe any of these animals after the beginning of September, I conceive they lay themselves up sometime in that month or the beginning of October when the frost becomes sharp, nor did I ever see them again before the last week in May or beginning of June. From their being enveloped in balls of clay, without any appearance of food, I conceive they sleep during the winter, and remain for that term without sustenance."—Lin. Soc. Trans Vol. IV, p. 156.

Thus it appears that life may be preserved in a torpid state without respiration, and this gives countenance to the frequently asserted fact that live toads have been taken from sandstone and other recent rocks. As a further argument in favour of this fact, I will mention that Spallanzani kept frogs and serpents alive for three years and a half at the temperature of 38° and 39°. In this case we cannot suppose that nourishment was necessary, and we are told by the same philosopher, that fat is not essential to torpidity as some persons have supposed. Dr. Monroe's hedge hog lost, during four months' torpidity, only two ounces, and a tame marmot kept by Pallas, very fat, continued awake all winter although exposed to the same severe weather that rendered the rest of its species torpid in Russia; but we have other instances where every attempt has been in vain exerted to keep animals from becoming so.

Some animals become torpid when their food fails them, and are thus preserved until accident shall bring them a supply. Mr. Gough preserved a large garden snail three years without food in a perforated box. An operculum, was formed at the mouth of the shell, and it remained in this dry state dormant until the end of the time when it was revived by putting it in water at 70.°

The same gentleman relates an experiment which clearly proves that the cricket may be revived and induced from his winter retreat by the encouraging warmth of a fire.

"The crickets," he says, "were brought from a distance, and let go in the room in the beginning of Sept.

1806; here they increased considerably in the course of two months, but were not heard or seen after the fire was removed. Their disappearance led me to conclude that the cold had killed them: but in this I was mistaken; for a brisk fire being kept up for a whole day in the winter, the warmth of it invited my colony from their hiding places, but not before the evening, after which they continued to skip about and chirp, the greater part of the following day, when they again disappeared, being compelled by the returning cold to take refuge in their former retreats. They left the chimney corner on the 28th of May, 1807, after a spell of hot weather, and revisited their winter residence on the 31st of August. Here they spent the summer merely, and lie torpid at present, (Jan. 1808,) in the crevices of the chimney, with the exception of those days on which they are recalled to a temporary existence by the comforts of a fire."—Reeve, p. 84.

The precautions taken by animals when about to enter their torpid state, indicate the power of instinct. The frog sinks deep into its muddy bed beyond the reach of frost, and the dipus envelopes itself in its clay cloak. The land testacea, the helix, pupæ, &c. retire into crevices and form an operculum to exclude the air. An animal reviving from a torpid state is equally an interesting object. I quote the following description of the hampster from the Edinburgh Encyclopedia.

"When the hampster passes from his torpid state, he exhibits several curious appearances. He first loses the rigidity of his members, and then makes profound respirations, but at long intervals. His legs begin to move, he opens his mouth, and utters rattling and disagreeable sounds. After continuing this operation for some time, he opens his eyes and endeavours to raise himself on his legs. All these movements are still unsteady, and reeling, like those of a man in a state of intoxication; but he repeats his efforts till he acquires the use of his limbs. He then remains in that attitude for some time, as if to reconnoitre, and rest himself after his fatigues. His passage from a torpid to a natural state is more or less quick, according to the temperature."—Edin. Encyc. Vol. X. pt. 2d. p. 745.

It has been observed that animals which do not hybernate possess a temperature considerably higher than the medium they inhabit, while those that do, are but a few degrees more elevated than their surrounding medium. Sir John Hunter, in his experiment on the power of animals producing heat, had frequent occasion to place fish in a reduced temperature, and uniformly found that when the subject of his experiment was no longer able to generate heat sufficient to resist the effects of cold, the part frozen could not be completely recovered. In all his experiments upon the freezing of animals, he was unable to restore the actions of life by thawing, from which the conclusion may be drawn that circulation once completely stopped, can never be recovered. An earth-worm frozen at the same time was completely dead when thawed.*

The moulting of birds as well as their migration is a species of hybernation. The first is a preparation for winter, and their change of colour, adapting itself to the season, frequently perplexes the ornithologist, and causes spurious species.

The change of seasons produces its influence on the secretive organs to increase the clothing of animals, as well as the reverse; thus we find the dogs of Guinea and the sheep of Africa almost without fur, and in Scotland the wool is pulled from the sheep when ready to fall off. The same cause, perhaps, produces its effects more powerfully on animals than on birds. The ermine, whose fur is so valuable, undergoes four changes.

"During the summer months its hair is of a pale reddish brown colour; in harvest it becomes clouded with pale yellow; and in the month of November, with us, it is of a snow white colour. Its winter dress furnishes the valuable fur called Ermine. Early in spring, it becomes freckled with brown, and in the month of May it completely resumes its summer garb."—*Edin. Encyc.* Vol. X. part 2nd, p. 731.

The migration of birds has been noticed by our earliest historians, and their wonderful precision and order have ever been a source of delight to the observation of the student of nature. Their periods and habitation so well

* Animal Economy, pp. 109, 112.

understood and practised by themselves call forth all our admiration.

In ornithology no individual member of the family has excited more interest or more discussion than the swallow (hirundo.) Its immersion has often been asserted, and as often contradicted. The archbishop of Upsala was the first person who suggested the idea that this bird passed its winter beneath the icy wave, and he asserts that they are frequently found in massive clusters in northern lakes; but all this is just as true as what the learned archbishop says about showers of mice. Linnæus was of opinion that the chimney swallow and the martin immersed themselves, but that the swifts or common swallow of Europe hybernated in church towers, &c. Many other naturalists of eminence have maintained the same idea, but I do not believe it to be upheld by one well attested fact, and I hope to prove it to be equally contrary to truth, as it is contrary to reason.

If we examine the conformation of the common swallow, (Hirundo Americana,) we find that every part of it is peculiarly fitted for flight, and it certainly is one of the most rapid of birds. Having therefore the power of locomotion to so great a degree, why should we suppose it to leave its aerial element and sportive joyous windings, to remain in an insensible state for seven months in a muddy and watery bed? It has been urged that we do not see it on its flight to the south like the pigeon and other birds; but the minute observer is not less sure of their migration. On the approach of cold weather the swallow may be seen in the evening to pass over our low grounds skimming the surface of the fields to the south in such numbers that hundreds have been counted in a minute, their rapid flight conveying them in a few hours to a more congenial temperature. The difficulties of the migration of birds vanish when we consider the great rapidity of their flight.

"A Falcon which belonged to Henry the IVth of France, escaped from Fontainbleau, and in twenty-four hours was found at Malta, a distance computed to be no less than 1350 miles: A velocity nearly equal to sixty-seven miles an hour, supposing the falcon to have been on wing the whole time. But as such birds never fly at night, and allowing the day to be at the longest, his flight was perhaps equal to seventy-five miles an hour."—*Edinb. Encyc.* Vol. X. part 2nd, p. 737.

If we calculate the flight of the swallow to be equally rapid as that of the falcon, the bird that this morning bade adieu to its summer nest within our barns, might in two days rest his weary wings beyond the isthmus of Panama.

If the swallow emerged in the spring from a watery bed, its resuscitation would be governed by the thermometer; but this is not the case. Foster says,

"I have sometimes seen them as early as April the 2d, when the mercury in the thermometer has been below the freezing point. On the other hand, I have often taken notice, that during a continuance of mild weather for the space of a fortnight, in the month of April, not so much as one swallow has appeared."—*Foster on the Swallow.* p. 13.

Let us now examine why this bird should not hybernate as it has been repeatedly asserted to do. If we try its specific gravity we shall find it requires some weight to sink it in water. It disappears too at a time so early that it is impossible the cold could produce torpidity, and we cannot suppose it to be voluntary. When animals become torpid it is because their food is no longer to be procured, and they are so by necessity; but it is not the same with the swallow. It loves the soft breezes of the south, and almost the first north wind reminds it of its equinoctial haunts.

Adanson, in his voyage to Senegal, states that four swallows alighted on his vessel in October, when fifty leagues from the coast of the latter place; and that they winter in Senegal, where they roost on the sand of the shore, and never build in that country.

Sir Charles Mager, first Lord of the admiralty, relates that on entering soundings in the British channel, a large flock of swallows covered every rope of his vessel, and appeared "spent and famished." Many instances of this kind could be related if it were necessary, but those few well attested facts are deemed sufficient to prove the act of migration.

With regard to the point of their migration it may be safely concluded to be so far south on both continents as not to be touched by the cold. Capt. Henderson, of the British army, relates that he saw myriads in Honduras, where they remain from October to February. They then roost in the marshes, from whence in the morning they rise in a spiral form to a great height and disperse to seek their food; when rising in this manner, he says, they resemble large columns of smoke.*

A Mr. Pearson of London, some years since took great pains to ascertain if the swallow became torpid. For this purpose he confined some of them in a cage, where they remained in a perfectly healthy state for three or four years, when they died for want of attention during his illness.

It has been asserted, and frequently, believed that the rail or sora (Rallus Carolinus) also assumes a state of torpidity during winter. Although I cannot urge the rapidity of the flight of this bird, as a reason for its not becoming torpid, I can, with truth, say I believe its wings are sufficiently strong to carry it beyond the reach of frost. If it remained here during the winter, is it not likely it would have been discerned? Yet we have not a single well authenticated relation of this. A farmer of Maryland, (Mr. Wilson tells us,) asserted that they changed into frogs, that he found one in the very act of its transformation, and that he showed it to one of his labourers; but it does not appear he ever satisfied any other person as to this *fact*.

On reviewing the subject I think we may safely conclude that a torpid swallow never yet has had an existence.

* My friend Mr. Ord informs me he has seen the swallow in the south of France in December, and was assured they remain there all the winter. It is strange this fact should not have been observed by the naturalists of Europe.

PHYSICS, MATHEMATICS, CHEMISTRY, MECHANICS, &c.

Art. XIV.—Prof. E. Kellogg *on the passage of Lightning.*

To the Editor,

Some of the effects described below are such as are not often produced by the descent of the electric fluid ; at least, I have not witnessed them, nor seen them described. If you think the account may interest your readers, please to insert it in your Journal.

On the 28th of May, 1824, the lightning fell upon a tree, about a foot in diameter, standing one or two hundred yards from the house of Ephraim Tucker, in Vernon, Conn. The fluid left few marks of its course down the tree, but tore up the earth very much at the foot of it and made, in one direction, a furrow eight or ten feet in length, by following a root that ran three or four inches below the surface, and throwing off the turf in ragged portions. No other effects of the fluid were to be seen near the tree. At the distance of thirty feet from the tree runs a *post-wall*, bounding the meadow and separating it from the highway ;—a low wall of small stones, surmounted by two rails supported by posts standing in the wall. In the highway near the wall at this place, begin to appear marks of the passage of the fluid below the surface. The sod in some places seemed to be a little raised along the line of its course towards the road. The road here is formed in the middle of a highway sixty-six feet wide, as turnpike roads are commonly built, by raising a path twenty-feet wide or more, with earth taken from the edges of it, which are thus sunk so as to form ditches commonly four or five feet wide, and one or two deep. From the wall to the ditch, and across the *road* and *ditch*, the fluid *ccrtainly passed under groued*, and almost in a straight line. Before reaching the ditch, it passed under a thick bunch of bushes, forming a matted bundle of roots and earth two or three feet in diameter and raised a little above the adjoining surface. In coming from beneath this cluster of bushes which stood near the ditch, the fluid came so near the surface as to throw off considerable lumps of earth from the side of the ditch, and raise and crack the surface all along its course across the bottom of it. It does not seem to have come out of the ground here; but continuing under ground, it went square across the road, cracking and crumbling the surface very much, eight or ten inches in width, and raising a convex ridge from two to four inches high, a ridge exactly resembling, except in size, those produced by a common species of mole passing near the surface. The fluid seems to have passed the road ten or fifteen inches deep. The soil is here somewhat gravelly, and the road trodden very hard. In approaching the ditch on the other side of the road, the fluid threw off from the edge of the road, a large cake of hard earth, eight or ten feet long, and from one to four wide. This was not entirely broken up; but was pushed a little forward, broken into large masses, and some of it crumbled. The fluid was here divided into three portions, and took as many different directions. In two of these directions it left marks of violent action along the surface. The third portion plunged under a very thick and matted clump of roots of small bushes, and came out on the opposite side, at a distance of ten feet, and in ten or fifteen feet more spent itself. The only circumstance that can be thought peculiar in this case, is the passage of the electric fluid for such a distance under the surface of the earth; and that without following any such substances as commonly guide its course there, as roots, stones, &c. The fluid seems not to have been guided at all by any attracting substance, but to have been carried forward nearly in a straight course by a momentum it had received, through a medium opposing the most powerful resistance; a medium in which it is commonly supposed to be almost immediately dissipated and lost. The fluid certainly passed thus from the wall to the second ditch; a distance of nearly fifty feet, and after passing this ditch, one portion of it passed ten feet through or under a very tough clump of roots. Without any difficulty, I thrust a stake six or eight feet long its whole length beneath a clump of bushes, along the course of the fluid; while my strength was insufficient to make it penetrate at all in any other direction. And along the whole fifty feet, the evidence of its having passed, was indisputable. How the fluid passed through the thirty feet from the tree to the wall, may perhaps not be thought quite so certain; as it left no signs of its passage above ground, and no indubitable ones could be discovered below by thrusting down a staff. But for myself, I cannot doubt the first part of its course was similar to the latter part; but passing below a thick and strong turf, and perhaps a little deeper, its course could not be so easily traced. If the fluid did not pass under ground the first part of its course it must have come out of the ground a few feet from the tree, leaped thirty-feet through the air to the wall, and without leaving any trace of its influence on the post and rails, or displacing the small stones which composed the wall,* sunk quietly down through the wall to its foundations, and there gone off as above described at right angles to the wall, in the direction of a line from this spot to the tree. I cannot doubt that it passed the whole way from the tree under ground.

Art. XV.—*A new method of resolving Equations of the third and fourth degree.* By Alexander C. Twining.

To resolve a general equation of the third degree.

Let the given equation be,

$$x^3+3ax^2+3bx+c=o, \text{ and put } z+r=x;$$

Then we have,

$$z^3+3\overline{r+a}.z^2+3\overline{r^2+2ar+b}.z+r^3+3ar^2+3br+c=o.$$

Assume, $(r+a)(r^3+3ar^2+3br+c)=(r^2+2ar+b)^2$;

Expanding; $r^4+4ar^3+\overline{3b+3a^2}.r^2+\overline{c+3ab}.r+ac=$

$$r^4+4ar^3+\overline{2b+4a^2}.r^2+4ab.r+b^2;$$

And uniting: $\overline{b-a^2}.r^2+\overline{c-ab}.r+ac-b^2=o.$ (A)

* One of the portions of the fluid after it forked, fell into a heap of similar stones, and threw them about very much.

Put $a'=r+a,$
" $b'=r^3+2ar+b,$
" $c'=r^3+3ar^2+3br+c$

Then, $z^3+3a'z^2+3b'z+c'=o$, also $a'c'=b'^2$.

$mz^3+3a'mz^2+3b'mz+c'm=o$

$z^3+3a'mz^2+3b'mz+c'm=\overline{1-m}.z^3$.

Assume $(a'm)^2=b'm$

Then also $(a'm)^3=c'm$; For, $\frac{(a'm)^4}{a'm}=\frac{(b'm)^2}{a'm}=\frac{b'^2}{a'}m=c'm$

Substitute values;

$z^3+3(a'm).z^2+3(a'm)^2.z+(a'm)^3=\overline{1-m}.z^3$. $\therefore z+a'm=\sqrt[3]{1-m}.z$

$a'z+a'^2m=\sqrt[3]{(a'^3-a'^3m}.z$, $a'z+b'=\sqrt[3]{(a'^2-b')a'}.z$.

$(a'+\sqrt[3]{(b'-a'^2)a'}.z=-b'$, $z=-\frac{b'}{a'+\sqrt[3]{(b'-a'^2)a'}}$

$=-\frac{r^2+2ar+b}{r+a+\sqrt[3]{(b-a^2)(r+a)}}$

From this we derive the

Rule.

To find x, when $x^3+3ax^2+3bx+c=o$;

(A) Find r in the quadratic, $\overline{b-a^2}.r^2+\overline{c-ab}.r+ac-b^2=o$,

(B) Put $z=-\frac{r^2+2ar+b}{r+a+\sqrt[3]{(b-a^2)(r+a)}}$

And $x=z+r$.

In those questions which are embraced by the irreducible case of Cardan, it will be seen that the value of r is imaginary. For then, if $x^3+3bx+c=o$, $br^2+cr-b^2=o$, whence $2br+c=\sqrt{c^2+4b^3}$; which gives an imaginary value, whenever b^3 is negative and exceeds $\frac{c^2}{4}$. When these two quantities become equal, the imaginary part of the expression vanishes; and, in the general solution, we have $2\overline{b-a^2}.r+c-ab=o$. (C)

This solution fails (in the case where no solution is needed) when $a^2=b$. For then the expression (B) becomes $z=-r+a$, whence $x=-a$; which would be, in most cases, false, the true value of x being $(-a+\sqrt[3]{a^3-c})$.

To explain this, let it be observed, that the assumption $(a'c'=b'^2)$, see (A), requires that $c=a^3$, whenever $b=a^2$. (E)

When the lower term of (B) vanishes, the upper vanishes with it.

For as $r+a=-\sqrt[3]{\overline{b-a^2}\cdot\overline{r+a}}$, $\therefore$ $\overline{r+a}^3+\overline{b-a^2}\cdot\overline{r+a}$ $=o$. Or, $\overline{r+a}^2+b-a^2=r^2+2ar+b=o$.

Therefore, $z=-\frac{o}{o}$; an expression which might seem indeterminate. In reality, however, since both terms vanish together, and the upper is in its form of two dimensions, while the lower is only of one, the whole expression will vanish, and $z=-o$; $x=r$.

To investigate the cases in which this will occur;— Since $(b'^2=a'c')$ and b' is now equal to nothing, either a' or c' must equal nothing. But if a' is 0, $b'-a'^2=0$. $\therefore r^2+2ar+b-(r^2+2ar+a^2)=b-a^2=0$, which cannot be supposed, for the reason stated in (E).

Next suppose c' to become evanescent. Or,

$$r^3+3ar^2+3br+c=0.$$

$$\text{But } (r^2+2ar+b)(r+a)=r^3+3ar^2+br+2a^2r+ab=0.$$

$$\text{Whence } \quad 2\overline{b-a^2}.r+c-ab=0$$

This therefore is the case already considered in (C).

To resolve a general Equation of the fourth degree.

Let the given equation be, $x^4+4ax^3+6bx^2+4cx+d=0$.

$x^4+4amx^3+4cmx \quad =\overline{1-m}.x^4-6bmx^2-dm,$

Add $(4a^2m^2+2\frac{c}{a})x^2+\frac{c^2}{a^2}$, to both sides;

$$x^4+4amx^3+(4a^2m^2+2\frac{c}{a})\,x^2+4cmx+\frac{c^2}{a^2}=\overline{1-m}.x^4+$$
$$(4a^2m^2+2\frac{c}{a}-6bm)x^2+\frac{c^2}{a^2}-dm.$$

$$(x^2+2amx+\frac{c}{a})^2=\overline{1-m}.x^4+(4a^2m^2-6bm+2\frac{c}{a}).x^2+$$
$$\frac{c^2}{a^2}-dm.$$

Assume the last member $=(\sqrt{\overline{1-m}}.x^2+\sqrt{\frac{c^2}{a^2}-dm})^2$.

Then $\quad \sqrt{1-m}\times\sqrt{\frac{c^2}{a^2}-dm}=2a^2m^2-3bm+\frac{\ }{a}$ (A)

Also $\quad x^2+2amx+\frac{c}{a}=\sqrt{1-m}.x^2+\sqrt{\frac{c^2}{a^2}-dm}$ (B)

Now (A) $\quad 4a^4m^2-6ba^2m+2ac=\sqrt{2a^2-2a^2m}\times\sqrt{2c^2-2da^2m}$, Put $2a^2m=z$.

Then $\quad z^2-3bz+2ac=\sqrt{2a^2-z}\times\sqrt{2c^2-dz}$.

Expanding; $z^4-6bz^3+(4ac+9b^2)z^2-12abcz+4a^2c^2=$
$4a^2c^2-2a^2dz-2c^2z+dz^2$.

Transpose and divide by z; $z^3-6bz^2+(4ac+9b^2-d)z-$
$12abc+2a^2d+2c^2=0$. (C).

Then (B) $ax^2+2a^2mx+c=\sqrt{a^2-a^2m}.x^2+\sqrt{c^2-da^2m}$.

$ax^2+zx+c \quad =\sqrt{a^2-\frac{z}{2}}\,.x^2+\sqrt{c^2-\frac{dz}{2}}$ (D)

From this we have the

RULE.

To find x, when $x^4+4ax^3+6bx^2+4cx+d=0$.

(C) Find z, in the cubic, $z^3-6bz^2+(4ac+9b^2-d)z-12abc+2a^2d+2c^2=0$.

(D) Find x, in the quadratic, $ax^2+zx+c=\sqrt{a^2-\frac{z}{2}}.x^2+\sqrt{c^2-d\frac{z}{2}}$.

It may be seen that this solution might also be applied to eqnations of the third degree; for every such equation may by simple multiplication by any quantity, $(x+w)$ be raised to one of the fourth degree, containing a variable in its co-efficients. In the cubic (C,) if we destroy the second term by substitution, the remaining co-efficient in the resulting equation is $(4ac-3b^2-d)$; and, as (w) enters but once into each of the quantities denoted by a, b, c, d, it is evident that the co-efficient named, can never rise higher than to the second degree. It may, then, be supposed to vanish; and the given equation is reduced to a cubic of the form, $z'^3+c'=o$.

Neither of these solutions presents any advantages in practice. Whatever value they possess, must be ascribed to the fact that they are apparently *new* in their form, and in the mode of investigation.

New-Haven, —— 1822.

Art. XVI.—*Formula for the Preparation of the Sulphate of Rhubarb.*

Philadelphia, Oct. 29, 1824.

To the Editor,

Dear Sir,

Having succeeded in the preparation of sulphate of rhubarb, which has been administered with success and satisfaction by several of the faculty of this city, I am induced to offer you my formula for the next Journal, as it differs somewhat from that given by A. Nani in Vol. VII; should you esteem it worthy you will greatly oblige

Yours very respectfully
GEO. W. CARPENTER.
No. 294 Market-st. Philad.

Boil for half an hour 6 lbs. of coarsely bruised Chinese Rhubard in 6 galls. of water acidulated with two and a half fluid ounces of sulphuric acid, strain the decoction and submit the residue to a second ebullition in a similar quantity of acidulated water, strain as before and submit it again to a third ebullition, unite the three decoctions, and add by small portions recently powdered lime, constantly stirring it to facilitate its action on the acid decoction. When the decoction has become slightly alkaline it deposits a red flocculent precipitate which is to be separated by passing it through a linen cloth and dried, after which reduce it to powder and digest in three galls. of alcohol at 36° in a water bath for several hours, which dissolves the Rhubarbine, separate this solution from the calcareous precipitate, distill off three fourths of the alcohol, there then remains a strong solution of Rhubarb, to which add as much sulphuric acid as will exactly neutralize it, evaporate this slowly to dryness, the residuum will be of a brownish red colour, intermingled with brilliant specks, possessing a pungent styptic taste, soluble in water, and its odour that of the native Rhubarb.

This preparation is a concentrated form of the active principle of that valuable cathartic, separated from the ligneous and mucous portions, and bears the same relation to the crude substance as Quinine does to Peruvian Bark. It is well worthy the attention of Physicians, as the quality of rhubard is so various that the dose is very uncertain. This preparation will be of uniform strength, and may be administered safely to new born infants.

The sulphate which I procured from the above has been sold in this city by C. Marshall, Junr. Druggist.

Art. XVII.—Mr. Patten's *Air Pump, Gazometer, and Balance Beam.*

Newport, R. I. Nov. 1st. 1824.

To the Editor,

Dear Sir,

The remarks of Prof. Dana upon the Air Pump that you did me the honor to insert in your Journal, necessarily require from me a reply. How far it may be possible for two persons, at no inconsiderable distance apart, and without a knowledge of each others plans to construct two instruments so similar in their "details," that it shall be difficult to tell the one from the other, is a question I shall not pretend to decide, but shall content myself with believing with the majority, that such a coincidence though possible is not at all probable. That the same principle should at the same time be discovered by two persons, is I acknowledge more probable; but to substantiate this, some higher evidence than mere assertion will be required. Now the fact is, that instead of the plans having been proposed by me *some months* since, as I said, it should have been *some years*—how many I cannot exactly say, but the instrument that was constructed to try the principle, and to which I alluded, was made in the winter of 1821, and was then at least shown to a number of my acquaintance, among whom was my particular friend and classmate Prof. Ruggles of the Columbian College at Washington, and Mr. James Stevens a remarkably intelligent and ingenious civil engineer of this place; it was also known to several scientific gentlemen in Providence, one of whom was Prof. D'Wolfe. The succeeding winter was spent in New-York and it was then again shown to many different persons; if I remember rightly, one was Prof. Griscom. Now unless Prof. Dana can go behind these dates, the "credit" will I believe rest where it belongs, and the insinuated charge of borrowing will return to the source from which it originated. With regard to to the proposed "improvement" I regret the Prof. did not take the trouble so examine the modus operandi of an instrument, the "details" of which he considers to "coincide" so nearly with his own; had he done so, it would have saved him the trouble of constructing in place of the valves, a substitution that is altogether useless. The object of the instrument proposed by me was to gain a vacuum in a receiver as nearly torricellian as the elasticity of the air would permit; the obstacles to this had always been the weight of the valves, and the difficulty if not impossibility of making a piston fit so nicely into a barrel that there should be no air below or around it; and lastly to prevent the vapor of the oil necessarily used, from interfering with the exhaustion. The principle proposed to overcome all these obstacles at once, was to make one fluid not easily vaporable, expel another, and was founded upon the self apparent axiom that two bodies cannot at the same time occupy the same space; if therefore the globe K, (see plate Vol. VIII, No. 1.) is *full* of mercury, there is evidently no air in it, and when the mercury descends by taking off the pressure, the vacuum is torricellian unless there is a communication with the receiver R; but in order to drive out *all* the air, it is necessary that the mercury should rise completely up into the valve S. Now it was to insure its doing this that the cap O was made with a view to contain a surplus quantity of mercury, and to supply any waste or contraction or to receive any that should be driven out by expansion. The valve S therefore, as will be seen by inspection, floats upon the mercury in the cap O, and almost the whole must return into the globe before the valve can close, it then does it so effectually that no air can possibly enter; upon the next return of the mercury not only all the air is expelled from the globe, but likewise the surplus mercury, and is retained in the cap. Now this object could not be attained by the proposed "improvement," for if by the contraction or waste the mercury should not ascend entirely up to the plug of the stop cock, there would of course be a quantity of air left in the globe, and should there be an expansion, the mercury would be thrown out at the aperture; but a great objection to it is, that any method that could be proposed to open or shut the cock except by hands, would be either inconvenient or complicated, and after all the "improvement," seems to be an awkward alteration of the very cock that is now upon the pump; for let that cock be as represented in fig. 2nd, (Pl. 2, Vol. VIII, No. 1.) if now the plug be turned "half round," (see the Prof's. description,) so that the back of the plug is against the hole *a* in the *bulb*, then there is only a communication between the receiver R and the globe K; —now let an exhausition be made, then turn the plug "one quarter round," with its hole *a* downwards, the air now from the globe can escape only into the atmosphere through the hole *a* drilled in the bulb where it should be, and not through a useless and crooked one that interferes with the screw that holds the plug tight—it is therefore apparent that as yet the only way of closing the aperture is by valves, and if constructed with the least accuracy, I can conceive no more efficient or secure way of doing it, and their weight in this case is a matter of perfect indifference as it is impossible from the manner of opening and shutting them, that they should interfere with the exhaustion. If I have not already intruded too far upon your patience, I transmit for insertion, a modification of the other pump, or rather an adaption of the principle to the ones of the usual construction; it was cotemporaneous with the first but I did not send it at that time, as I considered the other the most perfect; the only objection however to this is that it has an air tight collar, and the vapor of the oil is not removed; but it has its advantages—there is no glass that can be broken—it takes but an ounce or two of mercury—and there are no caps to be cemented to the glass, a difficulty that you feared might be experienced. ABCD represents an iron barrel with a solid piston E, the piston rod works through an air tight collar at F; at G is a valve opening inward at H and I valves opening out; K is the plate of the pump connected with the top and bottom of the barrel by the tube *aaaa*—the top of the barrel is made with a rim round it for the purpose of holding an ounce or two of mercury—through the piston rod a small diagonal hole is drilled as at *h*, fig. 2nd, and which when it is in the position it now is, opens a communication between the receiver and the barrel;—we will now now suppose the piston close to the bottom as in the figure, if the cock be turned as soon as the aperture at *h* passes the hole leading from the receiver K, all communication between the barrel, and *it* is cut off, the air therefore in the barrel is driven out through the valve at I. There is upon the *piston* about the eighth of an inch of mercury represented by the dots, but before this can come in contact with the top of the barrel it must have expelled every particle of air, and if the piston ascends any higher this mercury is itself expelled through the same aperture and is retained by the rim as represented by the dots, and the valve I, floats upon it. If the piston be now made to descend, the mercury runs back until the weight of the valve brings it in contact with the aperture; it then is effectually closed, with still a quantity of mercury round it: the piston continues to descend until it gets nearly to the bottom, when the tube *h* coinciding with the hole in the tube *aaa* lets in the air from the receiver K. Fig. 2nd shows the manner of connecting the tube *aaa* wiih the collar F, and also the diagonal hole L through the piston rod used instead of a valve. The lower part of the barrel with its valves H and G, acts as a common pump, and the air is admitted though the cock M.

Another instrument I enclose for your inspection is a simple method of making the common gazometer hold nearly double the usual quantity of gas, and which may be used instead of Pepys' ingenious gas holder. ABCD is the common gazometer, E is the outer cylinder with its frame AB. F is the inner cylinder, which instead of being soldered tight to the bottom as usual is screwed down by three or four angular pieces as in fig. 4th; at G is a valve opening inwards, and which is shut by a pretty strong spring, (an inch and a half of strong watch main spring is sufficient,) to the valve is connected the brass wires *aaa*, and at H the wire goes through a collar, and has a thumb screw upon it. To use it, press down the cylinder E as usual, turn the thumb screw H, which opens the valve G, pour in water and the air all escapes through the tube K, let the gas enter at D and the cylinder E rises, when it is full close the aperture at D and press down the cylinder E, the water in the cylinder F is expelled between the two outer cylinders at the aperture L; and its place supplied through the valve G, by the gas that was in the cylinder E; now if the cylinder is again filled with gas through D, both it and the cylinder F are full and may be used at the stop cock at H; that in the cylinder E by pressing it down, and that in the cylinder F by pouring in water between the two outer cylinders. If it is to be used as a Pepys apparatus, remove the cylinder E and its frame work AB, open the valve G by the thumb screw H, and fill the cylinder with water, shut the valve aud introduce the gas at the aperture C through the tube P which has a valve upon it to prevent the water or air from escaping, (shown in fig. 5th,) as the gas comes through P, the water escapes between the two outer cylinders at the tube L, and as this tube is above the top of the cylinder F there will always be a quantity of water upon it that answers instead of the dish in Pepys; if a jar is to be filled with gas, let it be first filled with water, and inverted over the valve G, turn the screw H and it is instantly done, because the gas in the cylinder F is pressed by the weight of a column of water of the height C*h*; the whole should be well japanned and the cylinder F should not come close in contact with the bottom of the outer cylinder.

Another instrument I take the liberty of sending you is a balance beam, intended to take specific gravities and to weigh articles of inconsiderable magnitude with a degree of accuracy not easily attainable by the usual method. One great objection to the usual balance is the difficulty of getting the points of suspension of the scales to be at equal distances from the point of suspension of the beam; another is the friction—this alone is sufficient to prevent the substance to be weighed from containing an *exact* quantity of matter with the weight used, for suppose a beam to be so nicely constructed as to turn with the tenth of a grain—now to weigh a hundred grains, that weight will be put into one dish and the substance into the other, but the tenth of a grain must be added before the scale has turned perceptibly, it therefore exceeds one hundred grains by the tenth of a grain, and the weights can only be equivalents when the index is at rest, which may be any where within the quantity required to turn the beam—sufficiently accurate for all common purposes, but not for weighing the gases and taking accurately specific gravities; and in analysis where the weights are often repeated it amounts to considerable. The only accurate method is to make the weight itself the standard. (I believe a French proposition.) To do this is the object of the beam ABC, (fig. 6th.) made of steel, sufficiently strong but light, the dish is suspended at A, the beam itself upon an axis at B; at C is the milled head of a long screw that is fitted with a shoulder and axis, and goes through the slide E that traverses upon BC and carries the weight D. Now suppose it is wished to obtain 10 grains, place that weight in the dish F, and screw back the weight D until it exactly counterbalances it—if the weight be now removed and a quantity of the substance to be weighed be substituted until the index points to where it did at first, there will then be very nearly the exact weight with but small allowance for friction—for were this beam a common one, and so nicely constructed as to turn with the 100th part of a grain, it would by making the distance from AB four times greater than from B to D, the point of suspension of the weight—turn with the 400th part of a grain. It is apparently an objection that 100 grains at A will require 400 at D, but the fact is settled by Coulomb that this kind of friction does not increase in an equal proportion with the weights used, that is, if with a pound in each scale, a beam turn with one grain, if there were two pounds in each, it would not require two grains.

This beam may be used as a steel yard by screwing the weight D to any number marked upon the scale, and should a greater quantity be required than that marked in the first line, another weight double of D may be substituted. These instruments are a few of a number I had occasion for while engaged in studies to which I was once particularly attached, but as they are in a great measure incompatible with my professional occupation, I am compelled in a great measure with reluctance to abandon them; when leisure and disposition again combine, I will send you, should you think they may he of *any* use to the scholar or the analyst, some further communications,

very respectfully,

your obd't. ser't.

JOSEPH H. PATTEN.

Art. XVIII.—*Professor Wallace, in reply to the Remarks of B. upon his paper on Algebraic Series, contained in Vol. VII. of this Journal, page* 278.

Columbia, S. C. Sept. 10, 1824.

Mr. Editor,

Your correspondent Mr. B. in Art. XI. of your Journal for May 1824 has, it appears, made some *profound* discoveries relative to a communication of mine, inserted in the Journal for Feb. 1824. Permit me to rectify some of Mr. B's. *mistakes*, and place the subject in its proper light. I am very unwilling to subject Mr. B. to the imputation of *mala fides*, or of a want of knowledge; and I am still more unwilling to revive, in any degree, the polemical spirit of ancient writers who scarcely communicated with each other, except in the way of attack or reproach, and in a manner too little creditable to their candour or impartiality.

Mr. B. commences his observations on the "*new algebraical series*" given by me, and endeavours to shew that these series can hardly be called *new*, &c. In my communication, Mr. Editor, I no where called them new. My introduction was omitted in the Journal* and the one which Mr. B. criticises inserted. If Mr. B. however had read the whole of the communication, he would find p. 285 of the Journal, that the series in question, were given by M. De Stainville of the Polytechnic School, in Vol. IX. of the *Annales de Mathématiques* for 1818 and 1819, by Gergonne, and therefore not mine. Where then is Mr. B's. candour? The series themselves are of little consequence, for many others might be substituted for the same purpose. It is the results produced by their multiplication, as Stainville has shown, that is interesting. For this simple operation

* As the Editor was, on account of ill health, absent at the Springs of Ballston, when Professor Wallace's communication was printed, he necessarily left the papers for the Journal in the hands of another person, and therefore knew nothing of the suppression of the introductory remarks, or of the title which was adopted. *Authors should always furnish titles for their own pieces*, and then they will incur no risk of having their views misapprehended. That Professor Wallace may have no cause for complaint, in the present instance, not a word of his MS. has been suppressed or altered, although there are a few expressions, which we could have wished had been omitted or modified. *Editor.*

leads to results in the higher analysis, which have not been rigorously and logically established, either by Newton, Leibnitz, or any of their followers, down to Lagrange. The whole of their methods, notwithstanding the application of the principle of exhaustions, of indivisibles, of the theory of limits, of prime and ultimate ratios, the expansion of binomials, multinomials, &c. in point of perspicuity and logical precision, are still liable to the objections of Berkeley, their reasoning being more or less infected with the *fallacia suppositionis*, or as he calls it *shifting of the hypothesis*. Even Lagrange in expanding the form $f\ (x+i)$ whch he makes the principal fonndation of his theory of analytical functions, is liable to similar objections. "It appears in short to me (says Woodhouse in his Preface to his Principles of Analytical Calculation) that M. Lagrange has generalized too hastily, *and inhis general form and demonstration has virtually included properties which he makes the consequences of that form and demonstration*." The results deduced from the simple multiplication of Stainville's series are not liable to the objection of the *fallacia suppositionis*. The laws of the expansion of binomial or multinomial functions are not assumed, as in most cases in Lagrange's method. They follow as consequences from the results obtained, and these results are applicable to almost every department of analytical functions. These were my motives in calling the attention of Mathematicians to some of the properties, deduced from the multiplication of these series, in your Journal.

But Mr. B. observes that "these series can *hardly* be called new." Admitting this, is the application of them the less important? The reason however which Mr. B. gives why they are not new, since they may be produced by the expansion of a binomial, has certainly the merit of novelty in it, if no other. Will Mr. B. then pretend to assert, that no series can be new which results from the expansion of a binomial? The expansion of the binomial itself results from common multiplication in algebra, and even the whole body of the modern analysis may be deduced from it. Woodhouse in the Preface to the work already cited, p. 25, remarks, that "between the differential Calculus and the rule for multiplication, the interval is not immense. It is that compendious method of addition which is the low basis of the most towering speculations, *the humble Origin of the Sublime Geometry.*" Now this being the case, according to Mr. B's. mode of reasoning, there is nothing new in the modern improvements in *Analysis*, for all are deduced from multiplication, which has been known time immemorial. In fine Mr. B. seems to adhere literally to the observation of Solomon, "*nihil sub sole novum.*"

Mr. B. next observes that *nearly* the whole theory of the functions, which I have named, is to be found in the "Complement des Eléméns d' Algèbre" of La Croix, where it is stated that the method was first given by Euler. Now any person who reads La Croix will find, that Euler pre-supposes the knowledge of the expansion of a binomial function, and the results which he has given do not include a single case of a transcendent function, and were only given as examples of the applications of the simplest case of the binomial theorem, viz. $(1+z)^m=1+\frac{m}{1}z+\frac{m\ (m-1)}{1.2}z^2+\&c.=f\,(m)$ where m is supposed a whole positive number. La Croix says, "Parmi les différentes preuves qu' Euler a données de la généralité de la formule du binome, la suivante tient le premier rang, par sa finesse et sa briéveté," (pa. 145. Ed. 3.) and then gives what Mr. B. calls my fundamental theorem, deduced from a knowledge of the above expansion. Now $f\ (m)$ to be general, even in this limited case, should include the expansions of a^{1+z}, $log.\ (1+z)$, $Sin.\ (1+z)$, $Cos.\ (1+z)$, &c. Where have these binomials been expanded by Euler, by any of the ordinary operations of algebra, such as multiplication? Before Euler deduced his fundamental theorem, these expansions should have been given, whatever m might be made to represent. But in the results deduced from the multiplication of Stainville's series, the expansions of the binomial and multinomial follow, as is evident from p. 283 vol. VII. no. 2 of the Journal, and in p. 284 the expansions of e^{Ax}, a^x, $Log.\ (1+x)$, &c. are given, e being the base of Napier's System of Logarithms, and $e^A=a$ where $A=log.\ a$ to Napier's System. The expansions of circular functions into series might be deduced in a similar manner, as Kramp has done by means of his *Factoriels*, (a name by which he designates series similar to Stainville's) and extended their application to definite integrals, &c.

When a writer generalises too hastily it is difficult to form an idea of the truth or legitimacy of his conclusions, and that Euler had, in no small degree, this failing, will be evident to any one who reads his works. Lagrange (Leçons sur le Calcul des fonctions, 1806, p. 409) speaking of the expansion of some functions by Euler, shews, that he takes as granted what he ought to prove. "Car (says he) la Démonstration qu'on trouve dans le tome XV des *Novi Commentarii* de Petersbourg, est si compliquée, qu' il est difficile de juger de sa justesse et de sa généralité." Does not this observation hold, in its full force, against Mr. B. also, in asserting that, $fa \times fb = f(a+b)$ as deduced from particular and limited premises.

If Euler has not been completely successful in the above and similar instances, still it would be an injustice to the memory of so great a man, not to acknowledge that he has contributed as much, if not more than any other individual of his time, to the modern improvements in almost every department of the new Calculus. In vols. XV. and XVI. of the *Nov. Comm. Petrop.* he has published his Integral Calculus, in tom. XVI. of which S. 28, the integral $\int dx \, (\log. \frac{1}{x})^{-\frac{1}{2}} = \sqrt{\pi}$, is given, and long before in tom. V. des anciens mémoires de Petersbourg p. 44. The integral $\int e^{-x^2} dx = \frac{1}{2}\sqrt{\pi}$ is of the same form, and is integrated between the limits $x=o$ and $x=\infty$; which shews that he had been in possession of the *germ* of the theory of definite intregals, one of the most useful, though one of the most difficult, in the modern analysis, and which has since been so far extended by Laplace in the Memoirs of the Institute, by Legendre in his "Exercises de Calcul Intégral," by Brisson, Poisson, &c. in the Journal of the Polytechnic School, by Herschel in the Phil. Trans. 1814, and others who have pursued and still pursue this interesting investigation. Similar researches have been carried on by different authors, and under various denominations, and Laplace has further generalized these theories in his *Calcul des fonctions génèrailces*, exhibited in vol. 8. of the Journal of the Polytechnic School, and in his

Théorie analytique des probabilités, 1814. These theories, as is well known, are applied with singular success in the most abstruse physical researches, whilst in the works of English Mathematicians, scarcely a word, relative to them, has been given. Lately, however, in the Phil. Trans. and some few other works of less note, several have distinguished themselves in these investigations. In calling the attention of the American reader to those important enquiries, it is to these works, and also to La Croix's work on the Differential and Integral Calculus, 2d. Ed. particularly the 3d. vol. published in 1819, that I would refer for general information on these subjects, and not to the *Complement des Eléméns d' Algèbre*, however useful as a *school book.*—To those who take a pleasure in proceeding from the most elementary principles to the most remote conclusions, it must be highly interesting to discover the different ways in which the same truths may be established, and to pursue those methods, which from the most simple principles lead to to the most general results.

As to *originality* in these investigations, it is extremely difficult to do impartial justice to the merits of authors. Whoever was the first author of the expansion of a binomial, or the law on which such series depend, I should consider as having the greatest claim to originality and invention; as all the improvements in the modern analysis principally depend on the developement and application of series. Hence Lagrange gives Fermat the honour of first exhibiting the *germ* of the new Calculus (Calcul des fonctions p. 325.) whilst Laplace gives almost the whole merit to Wallis. In his *Théorie analytique des probabilités* (2d. Ed. 1814,) one of the most profound and elegant analytical performances in existence, speaking, in the preface to this work, of the *Arithmetic of Infinities* of Wallis, he says, that it is "l' un des ouvrages qui ont le plus contribué au progrés de l' analyse, *et ou l' on trouve le Germe de la théorie des intégrales définies,* l' une des bases de ce nouveau calcul des probabilités." Wallis published his *Arithmetica Infinitorum* in 1657. (He was born in 1616, ninety-one years before Euler existed.) Laplace gives his remarkable theorem in p. 465. of the additions to his Theory of Probabilities, where he shews how nearly it is connected with the modern calculus, particularly the theory of definite integrals, so much cultivated at present. In p. 469 of this interesting dissertation, Laplace says, that it is worthy of remark, that *Newton availed himself of Wallis's method, for discovering his binomial Theorem*, and therefore merited the reproach which Wallis made to the ancient Geometricians, who concealed the methods which conducted them to their discoveries. In writing to Fermat, Wallis advises him not to imitate them, and *not to destroy the Bridge after passing the River.*

Those however who have developed these *germs* and caused them to bring forth such abundant fruit, have exhibited no less genius, nor is their merit in any degree inferior. They overcame the obstacles which prevented their predecessors from advancing. They have made new and extensive inroads into science They no longer confined it to the earth, they extended it to the heavens ; and every phenomenon observed in the universe, was submitted to the power of their calculus, and its particular cause, and the laws which govern it distinctly pointed out. So that while nature is interrogated by observations and experiments, the language in which she now seems most distinctly to answer us, is that of the *Modern Analysis.*

These remarks coming so late after Mr. B's. have been in circulation, must lose much, if not the whole of their interest. I could not however have forwarded them sooner, as, from some cause or another, it was only a week or two past, that the subscribers here received both the numbers of the Journal, in which my communication and Mr. B's. remarks are inserted. This being the case, I hope, Mr. Editor, you will do me the justice to lose no time in publishing the above.

J. WALLACE.

Art. XIX.—*On the asserted acceleration of the motion of Water Wheels during the night and in winter.*

1. *Extract of a letter from* Thomas Kendall, Jr. *to the Editor.*

New-Lebanon, Sept. 23, 1824.

"Dear Sir,

In compliance with a wish expressed in a remark in the last Journal, respecting the different velocity of water mills by day and by night, I would observe that the fact is well known to those who are conversant with water works. It is more sensibly discovered in the spinning of cotton, than in most other kinds of business, as it is the general practice to run the machinery as fast as it can be well attended, and it becomes necessary to lower the gate and let on less water in the evening than in the day time; the difference in the hum of the mill is very sensible to a bystander.

I cannot say that it is the case, in all temperatures and all weather, as it is some years since I have been in a situation to make observations, and cannot probably remember all the facts which were observed at the time. When I first noticed the fact in question, I enquired of the older mill workmen as to the cause, and was told that water was heavier in the night than in the day time, and supposed at the time that it was occasioned by a difference in the atmospheric pressure, and pushed my inquiries no farther. The mills in which the different velocities were noticed were of the horizontal or tub wheel construction. I do not recollect to have noticed it in a mill where a breast wheel was used, although I had opportunity to observe the latter, but probably the fact being familiar, had ceased to excite my attention, and was supposed to be the same as in the case of horizontal wheels. As it respects "mills moving more slowly as the water approaches the freezing point," I will relate a circumstance which I never knew or heard of at any other time. It occured at a mill owned by Messrs. Trowbridge, Merrifield, & Wilson, in Worcester, Mass., although not exactly in point, observation not being seasonably made. The wheel was a tub wheel; it was in the winter season subsequent to a thaw which had cleared the stream of ice; the wind for some time previous had blown very hard from the northwest, which at that place was opposite the course of the stream, (which was small, barely sufficient for a grist mill,) but had now subsided. The mill was started as usual, in the morning; after running an hour or more, it was observed to slacken; the gate was raised, but soon the wheel went slower than before; more water was let on, but with little effect: examination was then made for the cause, when it was found that the water was become thick with frost, having a large portion formed into crystals, in some measure resembling snow and water. It became so thick in a few minutes, that it had not sufficient fluidity to turn the wheel at all, and almost ceased to flow in the stream which had in consequence risen considerably. This was about 9 o'clock A. M.; between 10 and 11 the stream became clear, the frost having disappeared. It was probably occasioned, in part at least, by the cold wind blowing with so much force against the current, and mixing with the water that the whole stream was reduced to the freezing temperature and congelation pervaded every part equally.

Probably you will have communications from persons who have made observations more recently and with more attention. Should any thing, however, related above be considered of use, you are at liberty to dispose of this letter as you may think proper,—being always willing, however feebly, to contribute whatever is in my power to the advancement of science."

2. *Extract of an anonymous letter to the Editor.**

The author remarks respecting the supposed acceleration of water-wheels working during the night and in winter: "This fact is well known to most persons, who have been connected with mills, and I remember many years ago, being asked to give an explanation of the cause,

* Post marked Beaufort, S. Carolina, October 12, 1824.

The workmen themselves attributed it to the moon; probably from its supposed influence upon the ebbing and flowing of the tides. But, as I conceive that it exerts but little upon the ocean, still less upon lakes, and none whatever upon a mill pond, I therefore suggested that it is owing to the pressure of the atmosphere during the night; the earth and circumambient air being rarified during the day, the colder air above upon the going down of the sun condenses, and presses towards the earth. During the winter season the same result takes place in warm weather followed by cold, or the water is more directly acted upon by a body of ice upon its surface.* The assertion should therefore have been made with a little modification, not that every night a mill (water-wheel) goes faster than it does during the day, but upon such nights, and during such weather, as to produce the additional pressure of the atmosphere."

3. *Extract of a letter from ——— to the Editor, dated in the State of Maine, Dec.* 6, 1824.

"I live in the vicinity of numerous *saw-mills*, and it is here the universal belief, that these mills *move faster in the night* than in the day, and that more work may be effected in a given time, during the former period. More than a year since I was led to perform some experiments, the result of which is that they *do not* move more rapidly in the night than in the day. I had almost forgotten the subject until it was recently brought to view by some remarks on the subject which I saw in the papers."

"Now it is always considered a mark of prudence to ascertain the *existence of a fact*, before we attempt to explain it; and I am not certain but my attempts to ascertain the existence of the *supposed fact as to saw-mills* would be considered equally idle and unprofitable."

*This may be exemplified in a familiar way by placing the mouth to the bung-hole of a barrel partly filled with liquid, in the head of which a hole has been bored for a tap:—by blowing into the barrel the jet of water is increased.

ART. XIX.—*Notice of " The New Method of Determining the Longitude by the Culmination of the Moon and Stars : Being a Paper read before the Astronomical Society of London. To which are now added an Appendix, and a List of Stars, applicable to the purpose for the year* 1825. *By Francis Baily, Esq. F. R. S. and L. S.*"—Quarto, pp. 48. London, 1824.—By Rev. EDWARD HITCHCOCK.

THERE is probably no science whose practical application (to say nothing of the theory) has in it so much of grandeur and sublime interest as astronomy. The intense delight experienced by the real amateur, as he sees through his telescope the first contact of the limbs of the sun and moon in a solar eclipse, or of a star and the moon in an occultation, or of a planet and the sun in a transit, is of such a *sui generis* character, that, though not unfrequently felt, it is not easily described. And when the calculator sits down to apply the principles of spherics to his observations, he finds his mind pleasantly sustained through the most laborious processes, by a peculiar enthusiasm, that makes him forget the dryness of the mere arithmetic that is concerned.

The importance of the subject and the munificent rewards offered by some of the European governments, have served, no doubt, very much to sharpen the ingenuity and zeal of astronomers in that particular application of their science that relates to finding the longitude of places on the earth. And their success in overcoming the formidable difficulties that encumbered the subject, in perfecting the modes of observation, and simplifying the calculations, has long ago excited the highest admiration and the gratitude of seamen.* For a few years past, however, we believe the subject has not excited so much interest. We must certainly form this conclusion, if we judge from the

* In this connexion we are happy to refer to the indefatigable and eminently successful exertions of our countryman Hon. N. Bowditch. We are bold to assert that no man living has done so much as he for the safety and convenience of the navigator. And he has done as much for astronomers by his translations and elucidations of the " Mecanique Celeste." But that work is suffered to lie in manuscript, in this liberal country, for want of patronage !

shameful manner in which the English Nautical Almanac has been conducted.

The determination of the longitude by the culmination of the moon and stars, which is the subject of Mr. Baily's paper, cannot be employed at sea, because it requires a transit instrument fixed in the meridian. This gentleman does not pretend to be the inventor of this method, since it has been known nearly two centuries: But he proposes a more advantageous mode of making the observation, and a new formula for deducing therefrom the longitude. And in its present improved form, he regards this method as more likely than any yet proposed, to lead to accurate and satisfactory results: and after an examination of the subject, we are inclined to the same opinion. But we will let him speak for himself.

"The *meridional transits* of the moon, agreeably to the method about to be described in this paper, are free from all these objections: the observations are made with the greatest facility; the opportunities are of frequent occurrence; the absolute time is of no material consequence; the computations are by no means intricate or troublesome; and the results are (I believe) more to be relied on than by any of the preceding methods;" (by chronometers, eclipses of Jupiter's satellites, of the sun, and of the moon, and occultations, of which the author had been treating.) p. 3.

"The *newly proposed method* consists in merely observing, with a transit instrument, the differences of right ascension between the border of the moon, and certain fixed stars previously agreed on; restricting the observations to *such stars as differ very little from the moon in declination.* It is evident that this method is quite independent of the errors of the lunar tables, except so far as the horary motion of the moon (in right ascension) is concerned, and which in the present case, may be depended on with sufficient confidence: that it does not involve any question as to the compression of the earth: that a knowledge of the correct position of the star is not at all required: and finally, that an error of several seconds, in the state of the clock, is of no consequence. Consequently a vast mass of troublesome and unsatisfactory computation is avoided. Moreover, it is the only method that is *universal*, or that may be adopted, at one and the same time, by persons in every habitable part of the globe; for it is applicable to situations distant 180° in longitude from each other, and even *beyond* that distance, as I shall show by one of the subsequent examples." p. 5.

The longitude of a place may be deduced from observations made on the culmination of the moon and stars by calculations depending on the tables of the moon and stars; in which case, the correct time must be observed, and the errors of the tables are involved. But Mr. Baily, in this paper, speaks only of corresponding observations; that is, observations of the same bodies made at different observatories. In this case "it will not be of any consequence if the clock should not *exactly* show the correct time; as it is the difference only, between two given moments, that is required. All that is necessary therefore is, that the clock should go correctly during the short interval of the transits. In fact, the whole method is a method of differences only; and it is to these differences that the principal attention must be paid." p. 11.

This method of obtaining the longitude was first successfully, and not till recently, practised, by M. Nicolai, a distinguished astronomer at Manheim. He subsequently published a list of stars that would be favourably situated for corresponding observations of this kind, and invited the co-operation of other observers. These stars he calls *moon-culminating* stars—we wish he had chosen a better term. The result of this proposal was, that successive lists of such stars were published, "and already, at several observatories, the observers have been enabled to determine their difference of meridian, in a few months, with as much accuracy as they formerly could in as many years. It might, indeed, at first sight, appear that the same results would be obtained, if we merely observed the correct time of the moon's transit, without any reference to the contiguous stars: but a moment's reflection will convince us that, by referring the moon's border to the adjacent stars, we obviate all errors not only of the clock, but also in the position of the transit instrument." p 5.

The last circumstance mentioned above, relating to the position of the transit instrument, will be regarded as an important advantage possessed by this method; especially in this country, where we have no observatories, and so few meridians fixed with much accuracy.*

The author of this paper, after several pages of preliminary, historical, and explanatory remarks, proceeds to investigate, by the analytic method, a formula for solving the problem under consideration. We need not follow him through the several steps of the process, but only state the final equation.

$$x=\left[\left(t-\tau\pm\tfrac{1}{15}\left(\frac{r}{\cos.d}-\frac{\varrho}{\cos.\delta}\right)\right]\times\left[\frac{\varsigma}{5760}\times\frac{c-h}{a-b}-1\right].$$

In this formula, x denotes the correct difference of the meridians of the two observatories; t the difference between the time of the transit of the moon's limb and the star, at the most westerly observatory; τ the same difference at the eastern observatory; r the moon's true semidiameter, as seen from the earth, for the apparent time of her culmination at the western observatory; d the moon's declination at the same time; ϱ and δ, the same quantities respectively, as the two last, for the time of the moon's culmination at the eastern observatory; ς the true value of a solar day in sidereal time, or 24 hours added to the sun's daily increase in right ascension; c the apparent time of the moon's culmination at the western observatory, reduced to the meridian for which the ephemeris made use of was computed; a the moon's true right ascension at that time; h and b, the same quantities, respectively, as the two last, as shown by the observation at the eastern observatory. Where the ambiguous symbol $\pm$ occurs in the preceding equation, the upper sign is to be taken when the first or western border of the moon is observed; and the lower sign, when the second or eastern border is observed. But in all cases where the difference of meridians is not

* A few years since, we observed several meridian transits of the moon and stars, with a good theodolite and sextant, although the meridian was not accurately settled: and we had it in view, to propose to our countrymen, (in the dearth of facilities among us for astronomical observations,) a method of deducing the longitude from such observations with such instruments, depending on equal altitudes for correcting the meridian, and on the tables for the elements, instead of corresponding observations. But want of time and health has prevented the execution of the plan; and since reading the paper of Mr. Baily, and perceiving the much better mode of corresponding observations likely to be extensively practised we are inclined to dismiss our project *sine die.*

very great, the correction resulting from that part of the formula immediately connected with these signs, (depending on the variation in the semi-diameter and declination of the moon,) may be neglected, and the equation becomes simply

$$x=(t-\tau)\times\Big[\tfrac{c}{5760}\ \text{\&c.}$$

The values of t and τ are obtained by observation, and those of c and h might easily be deduced therefrom, if observers record their observations entire; since, the sidereal time of the transits being given, we might easily compute the apparent time to the nearest minute, which will be quite sufficient. The values of r, ϱ, d, and δ, may be taken from an ephemeris, and computed for the apparent times of observation as shown at the meridian for which such ephemeris is calculated; and the values of a and b may be obtained from the same ephemeris by second differences. See p. 9.

"I have already remarked that these formulæ are adapted to sidereal time only: if therefore the clock, by which any of the comparisons are made, should be adjusted to *mean solar* time, the observed interval, denoted by t or τ, must be multiplied by 1,0027379." p. 10.

We shall now present a case, selected from those Mr. Baily has furnished, of the application of this formula to practice. The differences between the culmination of the first border of the moon and three stars were observed March 3d, 1822, by M. Nicolai at Manheim, and by M. Struve at Dorpat, as follows:

1822.	Stars.	Manheim. $t=$	Dorpat. $\tau=$	Difference. $(t-\tau)=$
March 3.309	Mayer	$+13^m\ 18^s,30$	$+10^m\ 17^s,56$	$+3^m\ 0^s,74$
	82 Gemin.	$+8\ \ 9,43$	$+5\ \ 8,55$	$+3\ \ 0,88$
	μ' Cancri	$-9\ \ 41,11$	$-12\ \ 41,89$	$+3\ \ 0,78$
			Mean	$+3\ \ 0,80$

The times of the moon's culmination are not here given, and it becomes necessary to take them from an ephemeris. By the *Con. des Tems* it appears, that the moon passed the meridian of Paris March 3d, at $8h$. $51m$. apparent time; and as the estimated longitude of Manheim is $0h$. $24m$. $31s$.

east of Paris, and of Dorpat 1*h.* 37*m.* 28*s.* east, the Paris apparent times of her culmination at those places will be as below.

1822.	Manheim.	Dorpat.	Difference.
March 3.	$c=$	$h=$	$(c-h)=$
	$8^h\ 26^m$	$7^h\ 10^m$	$1^h\ 16^m$

The true declination and semi-diameter of the moon at the same times were as below.

	At Manheim.	At Dorpat.
March 3.	$r=15'\ 44'',\ 4$	$\varrho=15'\ 44'',\ 8$
	$d=23°\ 51'\ 42''$	$\delta=24°\ 2'\ 18''$

Consequently the value of $\frac{1}{15}\left(\frac{r}{cos.\ d}-\frac{\varrho}{cos.\ \delta}\right)$ will be $0^s,123$

Hence $t-\tau=3^m\ 0^s,\ 80=180^s,80-0^s,123=180,677=$ the true difference of the right ascension of the moon's centre for the two moments of observation.

The true right ascension of the moon for the times of her culmination at the two observatories, (reduced to the meridian of Paris,) must be computed by means of second differences from the *Con. des Tems*, and we shall have the values of a and b. Their difference will show the increase in the true right ascension of the moon, or her true motion in the interval denoted by $c-h$. The results are as follows:

March 3. $c=8^h\ 26^m$ $a=116°\ 49'\ 24'',4=$ moon's A. R.
$h=7\ \ 10$ $b=116\ \ 4\ \ 7,\ 6$

$(c-h)=1\ \ 16$ $a-b=\ 45\ \ 16,\ 8=$ moon's increase in A. R.

$$\frac{c-h}{a-b}=1,67845$$

The length of the true solar day, or the value of ς, March 3d 1822, was $24^h\ 3^m\ 43^s,\ 4=\ 86623^s,4$.

Hence the value of x, or the true difference of the meridians of Manheim and Dorpat, will be

$$x=180^s,677\ \left(\frac{86623,4}{5760}\times 1,67845-1\right)=1^h\ 12^m\ 59^s,\ 45$$

Which agrees very nearly with the mean result ($1^h\ 12^m\ 57^s$) of all the observations hitherto made in those places, as given in the *Con. des Tems* for 1826.

After Mr. Baily had nearly completed his paper, he received from M. Nicolai, whom we have already mentioned, an indirect method of solving the problem, which may sometimes be found convenient and is capable of considerable accuracy.

Let c and h denote the same quantities as before: let $\triangle=(t-\tau)\pm\frac{1}{15}\left(\frac{r}{\cos.d}-\frac{\varrho}{\cos.\delta}\right)$ of the former formula: let χ denote the assumed difference of meridians and e the error; so that we may always have $x=\chi+e$. Then will the apparent time of the moon's culmination at the western observatory, be

$$c=h+(\chi+\triangle)\frac{86400}{\varsigma}\text{ nearly.}$$

"Assume them as equal: and let a and b denote, as before, the true right ascension of the moon at those assumed periods respectively. Then if $15\triangle=(a-b,)$ the value of χ has been assumed correctly, and the problem is solved. But if not, call the difference, in this last equation, d; whence we shall have

$$15\triangle=(a-b)+d$$

and consequently $d=15\triangle-(a-b)$

"But d is evidently a function of the moon's difference in right ascension; and the time (e) in which it is described (or the variation which it will cause in the value of x) will depend on the relative motion of the moon, in right ascension, in a true solar hour. Now, since e is generally a very small quantity, the relative motion of the moon, during that short interval, may be deduced with sufficient accuracy from the moon's motion in 24 hours as shown by an ephemeris. Whence the value of e may be expressed by the following equation:

$$e=\frac{\varsigma}{m}\times d$$

where ς may be taken, in all cases, equal to $24^h\ 4^m$.

"For the convenience of those who pursue these inquiries, I have computed the following table of the value of $\frac{\varsigma}{m}$ depending on the true motion of the moon in right ascension in degrees during 24 solar hours, as shown by an ephemeris: which being multiplied by *d*, will give the value of *e* required."—p. 20.

Argument=m=Moon's motion in A. R, in a true solar day.

Argument.	$\frac{\varsigma}{m}$	Difference.	Argument.	$\frac{\varsigma}{m}$	Difference.
10° 0′	2.4066		13° 0′	1.8513	
		.1145			.0686
10 30	2.2921		13 30	1.7827	
		.1042			.0637
11 0	2.1879		14 0	1.7190	
		.0951			.0592
11 30	2.0928		14 30	1.6598	
		.0873			.0554
12 0	2.0055		15 0	1.6044	
		.0802			.0517
12 30	1.9253		15 30	1.5527	
		.0740			.0485
13 0	1.8513		16 0	1.5042	

M Nicolai hints that the formula proposed by Mr. Baily is nothing more than this indirect method in another dress, and suggests that it is to be used with caution in certain cases. We think the latter gentleman has shown that M. Nicolai is mistaken; but as we have not seen the paper of M. Nicolai referred to, we shall not attempt to take up the subject. Nor can we for want of room notice several other things in Mr. Baily's paper that are of importance in relation to the subject under consideration; particularly his remarks in regard to those observations made with a transit instrument containing a number of cross wires. We have already extended this notice to a greater length than we should have done, had we not felt much interested in the paper, and very desirous to have the method it proposes immediately adopted by observers in this country, where so few places have their longitude well settled. It was originally read before the *Astronomical Society of London* and will appear in the second volume of their memoirs; and Mr. Baily has obtained "an impression of some separate copies, with an intention of distributing them in various parts of the world, in order to procure a fair and general trial of the method therein proposed."

He speaks of "the rising greatness of the American States, both in the northern and southern hemispheres, as having led to the establishment of universities in various parts of that immense continent." What a severe though silent reproach upon that 'rising greatness' is it, that he could not add 'the establishment of observatories' also! We thank Mr. Baily for generously speaking of our greatness without hinting at this glaring *national* deficiency.

This country, however, has its practical astronomers; and many of its observers (among whom the names of Ellicot and Dunbar stand pre-eminent) have done wonders, considering the difficulties with which they struggled. We think some of these will be disposed to second the views of Mr. Baily; and to furnish them with additional facilities, we shall add a short catalogue from the list of moon-culminating stars of 18 quarto pages, which he has annexed to his paper, for the year 1825. The principal object of this catalogue is, to enable observers to find those stars most favourably situated for observation, which will also most probably be observed by astronomers in Europe.—This list is mostly taken from a German periodical publication, entitled *Astronomische Nachrichten*, conducted by Professor Schumacher, who has been very active in promoting this method of finding the longitude, and of whose work Mr. Baily speaks in terms of strong approbation.—The following list contains at least one star for every day in the year favourable for observation. The numbers prefixed denote the numbers in Flamstead's Catalogue, unless enclosed in a parenthesis, in which case, they refer to Piazzi's Catalogue.

A List of Moon culminating Stars for the year 1825.

1825.		Stars.	Mag.	AR.			Dec.	
Jan.	1	η Tauri	3	3^h	37^m	5^s	+23°	33′
	4	ζ Tauri	3.4	5	27	11	21	2
	3	9 Gemin.	7	6	6	18	23	47
	4	ε Gemin.	3	6	33	9	25	18
	5	θ Cancri	5.6	8	21	36	18	41
	6	o Leonis	4	9	31	48	10	41
	26	101 Piscium	6	1	26	26	13	46
	27	γ Arietis	4.5	1	43	57	18	26
	28	ε Arietis	5	2	49	13	20	38
	29	τ^2 Tauri	5	4	31	45	22	37
	30	132 ———	5	5	38	16	24	30
	31	μ Gemin.	3	6	12	23	22	36
Feb.	1	ζ Gemin.	4	6	53	43	20	49
	2	α^2 Cancri	5	8	48	55	12	32
	3	π Leonis	4.5	9	50	58	8	53
	4	58 ———	5	10	51	31	4	33
	26	108 Tauri	7	5	4	56	22	5
	27	1 Gemin	5	5	53	29	23	16
	28	μ ———	3	6	12	23	22	36
March	1	δ Cancri	4.5	8	34	44	18	48
	2	o Leonis	4	9	31	48	10	41
	3	π ———	4.5	9	50	58	8	53
	4	φ ———	5	11	7	47	−2	42
	5	22 Virginis	5.6	12	24	45	8	29
	6	α Virginis	1	13	16	0	10	15
	28	ζ Gemin.	4	6	53	43	+20	49
	29	α^1 Cancri	6	8	46	53	12	17
	30	11 Sextant	6	9	48	51	9	9
	31	23 ———	6	10	12	0	3	10
April	1	61 Leonis	5.6	10	52	54	−1	33
	2	χ Virginis	6	12	30	13	7	2
	3	53 ———	5	13	2	46	15	15
	27	10 Leonis	5.6	9	27	58	+7	37
		48 ———	5.6	10	25	40	7	51
	28	ν ———	4.5	11	27	59	0	1
	29	14 Virginis	6.7	12	10	21	−7	56
	30	α Virginis	1	13	16	0	10	15
May	1	69 ———	5.6	13	18	9	15	4
		(300) ———	7.8	13	57	44	15	21

A List of Moon-culminating Stars for the year 1825.

1825.	Stars.	Mag.	AR.	Dec.
May 2	ι² Librae	6.7	15ʰ 3ᵐ 23ˢ	−18° 59′
3	δ Scorpii	3	15 50 1	22 7
27	♆ Virginis	5.6	12 45 16	8 35
	α ———	1	13 16 0	10 15
28	i ———	5	13 17 29	11 48
29	(22) ———	6	14 5 47	17 23
30	ι² Librae	6.7	15 3 23	18 59
31	δ Scorpii	3	15 50 1	22 7
	θ Ophiu.	3.4	17 11 18	24 49
June 1	26 ———	6	16 49 28	24 43
2	31 Sagitt.	6	18 41 39	22 8
26	δ Scorpii.	3	15 50 1	22 7
27	β ———	2	15 55 18	19 19
28	θ Ophiu.	3.4	17 11 19	24 49
29	ν¹ Sagitt.	5	18 43 38	22 58
30	e¹ ———	5.6	19 30 43	16 41
July 1	β Capric.	3.4	20 11 12	15 20
25	θ Ophiu.	3.4	17 11 18	24 49
26	d ———	5	17 33 0	21 35
27	π Sagitt.	4.5	18 59 23	21 18
28	e² ———	5	19 32 32	16 32
29	β Capric.	3.4	20 11 12	15 20
30	19 Aquarii	6	21 15 48	10 30
31	30 ———	5.6	21 54 5	7 22
Aug. 22	θ Ophiu.	3.4	17 11 19	24 49
23	μ¹ Sagitt.	3.2	18 3 19	21 6
	π ———	4.5	18 59 23	21 18
24	57 ———	5.6	19 42 4	19 29
25	β² Capric.	3.4	20 11 12	15 20
26	ε Aquarii	4.5	20 38 14	10 8
27	30 ———	5.6	21 54 5	7 22
28	γ ———	4	22 12 39	2 16
29	γ Piscium	4.5	23 8 8	+2 20
30	45 ———	6	0 16 43	6 43
Sept. 20	ο Sagitt.	4.5	18 54 14	−21 59
21	β Capric.	3.4	20 11 13	15 20
22	μ Aquarii	4.5	20 43 15	9 38
23	θ ———	4.5	22 7 38	8 39
24	51 ———	6	22 15 2	5 43

A List of Moon-culminating Stars for the year 1825.

1825.		Stars.	Mag.	AR.			Dec.	
Sept.	25	λ Piscium	5	23h	33m	9s	+0°	49′
	26	δ ———	5	0	39	38	6	38
	27	75 ———	6.7	0	57	24	12	0
	28	η ———	4	1	22	10	14	27
	29	δ Arietis	4	3	1	40	19	4
Oct.	18	e^2 Sagitt.	5	19	11	41	−16	32
	19	π Capric.	5	20	17	20	18	47
	20	30 Aquarii	5.6	21	54	6	7	22
	21	51 ———	6	22	15	2	5	43
	22	γ Piscium	4.5	23	8	8	+2	20
	23	ι ———	4.5	23	30	59	4	41
	24	δ ———	5	0	39	39	6	38
	25	η ———	4	1	22	11	14	27
	26	γ Arietis.	4.5	1	43	59	18	26
	27	ζ ———	5	3	4	54	20	24
	28	η Tauri	3	3	37	8	23	33
Nov.	16	ε Aquarii.	4.5	20	38	14	−10	8
	17	14 ———	7.8	22	3	32	7	20
	18	γ ———	4	22	12	39	2	16
	19	λ Piscium	5	23	33	9	+0	49
	20	δ ———	5	0	39	39	6	38
	21	γ Pegasi	2.3	0	4	17	14	13
	22	4 Arietis	6.7	1	38	45	16	5
	23	γ ———	4.5	1	44	0	18	26
	24	η Tauri	3	3	37	9	23	33
	25	τ^2 ———	5	4	31	48	22	37
	26	ζ ———	3.4	5	27	14	21	2
Dec.	15	30 Aquarii	5.6	21	54	5	−7	22
	16	λ Piscium	5	23	33	9	+0	49
	17	θ ———	5	23	19	8	5	25
	18	62 ———	6	0	39	16	6	21
	19	η ———	4	1	22	11	14	27
	20	π Arietis	5	2	39	35	16	44
	21	47 ———	6	2	48	7	19	58
	22	η Tauri	3	3	37	9	23	33
	23	105 ———	6	4	57	33	21	20
	24	η Gemin.	4.5	6	4	23	22	23
	25	ε ———	3	6	33	13	25	18

MISCELLANEOUS.

Art. XXI.—*Notices of the agriculture, scenery, geology, and animal, vegetable and mineral productions of the Floridas, and of the Indian Tribes, made during a recent tour* in these countries;* by James Pierce, Esq.

The territory of Florida, a recent and valuable acquisition to the United States, is situated at the southern extremity of the Continent, between the 25th and 31st degrees of north latitude, and contains about forty thousand square miles. Having been little explored, it has generally been regarded as wholly alluvial—a land of morasses and sands; but from recent personal examination, and information derived from intelligent gentlemen who have passed through different sections of the country, it is ascertained that extensive, elevated, and interesting secondary districts, presenting peculiar features, are located in the interior.

* The following sketch of Mr. Pierce's tour is contained in a letter to the Editor, dated Litchfield, Nov. 19, 1824.

"I was about three months in Florida, during which time I made an extensive excursion into the interior, and examined a considerable section of the sea-board. At the weekly meetings of the Agricultural Society of Florida, I was able to obtain much correct information from the civil and military officers, and planters of the territory; but for my notices on the geology and mineralogy of the region I had to depend chiefly on my own observations. Returning, I passed from Island to Island, visiting the principal towns and plantations, and thus obtaining much information respecting soils, crops, modes of cultivation, &c. I rode up the St. Mary's forty miles—passed a week at the valuable Island of St. Simons, and the same length of time was pleasantly occupied at Savannah and Augusta. From Augusta I passed into the hilly counties of Georgia, and slowly travelled in July through the western counties of South and North Carolina, over a primitive country. At Cartersville on the James river, I left the southern stage, and passed by Monticello and the new University, over the Blue Ridge. Crossing the wide limestone valley and a succession of eastern ranges of the Alleghanies, I visited the hot and other mineral springs, the natural bridge, and Wier's cave—and returned by Harpers' Ferry, and the best districts of Maryland and Pennsylvania.

The sea board and southern portion of East Florida is mostly alluvial. The north-eastern part of the peninsula, between the head waters of St. Mary's, the river St. John, and the ocean, varies little in surface, soil, and vegetable productions, from the coast of Georgia, and is generally very level.

Large swamps and hammocks,* or dense groves, containing a variety of trees of annual and perennial verdure, are insulated in this generally pine barren region, ranging parallel with the ocean, or bordering on streams. The surface soil of the pine barrens and branch swamps, is mostly fine sand, blended with vegetable mould in proportion to the moisture of the ground, often resting on clay or compact earth at various depths; some of the large hammocks are dry part of the year, and have a deep vegetable soil, based on rich marl, but it is doubtful whether they can be cultivated, as in the rainy months of June, July, and August, when crops are on the ground, the swamps are filled with water which falls in torrents, and slowly drains from the flat surface of the country. In the extensive pine districts, trees of yelow and pitch pine are thinly scattered, and there is little underwood. The young sprouts are destroyed by fires proceeding from accident, or annually kindled to foster grass, which in spring clothes the ground with a luxuriant carpet often presenting, as far as vision can extend beautiful green lawns and prairies resembling young wheat fields. Fires are most intense on ground much of the year wet, and producing a rank vegetation; many trees are destroyed, they are swept from large tracts, forming prairies, or left single, and in park-like groups. Except on its borders the peninsula of St. John is an unsettled wilderness.

* The word *hammock* is in general use in Florida, as descriptive of a thicket or forest, containing a diversity of trees, usually live oak, magnolia, gum, ash, maple, &c. in contradistinction to *open woods of pine barren*, greatly predominating at the south. It is a term used in all their newspapers and in the descriptions in deeds, and was introduced into the late treaty made with the Indian tribes of Florida The "Big Hammock" mentioned in my communication is the northern boundary of the Indian reservation. The soil of these hammocks is regarded as the best in the Territory. By some these thickets are divided into wet and dry.

The northern part of East Florida is intersected by the river St. Johns, the largest stream in the Territory. It has its origin in a marsh not many miles from the sea, and adjacent to the head of Indian river. In the rainy season these streams communicate. The St. Johns pursues a very serpentine course north to Lake George, through a wide rich, but miry valley, that appears but recently reclaimed from the flood; marl and banks of shells often occur. If this wet and extensive alluvial tract could be drained, it would afford very valuable sugar-lands. The upper part of the basin is divested of trees, presenting a soft, grassy savanna, apparently unbounded.

Lake George, an expansion of the St. John's, is near fifty miles in circumference, but shallow. It is environed by pine lands, swamps, and a few good hammocks. A considerable stream that empties into the lake on its western side, called the silver spring, is bordered to its source by limestone ledges and banks; this large body of water, with great force, issues from the earth, through calcareous rocks and proceeding probably from unfathomed depths, it may be the outlet of some interior lake, passing through limestone caves. Limestone, in situ, abounds on an island situated in the northern part of the lake, and borders on, or forms the bed of the St. Johns, in many places, between Lake George and Bonavista.

The river is navigable to Lake George, by any vessel that can pass its ocean bar, which has fourteen feet of water at high tide. The St. Johns pursues a northern course to Jacksonville, with a lake-like expanse of waters, being in several places four miles in width; the water shallow, except in a comparatively narrow channel, the tide rising but one foot. For the remainder of its distance, twenty miles to the sea, the river takes an eastern direction, contracted to the width of a mile, the tide rising six feet.

Below Bonavista which is situated about one hundred miles from the river's mouth, there is but little good land adjacent to the river. The surface is occupied by pine barrens, swamps, and narrow hammocks with a sandy soil, but the ranges for cattle are in parts excellent.

Under the Spanish government, scattering plantations appeared on the river for seventy miles, but many were abandoned during the patriot war, and have not been resumed since the change of flags.

The river St. Marys, which is the northern boundary of the alluvial pine clad region of East Florida, is navigable seventy miles by vessels drawing twelve feet water—a canal connecting this river with a stream of Florida that empties into the Gulf of Mexico is contemplated, the distance between their boatable head waters being about twenty miles.

Forty miles from the sea, I remarked ledges of argillaceous rock on the bank of a stream near the St. Marys, and they occur in the bed of that river—this stone is fine-grained, hard, white, and with strata in horizontal position.

At this distance from the coast, the river winds among clay hills, thinly coated with sand; they extend twenty miles up the stream; the clay soil is productive, and highly coloured by oxide of iron.

The Atlantic shore of Florida is bordered by islands and peninsulas, generally separated from the continent by narrow navigable channels. Amelia, Talbot, and Fort George islands, situated between the St. Marys and St. Johns, resemble the isles of Georgia. Sand greatly predominates in the soil, and the uncleared surface is occupied by thinly scattered pines, and live oak thickets. Sea-island cotton is the principal crop; and of this, from 100 to 150 pounds of clean cotton are produced on an acre. Little attention is paid to improving the soil by manure; it is left fallow to recruit. By a dressing of salt grass or rich mud from the extensive marshes adjacent, from 250 to 300 pounds of cotton may annually be produced per acre, at an expense in labour of four dollars. The experiment has been successfully tried, by Mr. John Couper of St. Simons, one of the most intelligent and respectable planters of Georgia. Cattle grazed on the salt meadows of Florida and Georgia are subject to a fatal disease called salt sickness. Mr. Couper has discovered that ashes mixed with food is a certain cure, probably neutralizing an acid.

There are large mounds of oyster shells on most of the islands and adjacent continent, left doubtless by the Indians. The valves are separated, and not entire as in the diluvial beds of New-Jersey. Extensive oyster beds occur in all the salt creeks of Florida. I observed at Fort George, mural precipices of soft ferruginous sandstone elevated considerably above the waters of an adjacent sal creek; they are composed of sand, sea mud, and oxide oı iron indurated; similar rocks are formed on other parts of the coast.

Extensive beds of shell rock, of a peculiar character, occupy the borders of the ocean, in various places from the river St. Johns to Cape Florida. They are composed of unmineralized marine shells, of species common to our coast, mostly small bivalves, whole and in minute division, connected by calcareous cement. I examined this rock on the isle of Anastasia opposite St. Augustine where it extends for miles, rising twenty feet above the sea and of unknown depth. It has been penetrated about thirty feet. In these quarries, horizontal strata of shell rock of sufficient thickness and solidity for good building stone, alternate with narrow parallel beds of larger and mostly unbroken shells, but slightly connected. Hatchets are used in squaring the stone. Lime is made from this material, of a quality inferior to ordinary stone lime.

The large Spanish fort, and most of the public and private buildings of St. Augustine, are constructed of this stone. The rock extends in places into the sea, with superincumbent beds of new shells of the same character.

Similar shell rock is found on the continent in several places.

The eastern coast of Florida is lined with high sand-bluffs, surmounted by low entangled thickets composed principally of evergreens; dwarf live oak, small bay and cabbage trees, and myrtle, predominate. The saco palmetto infests the islands and adjacent continent—it has a large body recumbent on the ground terminating in tufts of fan-like leaves.

There is but little cultivable land on the isles and peninsulas below the St. Johns. Excepting narrow strips of hammock, the general character of the southern Florida sea-board is pine barren. Graham's Swamp, one of the largest of the hammocks, extends thirty miles between Matanzie inlet and Mocca, with an average width of a mile; its rich vegetable soil has a marl basis, and will be valuable if it can be drained. About Mocca, and Indian river, there is some good land. The thinly scattered plantations of the coast here terminate. Lime stone, in situ, forms the basis of sand hills near Indian river, and is found at Cape Florida, and at the Florida Keys in extensive beds. Below Indian river, good land rarely occurs.

The Florida coast is said to be gradually encroaching on the ocean; new isles and peninsulas are formed by shells and sand, accumulated by the gulf stream, and storms, leaving narrow sounds to the west, that are filled up, and support vegetation when their communication with the sea is cut off by tempests, which not unfrequently happens. The alternation of sands and narrow marl swamps of recent origin, running parallel with the sea, gives plausibility to this suggestion.

The interior of Florida, from the head of the St. Johns to the southern extremity of the peninsula, is little known, but is supposed to be mostly, if not entirely, alluvial. The Indians report that there is a succession of grassy wet savannas that extend far south, and within a few miles of the Atlantic, occupying much of the surface, alternating with swamps, wet hammocks, and pine barrens.

A section of the great savanna was crossed by Col. Gadsden in the service of the United States. He represents it as extending beyond the reach of vision, in one continued prairie, covered with grass and destitute of trees and shrubs with a sandy surface. It is supposed to be near 100 miles in circumference.

The southern basins, in the rainy months, present large bodies of water that mostly disappear in the winter.

Col. Gadsden found the region about Charlotte river and bay on the eastern side of Florida peninsula, to consist exclusively of flat pine barrens, and dry palmetto plains, containing shallow ponds, and wet, miry savannas, of recent formation from lakes or the sea. Charlotte river drains extensive bay and cypress swamps, and open savannas of the interior. Its western course is marked by scattering cabbage trees, and scrub oak thickets, marine shells in many places form its bed, and its banks present alternate strata of sea sand and shells.

The existence of a large permanent lake located by maps in the the southern part of the peninsula is doubted. Frosts rarely occur in Florida below the 27th degree of latitude.

A rolling tract of comparatively elevated ground, a continuation of Georgia and Alabama ridges, passes in an eastern direction, through the centre and northern part of West Florida, thence bends to the south-east into East Florida, dividing the waters that fall into the St. Johns and Gulf of Mexico and terminating between the Bay of Espiritu Santo and Charlotte harbour, and occupying in Florida, an extent of near 400 miles, with an average width of thirty. It presents the most diversified scenery afforded in the southern part of this country, an alternation of hills often of considerable elevation, and good soil, lakes, extensive prairies, savannas and pine plains.

This rolling district is principally of secondary formation. Ledges and beds of limestone and siliceous rock appear in many parts. Numerous sinks, caves and subterranean water courses peculiar to calcareous tracts indicate a basis of limestone. This rock occurs in sinks or circular tunnel shaped basins, generally very steep, and often of considerable depth, probably occasioned by a passage opened by water into limestone caves—these sinks are numerous and observed in every part of the hilly country of Florida. Some have perpendicular walls of limestone, with a decomposing surface embracing marine shells, others have wells of pure water. Near the Indian village of San Falases at the bottom of a deep sink is a natural well about three feet in diameter; its limestone border is circular, vertical, and well defined, it was filled with pure water. Sinks border most of the lakes and savannas, affording an outlet for the waters. In a section of the hilly district of East Florida called Alachua, I visited a sink filled with water, covering an acre. It is the outlet of a mill-stream that winds through a handsome prairie, and plunging into the rocky basin takes a subterranean course—ledges of calcareous and siliceous shell rock formed the banks of the pool. Rocks in situ and detached, enclosing in a white siliceous matrix, siliceous petrifactions of marine shells were frequently noticed in this vicinity. This mineral gives fire copiously with steel, and no effervescence is produced by acids applied to a recent fracture, and on minute division it appears entirely siliceous. A siliceous petrifaction of madrepores retaining no calcareous particle, but the cells perfect, and the stone white as coral rock in its native bed, were seen. Bowlders of hornstone and quartz and beds of indurated clay and ferruginous sandstone occur.

Compact light coloured limestone, resembling the predominant rock of Cuba, is found on the western border of the great Alachua savanna, forming the nucleus of a considerable eminence. The rock embraces serpulites, pectinites, and various bivalves, observed in northern secondary calcareous rocks. Limestone hills occur in other parts of Alachua.

Limestone beds are noticed at the disappearance and emergence of the great and little Santa Fe. The largest stream has a subterranean course of three miles, the other of half a mile.

Caves have been explored in West Florida. Some occur on its southern border adjacent to Pensacola; extensive beds of limestone were noticed by Dr. Simmons under the shallow waters, and on the shores of West Florida. Between the hilly range of West Florida and the Gulf of Mexico, a distance of about twenty miles, a low level pine barren district is situated. In East Florida near the gulf shore there is considerable poor land timbered with black jack oak.

Calcareous rocks, in sinks and beds of rivers, were seen by Col. Gadsden in travelling south almost to Charlotte harbour. The banks and bed of the Talachopes river which rises in a large lake about forty miles east of the bay of Espiritu Santo, and discharges into Charlotte harbour, are in numerous places composed of limestone. Extensive beds of calcareous rock are seen above low water mark on the shores of Tampa bay. The limestone of the south resembles that of Alachua. It is probable that limestone is the basis of most of the hilly district of Florida.

Hornstone, flint, agate, and chalcedony, occur in the southern part of the secondary district—coral mineralized in chalcedony, and cacholong, is found near Tampa bay.

The most elevated hills of the interior of East Florida are seen near the sources of the Acklewaha, a branch of the St. Johns, they have a surface of white sea sand covered with black jack oak. The range south, contains numerous lakes of clear water, generally circular and deep, with steep banks, the water cool and stored with fish. Elevated ridges, on the north, border Hillsborough, Amaxura, and Talachopco rivers, that empty into the gulf of Mexico, and are noticed between Lake George and Alachua.

The lake scenery of Florida presents some peculiar features and is often beautiful. There is no lake in mountain or valley in any of the states south of New Jersey. The shallow stagnant pools sometimes located in swamps of the alluvial sea board, are not deserving of that name. In the secondary districts of East and West Florida lakes and ponds of pure water are very numerous. Several have a circumference of near fifty miles—they are usually bordered by rising ground clothed with towering forests of live oak, magnolia, laurel, gum, ash, hickory, and other trees of varied verdure. The banks are sometimes diversified by Indian clearings, or by open groves of pine on green lawns. Flocks of geese, ducks, herons, cranes, and various birds are seen fluttering over a wide expanse of clear water. The lakes are replenished with large trout, bass, mullet, sunfish, catfish, and eels. Many of these ponds have no apparent outlet, although the water is constantly shifting, being drained by subterranean channels, connected with pools of lesser elevation, or emerging from the source of considerable streams.

Orange lake in Alachua, one of the largest of these inland bodies of water, communicates through the Oclawaba with the St. Johns. Between this lake and the St. Johns in the distance of twenty-five miles, I passed within view of thirty lakes and ponds. They are situated in basins separated by high sand hills and ridges that rise gently from the waves, clothed with a green carpet of grass, and decked with flowers. Tall pines are thinly scattered over these smooth lawns, intermixed sometimes on the shores with evergreen groups. No shrubs or underwood detract from the beauty of these views. Many large sinks occur in this vicinity.

The savannas and prairies of the interior are grass covered plains, without trees or shrubs, and in the rainy season often partially covered with water, but generally sufficiently dry and firm to support cattle. The surface soil of many is sand mixed with black vegetable mould resting on clay. They often contain pools of water, and have elevated hammock borders resembling the lake shores, and some of these basins were probably at a remote period, beds of lakes, and have been gradually filled up by clay, sand, and vegetable mould washed from the hills.

The soil of the pine barrens, situated in the interior is almost uniformly fine sand with a thin dressing of vegetable earth, and sufficiently compact for roads. In some places it rests on clay, but generally at a considerable depth. Most of the hammocks of the rolling region are dry, the surface-soil sand, blended with various portions of mould and clay, with a sub-soil of compact earth or clay, situated from one and a half to three feet from the surface. On some of the hills, the earth has a limestone basis. The dry hammocks of Florida have less vegetable mould on the surface than the northern forests—this probably arises from the rapid decomposition of vegetable deposites in warm moist climates, and the porous nature of the soil. A large growth of timber, particularly where there is much ash, gum, and magnolia, is regarded as a sign of good land; but it is sometimes deceptive. I have found by boring in apparently good hammocks, pure sand to the depth of four feet resting on a compact basis, to which the roots of trees could penetrate and find ample support from the vegetable mould and water there arrested, but lies too deep for planters crops.

It is probable that most of the hammocks, hickory and oak elevations, have a retentive soil sufficiently near the surface to encourage the planter in manuring to form rich sugar grounds.

Much of the good dry pine land having a basis of clay may produce profitable crops of sugar and cotton, if the soil is ameliorated by mineral, vegetable, or animal manure—a dressing of clay, or any compact earth, would be beneficial. Good marl is found in many places. Rich mould and grass can often be procured from adjacent savannas or the ground enriched by penning cattle.

The sugar crop will be of sufficient value to authorize extra expense in manuring. The heavy duty on foreign sugar operates as a bounty on its domestic production. The Big hammock near the Indian reservation, containing about 20,000 acres, from its climate and soil, will support the best sugar plantations in Florida.

For the production of the ordinary crops, wheat, corn, cotton, potatoes, and rice, Florida possesses no advantange over the southern states, but it has a superiority for the cultivation of the sugar cane, of orange, olive, and date trees. In Georgia the cane rarely matures except near its southern extremity, and is often destroyed by early frosts. It is seldom that more than three joints afford good juice. In East Florida canes will have a growth of nine and ten months, affording juice mature for crystallization, yielding a third more sugar than the Georgia canes. The rattoon in Florida survives the winter, saving the expense of annual planting. In the southern part of the peninsula, the growth will be unchecked by frosts.

The oranges of Florida are the best brought to the northern market, and the crop more certain than in a higher latitude. The orange trees of Georgia and Louisiana have been generally killed to the root within a few years by severe frosts, an effect unknown in Florida. There are trees in St. Augustine upwards of a century old, and date-trees sixty—likewise olive-trees mature in size and very productive. The fig-tree yields successive crops in the summer without blossoming. The fruit may be profitably dried. The palma christa is now considerably cultivated. Coffee plantations will not succeed in the territories, as the slightest frost destroys the tree, and no part of Florida is exempt for many years from frost.

For grazing, the climate of East Florida is preferable to that of Georgia, Alabama, or Mississippi. In these states much stock is lost from a scanty supply of nourishment in winter. In East Florida there is rarely a deficiency from the severity of frosts. In the southern part of the peninsula there is perpetual verdure, and there are great prairies to which cattle can be driven if necessary. Droves of cattle and horses can be supported through the year at a trifling expense on the spontaneous product of the savannas, prairies, and extensive low pine lands, that are well watered in the hot months. The grasses of the wet sandy lands and of the prairies are generally fine and preferred by native horses and cattle to other food. In March I observed cattle, fed on the Alachua savanna, sufficiently fat for any market. Southern mules are more valuable than northern, and can be advantageously raised in Florida. The native horses are a small breed, but strong and active—the cattle of the interior are of a good size and form. It is expected that a pastoral life will be adopted by many and found profitable.

The dry hammocks of Florida contain a variety of trees. I noticed magnolia grandiflora, ash, hickory, black and sweet gum, red and white maple, hackberry, iron wood, umbrella tree, European holly, live oak, chestnut oak, red and black oak, Spanish oak, post oak, gray oak, overcup oak, and scarlet oak, sassafras, and cabbage tree. On the dry sand hills, pine, scrub oak, black jack oak. Open groves of large black oak, hickory, and yellow pine, are located on hills of a good soil in various parts of the rolling district of the interior; many are noticed south of Alachua.

In swamps are found cypress, red maple, swamp, white and chestnut oak, white cedar, loblolly bay, red and white bay, loblolly pine, water oak, and tallow-tree.

Live oak of large size, in some instances thirty feet in circumference, grows in most of the dry hammocks of the interior, but of a quality inferior to that of the coast. It is thinly scattered on the Ocklawaha and St. Johns, where the best has been culled out. The live oak remaining on the islands and Atlantic coast of Florida is small, and it is the general impression in Florida that there is little of this valuable timber on the western shore, but large groves of it have recently been discovered by Commodore Porter in the south-western part of the peninsula.

From the hickory-nut and acorn, the Indians extract, by boiling, a clear and sweet oil, much used for culinary purposes.

Considerable groves of the bitter sweet orange occur in a wild state in Alachua, on the St. Johns, and the Atlantic coast, extending on some parts of the shore twenty miles; they may be rendered valuable by ingrafting the sweet orange.

Among the shrubs of Florida are seen the running oak, paraguatea, myrtle, reed cane, black-berry and whortleberry. The grape-vine grows luxuriantly in Florida: some of the native varieties are excellent. Vineyards might doubtless be established to advantage. A vine called the china root, affords to the natives a substitute for bread, the root is beat in water, dried, and pulverized. The root of the Indian potatoe, a native plant, has an agreeable taste and is much used by the Indians.

Tigers, supposed to be a variety of the northern panther frequent the extensive thickets of Florida; they are large and ferocious. Wolves are often seen—the Indians destroy many of them by poisoned meat, which is drawn a considerable distance and attracts all that encounter the trail. Bears, wild-cats, foxes, pole-cats, raccoons, rabbits, and squirrels are common. Deer are numerous on the continent and islands, the pines and prairies afford them fine grazing, and the thickets shelter.

The birds most frequently seen are wild turkeys, geese, ducks, owls, cranes, herons, hawks, crows, black birds, rice-birds, robins, mocking-birds, woodpeckers, turkey-buzzards, and Spanish whip-poor-will. The most troublesome insects are moschetoes, fleas, chicers, and ticks. Below the 28th degree of latitude they are active through the year, and in the northern part of Florida, from April to December. Scorpions are sometimes seen.

Rattlesnakes are numerous in Florida, and not unfrequently six feet in length, sometimes eight and nine, and in one instance twelve. From the warmth of the climate, rendering the poison very active, from the size of the serpent and deep wound inflicted by its large fangs, the bite is generally fatal, though of rare occurrence. Of this reptile, three descriptions are remarked in Florida; the common rattlesnake with a checkered back; a snake black or dark brown on the back, a whitish yellow belly with spots near the tail; and the ground rattlesnake, about a foot in length. Mocasins are common in the fresh waters. Black and chicken snakes are often seen.

Alligators are numerous in all the lakes and considerable streams of the interior; their loud and heavy roar sounding like distant thunder, or a lion's growl, is most frequently heard at night, or during a warm rain; they travel on shore from one body of water to another, often a considerable distance; they *rarely* attack the human race—dogs are their favorite prey.

Fish are abundant in the salt and fresh waters of Florida. Among the best and most frequently caught, are sheepshead in salt water; and in fresh near Lake George, trout, bass, cavallaroes, mullet, and perch ; large green turtle are taken on the coast in summer.

From the peninsular situation of East Florida, it probably will be more healthy than the adjacent states. Most of its surface is daily cooled by sea breezes, and it is often swept by winds from the ocean and gulf, producing a more uniform temperature than is experienced in districts that have snow clad mountains on their borders. At St. Augustine, from April to August, the thermometer, during the day, rarely varies more than ten degrees, ranging between seventy degrees and eighty degrees; but in August and September it is a little higher, from about seventy-five degrees to eighty-five degrees. In the hilly region of the interior, the extremes of temperature are greater than on the coast. In the summer of 1823, in Alachua, the thermometer sometimes stood at ninety—on four days of the preceding winter it fell to twenty-eight. The nights in spring and summer are often cool; in winter north-west winds are prevalent; in summer a sea breeze from the Gulf of Mexico. The hills are elevated and dry. During the rainy or warm months the lakes are full, preventing the decay of vegetable deposits ; the waters are purified and cooled by their subterranean passage. Fogs rarely rest on the lakes; the water being colder than the air, no vapours are condensed.

The Indians and negroes of this district have not been subject to fevers, and the few white settlers who have passed two seasons in Alachua, retained their health notwithstanding some were from northern climates, and daily exposed to the sun in the fields. Emigration to the interior of Florida has recently been considerable.

West Florida, being situated nearer the mountains with water only on one side, is colder in winter than the Peninsula.

THE SEMINOLE INDIANS.

The Seminole Indians of Florida are derived from the Lower Creeks, and obtained their present location by conquest—they were once numerous, but have been reduced by wars to a small remnant, probably not exceeding two or three thousand, who are sociably grouped in small villages, principally in the secondary or rolling districts, uniting the hunter, pastoral, and agricultural states of society. The men hunt, erect dwellings, and attend to their cattle. They have many dogs of European species, but rarely use them in pursuit of game. On hunting excursions, they often lie in ambush with their rifles, on the border of a thicket, and arrest the deer with unerring aim, as they issue forth at dusk to graze on verdant prairies. Fire hunting with torches is sometimes resorted to at night—the game remains stationary, and is easily killed: this mode is prohibited among the whites as dangerous. Fortunate hunters supply their less successful neighbours.

The Seminoles formerly possessed large herds of fine cattle, but lost many during the late civil war. They have hogs and poultry. The male Indians regard agricultural labour as degrading,—but every settlement has its enclosed and cultivated field, often extensive. The ground is prepared, planted, and tended, by females, with hoes, raising good crops of corn, sweet potatoes, pumpkins, beans, roots, and tobacco, on fertile hills, and rice in swamps. They milk, make butter, procure wood and water, and do all the drudgery. The wives and daughters of chiefs are not exempted from labour; some of the principal Indians, following the example of their civilized neighbours, are proprietors of blacks, mostly born in the Indian region, and occupy separate villages. They are well treated, being rarely required to do much labour, except in pressing seasons of tillage, have acquired the erect independent bearing and manners of the aborigines, and are faithful. There is a mixed race, in form and intelligence superior to the Indian and negro.

The male Indians, in warm weather, are almost divested of clothing, but females are modestly dressed, ordinarily with short gown and petticoat, imitating the fashions of the whites, from whom the materials are procured in exchange for skins, furs, mocasins, leather, venisòn, nut oil, &c. Females have ornaments of silver in their ears, and around their necks and arms; married women wear plates of silver on their breasts, sometimes suspended by small silver chains—they behave with modesty and propriety: long slits are sometimes observed in the ears of both sexes. The men are fond of ardent spirits and tobacco, the only articles they ask for importunately; but if refused, no dissatisfaction is expressed. When presented with a bottle of whiskey, it is fairly distributed among the adult males present, but I observed none was offered to the women and children, who did not appear to expect or desire any, though often requesting tobacco and segars for smoking, of which the smallest are fond.

The Indians we had communication with were honest and fair in their dealings, evincing no thievish disposition; we were received with kindness and hospitality, our wants supplied, and they cheerfully put themselves to considerable inconvenience for our accommodation. They are in general tall and well-formed. The Seminoles differ considerably in their manners from northern tribes, being very curious, lively, and inquisitive. Our clothes, arms, knives, umbrellas, &c. were carefully examined; and some marked on the ground with much exactness the component parts of a coat, or other garment, they fancied.

Our mode of cooking and eating was to the natives a source of much amusement and laughter, eliciting many humerous remarks. They are usually cheerful, and the the intercourse of relatives and neighbours evinced good feelings.

At the Indian village of Sanfalasco not far from the river Santa Fee, we witnessed the amusements of wrestling and dancing. Dances are held at night on a level hard beaten central spot; males and females move in Indian file around a fire, singing a wild song; there is little diversity in the steps, but the tunes are varied, each dance is terminated by a general whoop.

The chief conducted us to a bower, where we were seated with some of the head men, the villagers not engaged in dancing located themselves in an opposite arbour. The young men, unusually dressed and ornamented, had spurs attached to their showy long mocasins, and with cheeks blackened to represent whiskers, and faces painted, made a ludicrous appearance. Small terrapin shells filled with pebbles affixed to the ankles of the female dancers, were their only instruments of music; much laughter was excited by the dancing and various amusing tricks. The dogs responded to the Indian yell, and numerous owls attracted by the light, hooted from the tall hickories and oaks adjacent, while the roar of alligators added to the diversity of sounds. The Indians hold an annual feast, when their crops are gathered, at which if adulterers, who had fled to avoid the punishment of losing their ears, appear, they are pardoned. The Indians are well acquainted with many medicinal plants. Their dwellings are usually constructed of logs; the roofs of bark or split pine are very tight; the sides of the best are neatly lined with clapboards, but without floors or divisions, and much infested by fleas. They have little furniture. Potters' ware of a good shape and well baked, is made by females. The chief of Sanfalasco, aided by a small bellows, anvil, hammer, and file, manufactures with much ingenuity, from coin, handsome ornaments of silver. We conversed frequently with this intelligent old man, through the medium of our interpreter, a shrewd native negro, who spoke fluently Seminole and English. The chief mentioned an instance of Indian credulity. It is believed by the natives, that a monster, with a large serpent's body shining like silver, whose breath is destructive to all that approach, occupies a large sink or cave in East Florida, guarding a mine. Similar stories are current among the Cherokees. The Spanish authorities made a fruitless search for this treasure a few years since.

These Indians do not appear to have a form of worship, but believe in a Supreme Being. The chief informed us that according to Indian traditions, the world was created by the Great Spirit; that he formed three men, an Indian, a white, and a black man; the Indian was the most perfect: they were called into his presence, and directed to select their employments; the Indian chose a bow and arrow, the white man a book, and the negro a spade. The chief had heard of our Saviour, and his sufferings, but supposed he had been put to death by the Spaniards.

The Indians are very unwilling to leave their lakes, fertile hills, and agreeable climate, for the southern reservation, that has little to recommend it except its being so undesirable, that the Indians may remain there unmolested. The chief said they had cherished a hope that the whites would continue satisfied with the coasts, and suffer them to retain a valuable remnant of their possessions, but observed that it was the will of the Great Spirit and they must submit. It was with difficulty the Seminoles were induced to assent to the treaty of cession, and they would probably resist its execution if they had any chance of success. Several of the chiefs have reservations, and are permitted to remain in West Florida, with a limited number of followers. There are now several Indian villages in the great southern reservation.

Art. XXII.—*Remarks on Art. VI. Vol. V. No. I. of this Journal, and on a passage in Dr. Dwight's Travels, Vol. III. p. 245, relating to some phenomena of moving rocks; in a letter to the editor, by the* Rev. J. Adams, *Principal of Charleston College, S. Carolina.*

Professor Silliman,

Dear Sir,

In the 5th volume, p. 34th, of your Journal of Science, your correspondent "Petros," has given an account of some rocks situated near the shore of a lake, which appear to have been gradually approaching the shore for many years. Your correspondent has shrunk from the responsibility attached to what he has related, by suppressing his name; and in this seems not to have acted in exact accordance with that philosophic spirit, "which knows how to distinguish what is just in itself from what is merely accredited by illustrious names; adopting a truth which no one has sanctioned, and rejecting an error of which all approve, with the same calmness as if no judgment were opposed to its own." (Brown's Lectures, 18.)

A cause of the motion of these rocks, which appeared satisfactory to myself, occurred when I perused the account of them, and I had thoughts of writing you my views at the time, but neglected to do so. Yesterday, however, in reading a review of Dr. Dwight's travels, in the Quarterly Review for April, 1824, I met with a passage which has induced me to resume my original design of writing to you on the subject. I extract the passage as given by the reviewer, not having a copy of Dr. Dwight's Travels at hand.

"Friday morning, Oct. 18th, says he, we rode to the south end of the lake, accompanied by Mr. Whittlesey, to examine a rock, of which a singular, not to say an incredible, opinion prevails in the vicinity. Our road for near half a mile, lay on a natural causeway, about 30 feet in breadth, which separated the lake into two parts, and was formed of earth, probably washed up by its waves. The rock which was the particular object of our curiosity, is said, by the inhabitants long settled here, to have moved a considerable distance from the spot where it anciently stood, towards the south-western shore. You will not suppose we considered this story as founded either in truth or good sense. However, having long believed it to be prudent, and made it a regular practice, whenever it was convenient, to examine the foundation of reports credited by sober men, I determined to investigate this, as I saw that it was firmly believed by several discreet persons.—One particularly, a man of unquestioned reputation, and long resident near the spot, declared, that 40 years since, the top of this rock, at the ordinary height of the water, was at least two feet below its surface, and 15 or 20 rods farther from the causeway than when we saw it. The shore has unquestionably remained as it then was; for the trees and stumps standing on the causeway are older than any man now living, and the space between them and the lake is very narrow, scarcely extending fifteen feet from the trees.

"The top of the rock is now at least two feet above the water. This height, it is declared to have gained imperceptibly, year by year, for many years, in consequence of its advancing towards the shore, and standing continually in water more and more shallow. The water is evidently of the same depth now as formerly, as is proved by the appearance of the shore.

"When we came up to the rock, which was standing where the water was scarce knee-deep, we found a channel behind it, towards the deeper water, formed in the earth, about fifteen rods in length, it was serpentine in its form, and was sunk from two to three feet below the common level of the bottom on its borders. In the front of the rock, the earth was pushed up in a heap, so as to rise above the water, declining however at the distance of a few inches, obliquely and pretty rapidly. Not far from this rock, we saw another much less, attended by the same phenomena, except that they were diminished in proportion to its size. The whole appearance of each was just as one would expect to find, if both had actually removed from their original places towards the shore, throughout the length of their respective channels. How these channels were formed, or by what cause the earth was heaped up in front of these rocks, I leave to the divination of others. The facts I have stated, as I believe, exactly."

Dr. Dwight continues, "Several years since this account was first written, I met with the following paragraph in the collections of the Massachusetts Historical Society, Vol. III. p. 240.—There is a curiosity to be seen in the Long Pond in Bridgton. On the easterly side of the pond, about midway, is a cove which extends about one hundred rods farther east than the general course of the shore—the bottom and the water so shoal, that a man may wade fifty rods into the pond. On the bottom of this cove, are stones of various sizes, which it is evident from visible circumstances, have an annual motion towards the shore. The proof of this is, the mark or tracks left behind them, and the bodies of clay driven up before them.—Some of these are perhaps two or three tons weight, and have left a track several rods behind them, having at least a common cart load of clay before them. These stones are many of them covered with water at all seasons of the year. The shore of this cove is lined with these stones three feet deep, which it would seem, have crawled out of the water. This may afford matter of speculation to the natural philosopher."

"Until I saw this paragraph, I did not imagine that a story, such as I received at Salisbury, would ever be repeated."—Vol. III. p. 245.

Upon the preceding statement, the English reviewer remarks: "Dr. Dwight has not stated the size of the rock which is said to possess this extraordinary power of locomotion. If he had, it is possible that a story, which in another of his journals he relates of the Oneidas, might explain the apparent prodigy. Those Indians regard a large stone with religious reverence, and speak of it as their god, because it has followed them in their various removals, slowly indeed, but to a considerable distance. The truth is, a stout young man resolved to amuse himself with the credulity of his tribesmen, and therefore, whenever he passed that way, took up the stone, which was too large to be removed by a man of ordinary strength, and carried it some distance westward. In this manner, the stone advancing by little and little, made in a few years a considerable progress, and was verily believed to have moved this distance spontaneously. The young fellow told the story to an American gentleman, and laughed heartily at the credulity of his countrymen." But had the rock which Dr. Dwight saw been of dimensions which would render a trick like this possible, he would surely have suspected it; it is highly improbable that the same strange and troublesome deception should be attempted in two places; and in the statement quoted from the Massachusetts Transactions, some of the stones are said to be of two or three tons weight. That statement appears to have been re-printed from a Portland newspaper, the place where the phenomenon is said to exist, being only eighteen miles from Portland. Any thing, therefore, which might be so easily contradicted or disproved, would hardly have been published, unless it had been commonly believed. But if science and literature are making such progress in this part of the United States as some suppose, the matter will doubtless be investigated as it deserves, and the truth or falsehood ascertained of statements apparently so impossible."—p. 17th, of the Review.

By comparing the narrations of Dr. Dwight and your correspondent *Petros*, your readers will perceive, that, though circumstantially different in some respects, they relate to the same objects. The testimony, also, in relation to these effects, is certainly not to be resisted. There is a pond in Rhode-Island in which similar phenomena are seen, and perhaps if inquiry were made, they might not be found to be very uncommon.

The cause to which I am inclined to attribute them, and which appears to me satisfactory, is, *the operation of the ice*. The manner, in which the effect is produced, I conceive to be this. The ice forms firmly about the rock, and as it expands from the middle of the pond towards the shore, carries the rock along with it. The fact, that the ice does expand from the middle towards the borders, in all cases where water is frozen, must be evident to all acquainted with cold climates, and who have observed the circumstances in which ice is formed. When water is left to be frozen in a vessel, the expansion from the middle to the outside is so strong as to break the vessel. This is sometimes the case even where the vessel is of iron. There is often, also, a considerable elevation in the middle of the ice resulting from the resistance of the sides of the vessel to the outward expansion. But in ponds and lakes this central elevation is never formed, on account of the immense weight of the ice,* and the little or no resistance to

* The expansion of ice, though so great a force, that no known resistance can confine it, is always exerted in the direction where there is *least resistance*. I several times repeated the following experiment before my classes, while Professor of Mathematics at the University in Rhode-Island. I procured a military shell weighing 70 or 80 pounds, and capable of containing nearly two quarts of water. The orifice was about an inch in diameter. At the approach of a very cold night, I filled it with water, and placed it in a situation favourable for freezing. In the morning, all the water was frozen, and a column of ice was driven through the orifice, of the diameter of the orifice, rough in appearance, and 5 or 6 inches long. When water freezes in a vessel of some strength, at first the resistance of the sides causes the elevation of the ice adverted to above. As, however, the ice continues to thicken, and to oppose a resistance continually increasing to the expansion upwards, a time arrives at length, when the sides of the vessel present a less resistance to the expansion, than the super-imposed ice, and at this point, the vessel is broken. But when ice forms upon a lake, this elevation cannot take place on account of the *very great weight* of the whole mass of ice, which *weight* in ordinary circumstances prevents the expansion upwards. Its expansion below into the general mass of the water is hindered by the water being confined *on all sides*, and thus opposing a resistance scarcely less than that of a solid body. The expansion, therefore, will naturally be directed towards the shore, and a disruption between the main body of the ice and the shore will be made, where the shore is inclined at a moderate angle to the surface of the water, and a projection of the ice will take place. This projection must have often been seen, by every one accustomed to cold climates, when thick ice is melting; as it frequently lies several feet beyond the edge of the water. And if the fracture of this ice be examined, the appearance indicates that the lower part of the formation has been *forced* outwards.

Whenever the shore is perpendicular to the water, or approaching to it, this projection cannot take place in any considerable degree, and in such circumstances, I have seen the ice cracked in many places, and numerous planes joined at the crack, elevated so as to be gently inclined to each other like a very flat roof. This was the natural effect on the mechanical principles which must govern the results. My views on this part of the subject, are very much confirmed by the circumstances of the "Deerfield the outward expansion on its borders. When an egg is frozen, it bursts from the same cause, with a wide fissure. The same is true of trees, which in very severe weather sometimes burst with a loud report. Again, I have observed, that in large ponds and lakes where thick ice has been formed, a disruption, just at the edge, between the main body of the ice and the shore, has taken place, and that the ice has projected upon the shore a considerable distance over the line of disruption. In case this ice had formed upon a rock near the shore, the rock must have been carried with it in its expansion towards the shore, and must have been left in that situation at the melting of the ice. When the ice formed again, it would be carried further forward, and since in New-England the ice forms and melts often several times in succession during a single winter, it is easy to see, that in several years a rock might make very perceptible progress.* I have also noticed, that, in New-England, fences which originally stood erect,

disruption," and by your remarks on the phenomenon in No. III. of your Journal. In this instance, "the earth, to the depth it had frozen the past winter, 14 inches, was broken in a straight line above 6 rods, and the south edge of the fissure, having been forced up, overlapped the other, three feet."

* Your correspondent *Petros* thinks it impossible. that these rocks can be moved by ice, and asks with an air of triumph, how it can remove some rocks, and not others. I answer, that the expansion of the ice will move all the rocks which are within its reach, except those which are so firmly fixed in the ground, that the resistance arising from this cause, is greater than the force by which the ice attaches itself to the rocks. Where such is the case, there will be a disruption between the rock *towards the middle*, and the ice will, if the inclination be not too great, be driven upon or over the rock. This effect I have often seen produced.

It may be objected, that if this account of moving rocks were true, such phenomena would be more frequently seen. In answer to this I observe, that most of the rocks capable of being the subjects of such phenomena, have probably been deposited on the shore ages ago; and I cannot but regard the immense piles of loose rocks with which the borders of most ponds and lakes iu New-England are lined, as the effects of this cause. At least, those who reject this explanation, ought to point out some other way, by which these piles of rocks were accumulated. But it may be replied, if you have assigned the true cause, why have not all rocks situated within reach of the ice in lakes, been long since carried to the shore? To this it may be said, it is not without example, that new lakes should be formed, or old ones enlarged or diminished by earthquakes, by masses of materials deposited by torrents, by land-slips, or other causes with which we are less acquainted. Any one of these circumstances, would be sufficient to produce such an effect. Besides, though there are but few instances, on record, of moving rocks, such phenomena may have frequently occurred without being observed, or if observed, without being recorded.

near the edge of grounds covered by water during the winter, have considerably inclined towards the shore as soon as the ice was formed, and fences in this situation always require to be placed upright in the spring. It is well known among the farmers of New-England, that, if a stone fence is erected in a similar situation, it will after some time be overturned. These instances, show both the reality and great force of expanding ice. It is no objection to this explanation, that the principal rock which Dr. Dwight saw, was originally, according to the testimony, two feet at least under the surface of the water, because in New-England the ice sometimes forms three feet in thickness, which would be sufficient to form about this rock, and also for aught that appears to the contrary, about those mentioned in the Massachusetts Transactions. The firmness with which ice attaches itself to rocks, may be estimated from the circumstance, that those of many tons weight are sometimes raised from the beds of rivers, where the ice reaches to the bottom, and carried imbedded in the ice to a great distance. (Edin. Encyc. X. 773.)

It appears also by the testimony, that the principal rock now moves much more rapidly than many years since, and this is what might have been expected according to the explanation I have suggested. When the top was " two feet at least" below the surface, only the thickest formations would reach it, and of course its progress would be very slow. When the top reached the surface, the thin formations would affect it, and when it rose above the surface, it would be grasped in the middle by every successive formation, and would be carried forward by the whole amount of the expansion. Your unknown correspondent *Petros* says, that " twelve years ago it moved but five feet in a year," while according to a measurement given by him it was moved about 3 rods between Sept. 1819, and Feb. 13th, 1821. The extent of its motion during this period is more than I should have expected, but probably during the two winters embraced in it, the ice formed and melted an uncommon number of times.

The circumstances of the channels behind the rocks, and the earth heaped up before them, render two things evident: First, that each rock was always moved in a *position similar to itself,* without ever being turned over; for if the motion had been produced by repeatedly overturning the rocks, they would not have left channels behind them. And again, an immense force must have been exerted to remove these rocks, especially when we consider that one of them weighed by estimation 40 or 50 tons, and when we add to the resistance arising from its weight, that which must have been caused by the formation of a deep channel after it. The expansive power of ice is a force abundantly sufficient.

The view here given will explain another fact, which I have often observed, and for which I could never form a reasonable explanation, until I perused the statement in your Journal and the paragraph from Dr. Dwight. It is mentioned in the statement from the Massachusetts Transactions, "that the cove at Bridgton was lined with stones which had apparently crawled out of the water." The borders of many ponds and lakes in New-England are lined with rocks in the same manner. While bathing on such shores, I have frequently found a gravel bottom quite free from stones, until I had advanced to the depth of about 3 feet, when suddenly the bottom was covered with stones as far as I could reach it, in size and other respects resembling those with which the shore was lined. The case seems to have been this; the ice had gradually carried the stones on the bottom, as far as it could reach them by its thickness, to the shore, and had there deposited them. The hardness of the bottom had prevented deep channels from being made behind them, or they had been gradually filled up.

If this explanation should be deemed unsatisfactory, it may, perhaps, at least, serve the purpose of leading others to give their attention to the subject, who may be more fortunate in their inquiries, and who have had greater opportunities of observation. The cause to which I have ascribed these singular effects, viz. the expansion of the ice from the middle towards the borders, certainly exists, and is adequate to produce the effects in question.

With great respect, I remain, dear sir, your friend and very obedient servant,

J. ADAMS.

Sullivan's Island, S. C., Aug. 9th, 1824.

P. S. The soundness of my conclusion with respect to these moving rocks, might easily be tried, if any one living in their vicinity, would for several successive years, measure their distance from some fixed object, such as a tree, both before and after the freezing season. If all the motion was accomplished during the freezing season, my conclusion would be rendered certain.

Art. XXIII.—*Remarks on the moving of Rocks by Ice; in a letter to the Editor, from* J. Wood, Esq.

Stamford, Conn., Dec. 18, 1824.

Sir,

I observed in a late number of the Quarterly Review, a short time since, a criticism on Dr. Dwight's Travels in New-England—and among various interesting extracts from that work, is the account of the moving rocks in Salisbury pond; which, as related by the Doctor, does indeed present to the world somewhat of a mystery. The reviewer, as might have been predicted, passes upon it with a few gibes and jeers, but in a way which leaves the reader to doubt, whether he discredits the story in toto, or considers it as inexplicable. If I remember correctly, the same account was published some time since in your Journal of Science, as a phenomenon yet unexplained; nor do I know that any exposition of it has ever been attempted. Yet, like many other apparently unaccountable phenomena in the natural world, it may be solved on the most obvious philosophical principles.

From the account it appears, that the rocks all approach *near* to, or project *above* the surface of the water. In the winter, when the surface of the water freezes, the ice must attach itself strongly to the tops of the rocks, wherever it comes in contact with them. Thus grappled, they remain immoveable till the breaking up (as it is called) of winter. As the earth contains a greater portion of caloric than the water, the ice dissolves most rapidly nearest the shores of the pond, and therefore, in the gradual progress of its dissolution, becomes detached from the shore on all sides, and is thus converted into an island, moored by the rocks.

The earth on which they rest, being soft mud, much less power is requisite to raise them from their beds, or to project them alongon this slippery surface, than would be required to raise or move them on dry, stony, or gravelly ground. By the abundant rains of the spring, and the dissolution of the snow and ice, the water of the pond is accumulated, whereby the island of ice, with every thing which remains attached to it, is raised until its strength is overpowered by the pressure. And we know that a single rood of ice of but a few inches in thickness will sustain an immense weight while lying on the surface of the water.

A strong wind then, blowing from any quarter, will agitate the water between the shore and the ice, as also that under the ice. Thus the increase of the water, or the raising of the surface of the pond, will loosen, or extract from their beds all those rocks whose weight and depth in the earth are not too great for the strength of the ice; and the force of the wind, acting upon the water and the ice, will propel them toward the opposite shore.—Like the ship therefore, whose anchor is unable to sustain the force of the tempest, the floating island is driven from its moorings. Thus forced toward the shore, the ice gradually dissolves on the side nearest the land, so that the rocks yet attached to the ice, and partially resting in the mud, are dragged nearer and nearer to the shore, propelling the mud before them, until the island becomes so diminished, that with the power of the wind and the waves, it can no longer drag its anchors, and therefore deposits them near the margin of the pond. It is therefore a natural consequence that they leave a track behind them by which their progress may be traced.

If this exposition is not the true one, it may, at least, answer until a better one can be given.

Art. XXIV.—*Remarks additional to the Review of Conybeare and Phillips's Geology of England and Wales,* (Vol. VII. No. 2. of this Journal,) *with reference to the communication of Professor Eaton in the last No. of this work, page* 261.

[Communicated by the author of the Review.—*Ed.*]

We have doubted whether the remarks of Mr. Eaton upon our review of the work of Conybeare and Phillips, call for any thing additional from us. We certainly have no disposition to engage in a controversy on the subject, nor do we perceive any evidence that such is Mr. Eaton's desire. But we think he has misapprehended us in some respects, and probably his views differ in some respects from ours; and we feel it to be due to him, as well as to ourselves, to explain our real meaning, and to give our reasons for some of the opinions advanced in that review.

If we do not misapprehend this gentleman, he represents us as recommending the adoption, by American geologists, of the new classification of rocks proposed by Mr. Conybeare. We really had no such intention; and we cannot see that our language conveys this idea. We merely said that we were "pleased with its remarkable simplicity," and could not "see but it answered every purpose of primitive, transition, and secondary;" and after stating the system, we left it to others to form their opinion of it, without offering any further arguments in its favour. Nay, we did not even say that we had adopted the system ourselves. But were we frankly to give our views concerning the propriety of adopting this system, not only among American, but also European geologists, we confess that our recommendation would be given in favour of it. For we still cannot see why it does not "exhibit an utter exclusion of all hypothesis." The principle on which the whole of this classification rests is simply this, that *some rocks are usually found above other rocks.* The terms employed by Mr. Conybeare to designate his orders, (inferior, sub-medial, medial, super-medial, and superior,) certainly imply nothing more. Now it appears to us, that this principle is merely one of those facts in geology that are grounded on observation, and equally acknowledged by all geologists, and that it does not require any hypothesis to establish it. For instance, wherever geologists have had an opportunity of observing granite and other rocks, they have always found granite to be the lowest, although they sometimes alternate. Now who ever thought that it implied a love of hypothesis, to infer from these facts that granite was the "inferior," and other aggregates the "superior" rock, merely because geologists have not uncovered every foot of granite in the globe, to see if there were not some chink or crevice through which other rocks passed beneath it?

Mr. Eaton objects to the work of these authors, because they "propose that we should begin at the upper surface of the earth, and proceed downwards, when we study its structure." It is true this is the method they adopt as the most convenient: but this is not a necessary adjunct of their system; for they might as well commence, for aught we can see, with their inferior order, as the Wernerian with his primitive.

We were not aware, as this communication asserts, that according to the Wernerian scheme, "it is sufficient that we show the series of rocks *at the surface* in that order of succession denominated primitive, transition, and secondary" If Werner ever taught any thing, he taught that his transition class lies above the primitive, his floetz class above the transition, and his newest floetz class above the floetz, *throughout their whole extent.* And this is necessarily implied whenever any follower of Werner gives us a map or description of any country according to this classification. So we cannot perceive how it is, that the Wernerian arrangement is any more limited to the surface, than that of Mr. Conybeare.

We objected to the Wernerian names, primitive, transition, and floetz, or secondary, as tending to impress the mind of the student with 'false, or at least hypothetical views,' and exerting an undesirable influence upon his researches. Mr. Eaton regards this objection as 'most extraordinary,' because every science has names in it, originally founded upon false or hypothetical views. We do indeed regard this as a defect in every science that has such names in it; because the student has not only to learn these names, but also to learn that their literal meaning is false; whereas, were things correctly named, the literal meaning might help, instead of retarding him, in his progress. How striking an instance of the importance of this principle, is presented to us in the reformation that has taken place within a few years in chemical nomenclature! Yet we by no means suppose this abuse of terms to be great enough, in all the sciences, to justify any sudden and general changes, since the evils of such a revolution would be greater than those which would be thereby remedied. But there is a very great difference in different cases, in the magnitude of the evil here referred to. In those instances where things derived their names from a real or fancied resemblance to some real or fancied object, (as is the fact in all or nearly all those cases mentioned by Mr. Eaton,) a change would be of little importance, since the name itself is not supposed to describe the thing. But in some instances the hypothetical views on which a name is founded, constitute the essence of a description of the object designated; and if you abstract those hypothetical views, you leave the object 'without form, and void.' Such cases as these, especially when the hypothesis is every day growing more doubtful, call for immediate reformation, and if we do not greatly mistake, the Wernerian names, to which we objected, form one of these cases. We do not so much disapprove of primitive and secondary: but take away from *transition* the hypothesis from which it was derived, and we very much doubt whether any distinctive characters can be found in nature, that would definitely describe it to the student. On this point we are happy in quoting the opinion of one of the ablest and most judicious geologists living. "I shall now, perhaps," says Dr. MacCulloch, "be expected to assign a place to this rock, (limestone,) in the usual division of *primary*, *transition*, and *floetz*, distinctions which I am inclined to think are more easily made in the closet than in the field. In the present state of geological science, it would appear a safer practice in this case, as in many others, to describe that which actually exists, without the use of hypothetical terms, which only serve to perplex the observer, and to mislead the student, who either boldly pronounces on the character which suits his particular creed, or modestly supposes himself incapable of sound observation, because he is unable to see that which is not visible "—Again he says, in reference to another limestone rock, "In this case the same limestone will, like clay slate, bear a share in both these artificial divisions, (primary and transition,) for artificial I must needs consider divisions which nature has separated by a boundary so feeble and so undefinable." And in conclusion he remarks: "Should this be the case, it will confirm the supposition which I have suggested in other parts of these papers, that no real and well defined line of distinction exists between the transition and primitive rocks, but that they form a graduating series of one single *formation;* a series so gradual as to render it expedient once more to return to the most simple division of rocks, into primary and secondary."*

To those conversant with recent geological works, we need not say, that views similar to the above are rapidly gaining ground.

We regret that we should be thought to "neglect our own countrymen in order to do homage to Europeans." We regard geologists as constituting one great family, who ought to feel that they are brethren; and we have always endeavoured to avoid those unworthy and unfounded partialities and antipathies that result from a difference of country or of opportunities. We endeavour to look upon a geological production with equal eye, whether it come from the banks of the Seine, or the Danube, or the Thames, or the Hudson, or the Potomac. Much as our feelings as Americans prompt us to appreciate the works of our own countrymen in such a manner that they may sustain a favourable comparison with those of Europeans, yet our feelings as members of that great scientific republic which embraces the whole world, check our national partialities, and lead us to adhere to the principle,

Tros Tyriusque mihi nullo discrimine agetur.

We do not, however, wish to conceal the fact, that we regard Europe, rather than America, as the centre of geological science; and of course maintain that we are

* Geological Transactions, vol. II. pp. 410, 417, 449.

very much dependent on her writers, and are bound to pay to them much respect and deference. And why? Not because this country does not furnish so good a field for observation; for it is decidedly a better one: nor because our countrymen have been deficient in industry and skill in exploring our rocks; for their efforts are worthy of all praise, and when we consider the disadvantages under which they labour, will not suffer by a comparison with those of any country. But European geologists have been engaged in the study of their rocks twice as many years as Americans, and in consequence of the more extensive patronage bestowed upon the former, and the less urgent demand for talent in other departments, more scientific men have been able to give themselves exclusively to the subject in Europe than in this country. The consequence has been that more extensive geological cabinets have been formed, than among us, and greater particularity has been attained in the knowledge of rocks. Valuable as are many of our geological treatises and maps, where shall we find any that will compare with the transactions of the London Geological Society, with the great work of Cuvier on fossil remains, with the work of Conybeare and Phillips which we are considering, or with the truly magnificent map of Greenough! We make not these comparisons because we think meanly of American geologists, nor because we wish to inculcate any servile deference to Europeans. From their frowns or their favour we have nothing to fear or hope. But in matters of science, we wish things to be stated just as they are, and we are not willing to be warped by national partialities, or envious rivalries. We wish to justify ourselves from the charge of paying an undue homage to Europeans. We rejoice to believe that our country is rapidly advancing in geology, as well as in other departments of science; and we with pleasure anticipate the day, as not far distant, when she will take the lead in geognosy. But if we attempt to elevate our geological character above that of Europeans, when facts will not warrant it, we only excite the pity or contempt of the world for our arrogance and vanity.

But a particular instance of our neglect of our countrymen has been pointed out. We recommended the adoption of the terms diluvial and alluvial as defined by Mr. Conybeare, and did not notice a somewhat similar distinction previously suggested by our countryman Mr. Schoolcraft, and explained by Mr. Eaton in his Index to the Geology of the Northern States. We would not be thought to have done any injustice to either of these gentlemen, whose scientific efforts we approve and respect. Yet we cannot plead ignorance in this case: for Mr. Eaton's work was in our hands and we were familiar with its contents. We frankly confess then, that we did not refer to the views of this gentleman on this subject, because we were not satisfied of their utility, and we doubted whether they would at all relieve the difficulties under which the subject laboured. The views of Mr. Eaton we say: for we do not definitely know what were Mr. Schoolcraft's views on the subject. Mr Eaton does not give them in his work; but says that Mr. Schoolcraft "proposes to subdivide the stratum (alluvium) according to the relative ages of the different kinds, and assigns distinctive characteristics for each kind" He further says, that Mr. Schoolcraft makes a threefold division of alluvium: but instead of giving us the 'distinctive characteristics' of this division, he tells us he is inclined to consider it as 'hardly tenable', and says, "I shall attempt a twofold division upon this plan," comprehending in that twofold division all that stratum which Mr. Schoolcraft refers to three divisions. Our neglect of Mr. Schoolcraft then consisted in omitting to mention that he had suggested a division of alluvium, although we were ignorant of its nature. But we had no idea that Mr. Conybeare was the first person who had made a division of alluvium: for although Mr. Eaton states in his 'Index, &c.' published in 1820, that "hitherto there has been no subdivision of this stratum, founded upon the relative ages of different layers," we think he must have forgotten the *geest* of Kirwan, which Prof. Jameson in his notes to Cuvier's Theory of the Earth, (published in this country in 1818,) thus defines: "By geest is understood the alluvial matter which is spread over the surface both of the hilly and low country, and appears to have been formed the last time the waters of the ocean stood over the surface of the earth." Prof. Buckland also, in his tabular arrangement of the strata of England, published as early as 1818, (we do not know the exact time,) and copied into Rees' Cyclopedia in 1819, divides alluvium into '*diluvian detritus*,' or "fragments of neighbouring rocks, with stones not mineralized;" and '*fluviatile detritus*,' or "post diluvian accumulations of mud. sand, and salt." Nay, even Werner himself made the following division of alluvium which must have had a reference to "the relative ages of different layers."

"1. Mountain alluvial formations.

a. On the summits of mountains.

b. On the sides of mountains and at the foot of mountain ranges.

2. Alluvial formations of low or flat lands."

If then we are guilty of neglect, it is neglect of Mr. Eaton's division of alluvium into "primary and secondary alluvion." But our object was not to notice all the attempts to divide this stratum that had been made by geologists; but to notice that which appeared to us the best: and we then believed, and still believe, that Mr. Conybeare has been so happy as to seize upon such characters for his diluvium and alluvium, as are easy of application, and in strict accordance with those distinctions that actually exist in nature. We believe too, that until geologists adopt these terms, their descriptions of the newest formations will be extremely vague and unintelligible. Mr. Eaton's primary alluvion is distingushed from his secondary alluvion by the absence of vegetable remains, in the former. Now suppose he comprehends in the general term alluvion, all the unconsolidated strata—which extensive meaning we believe has usually been affixed to the term—and let us inquire what part of these strata will be included under his primary alluvion. For convenience, let us use the terms employed by Mr. Conybeare, in the work under consideration, as our guide in answering this question. No doubt will exist but his alluvium is comprehended in Mr. Eaton's secondary alluvion, because it abounds in vegetable remains. His diluvium also belongs to the same place: for this also contains beds of fossil wood: and these two formations constitute the greater part of what is usually called alluvion. We come next to the alternations of the fresh water and upper and lower marine formations, a few of the varieties of which are not consolidated; yet in nearly all of them, if not all, vegetable remains occur. Certainly they occur in great quantity in the London Clay and Plastic Clay, which lie beneath the formations just mentioned, and therefore, if any of those are destitute of vegetable reliquiæ, they cannot belong to Mr. Eaton's primary alluvion, since "there are no trunks of trees nor other vegetable remains embraced in it *nor under it.*" We have now descended as far as the chalk strata, and although no vegetables are mentioned as occurring in the green sand or weald clay, yet in the iron sand beneath these, are found ferns and charred wood; so that these also belong to his secondary alluvion. If it be necessary to descend still lower, the same remark will apply to the whole of the oolitic series, since in their lowest part are found ferns, flags, and mosses. Below the oolites, are no unconsolidated beds; and hence, if we do not mistake, Mr. Eaton's primary alluvion is not to be found.

We have made these remarks upon this gentleman's attempt to make a tenable division of alluvium, not from a wish to disparage his efforts. But as we were compelled frankly to acknowledge that we did not see the utility of his distinctions, we felt bound to give the reasons of that opinion. Whether they are conclusive we leave our readers to judge.

We heartily join Mr. Eaton in his caution to geologists to pause before they adopt any important innovations in their science. "The late introduction of a new chemical nomenclature," says Dr. MacCulloch to the Geological Society, "has possibly, in conjuction with other causes, excited a taste for neology, which it behooves us to restrain by every method in our power, and it is the duty of our Society to watch over and protect the science from those changes which will, if not restrained, shortly inundate us with as many names as we have writers."

Our readers, however, must not suppose that Conybeare and Phillips, in the work under consideration, have multiplied new names. With the single exception of their using inferior, submedial, medial, supermedial, and superior, for primitive, transition, &c. they have been remarkably cautious in coining new terms. Well understood as the English rocks are, these writers are so fearful of multiplying synonymes, that they prefer using such uncouth names for their rocks, as coral rag, bagshot sand, Kimmeridge clay, &c. rather than attempt to form more scientific designations.

To conclude: friendly as we are to Mr. Conybeare's new classification, we suspect we do not feel its adoption or rejection to be a matter of so much importance as it appears to Mr. Eaton. Had we been writing a review of Dr. MacCulloch's new system of the arrangement of rocks, we should have given it a commendation not much inferior to that we have bestowed on Mr. Conybeare's; and for nearly the same reason—viz. its freedom from hypothesis. And we assure our Wernerian brethren, that we shall not withhold from them our fellowship, nor look with an evil eye upon their productions, if these are clothed in the Freyberg dress, provided they state facts in such a manner that they can easily be separated from hypothesis. We really have not a heart to indulge one unkind feeling in consequence of a difference of opinion about that most uncertain of all things—a geological hypothesis. We feel the more disposed to cultivate harmony and peace, as the fate of Mr. Conybeare reminds us how short and transient is human life. Since we perused our notice of his work, intelligence has reached us that he is no more. He is now beyond the reach of censure or applause, and is gone, we trust, to a world where doubt and hypothesis will never trouble him again. Whatever any may think in regard to his peculiar views upon the classification of rocks, none will now deny him the title of an able geologist.

Art. XXV.—*Botanical Fêtes in France.* By Prof. J. Griscom.

The Linnæan Society and its ten French and foreign sections, celebrated, on the 27th of June, the Linnæan fête, founded in 1818, at Arlac, and fixed on the first Friday after the feast of Saint-John, in honour of Jean Bauchin, the restorer of Botany in France.

1st. At Bordeaux, the excursion was made to Cypressac, (so called from the number of cypress-trees which grow there,) a place rich in plants, and in attractions relative to the flora of the Gironde. The session was held near Cénon Labastide, in a wood of tufted oaks, and upon benches of green turf. Many ladies, drawn by the novelty of the spectacle, attended this academic session, thus held in the open air. It was opened according to custom, by the reading of the procès-verbal, of the institution of the fête, and that of the last rural session which took place at Pessac in 1821. M. Soulier then presented some important observations, on mildew, ergot, &c. and the means of preventing these formidable enemies of the graminæ. M. Chabrely pronounced an eulogium on Abdolonymus. M. Chausaret, the secretary, treated of some differences between the animal and vegetable kingdom. The *Director* then made a summary report of the fruits of the various excursions of the morning which were spread before them, with the result of the meteorological observations which the society had just made. The reading was then continued as follows: The *influence of Botany on the moral faculties of man*, by M. Caboy. On the *circulation of sap, and the colour of flowers*, by M. Bermond; *Eulogium of Dalichamp*, by M. Teulère, vice-president; *Apotheosis of la Pervenche*, by M. Cauvain, president of the section of Paris. M. Laterrade, the director, (author of the *Flora Bordelasensis*, the second edition of which includes 1611 species,) pronounced a discourse in which he brought into view the agricultural, botanical, and meteorological researches of the society since its last public session. The two following paragraphs may interest cultivators. "The unseasonable heats which we have experienced, excite your attention. Scarcely had the Ram opened the portals of spring, when we beheld expanded the flowers of summer. At the end of March, the nenuphar displayed its golden corals, and the orchideæ embellished our meadows. The thermometer of Reaumur, placed in the shade, and exposed to the north, has often stood at 30° or 31° (=100 F.) How different is the scene at the present time, from that of preceding years! The greater part of the spring flowers have run their race; the last plants of summer are opening their calices, and the vine shows us its grapes, ready to change their colour."

"In its excursions the society visited the domain, where it is proposed to establish an experimental farm, for which the duke D'Angoulême has just taken five shares. Your committee has found a place proper for its destination, convinced that it is by experience that we must prove that our waste lands may be made productive."

A new section of the society at Montpelier was proclaimed, and the reception of its new members.

2d. At Libourne a report was made of the excursions of the year, under the direction of M. Moyne, M. D. president, and they found, for the first time in the department, the *Dianthus superbus*.

3d. At Paris, the members of the section, under the presidency of M. Piètry, titulary of the parent society, made their excursion in the plains of Montrouge. Many strangers and a number of ladies attended the session in which there was a *discourse* from M. Piètry; a memoir on the *Botanical topography of the Isle of France*, by M. Maillard; a memoir on *ossification*, by M. Lalanne; an interesting morceau on *antidotes*, by M. Venot; and a piece of poetry, entitled *Piron, botanist*, by M. Derratier.

4th. Rochefort. The excursion was made in the place called Mouriere, and the session was held in a cabinet of verdure. It was opened by M. Boin, M. D. president. He brought into view the origin of the parent society, and the formation of the Linnæan section of Rochefort. M. Rejou pronounced the *Eulogium of the late Tochon Dupuy*, founder of the Botanic Garden of the city. M. Follet, professor of botany, secretary, a *historical eulogium on Bernard de Jussieu.* The other prelectors were M. Rejoy, fils, and Languadin.

5th. At Ogennes, (lower Pyrennees,) the respectable M. Patasson, author of memoirs on the Pyrennees, &c. opened the session by a description of the site where the section was collected. Among the readings was a *notice on the paragrêles*, by the Baron de Vallier; the report of several excursions made in the valley of Asp, &c. by M. Labarrere; and a piece sent by M. Laterrade, on *the situation of plants and their influence on the character of man.*

6th. At Montpelier a new section has been created under the presidency of M. Raffenau Delitte, professor of the faculty. This section was installed in the conservatory of the Jardin-du-Roi, where the bust of Linnæus was elevated upon steps garnished with flowers, in the midst of which was observed the modest Linnæa borealis. The excursion was rich in plants and observations.

7th. At Narbonne the excursion and the session took place on the borders of the Mediterranean, and under the presidency of M. Julia, M. D. who had just arrived from Barcelona.

In every place, meteorological observations, which will be published in the Annuary of 1823, (now in press,) were made between noon and one o'clock. In every place, a banquet was prepared, and toasts were drunk to botanists and to the king, and in this way were terminated those feasts, so unique in the history of the sciences. The society has just received from the Section des Indes, a package of beautiful plants, some of which were before unknown. On the same day and hour, the three foreign sections *de l'Inde* situated at the Island of Maurice, of *French Guiana* and of *Senegal* will have made the same meteorological observations, which they will not fail to insert in the procès-verbal, destined for the parent society, in order that philosophers may compare them with each other. In those very distant regions, this interesting feast will have been celebrated, which, renewed every year, and in such different places, cannot fail to spread, and inculcate more and more a taste for that noble science which is so intimately connected with our wants, and which deserves to be much more extensively cultivated and encouraged than it has generally been.

ART. XXVI.—*Extracts from letters, addressed to the Editor,* by WILLIAM MACLURE, Esq. President of the American Geological Society.

MOSAIC GEOLOGY.

DUBLIN, June 30th, 1824.

DEAR SIR,

"FATIGUED and tired with the injustice, cruelty, oppression, and folly of despotism, I left Alicant on the day your two letters of January 23, and March 3, arrived.

Your division* of the Mosaical Geology applies better to the transition and older secondary than any thing I have yet seen, and is, perhaps, as good a solution of what is completely out of our reach, as any other.

The fact that the transition is at a constant dip, may be owing to its being disposed on the primitive, concerning which we can as yet scarce conjecture any thing, and may

* That is, *by epochs*, corresponding with the order of time, described in the Genesis, and with the *succession of geological formations*, which we actually find, in the structure of the globe. This was briefly sketched in the letter alluded to by Mr. Maclure.

therefore perhaps as well leave it for the present, until we have caught nature in the act of forming similar rocks."

Cupidity of Mineral Dealers.

The conduct of many European mineral merchants, is in a high degree scandalous and disgraceful. Some of them falsify the locality, exaggerate the scarcity, and enhance the value of all the minerals within their reach, and for the purpose of obtaining a greater price for what they have collected, actually destroy, with the rage of avaricious cupidity, thousands of specimens at the locality, where they were in abundance, concealing, and so disguising the place from whençe they came, as to render it difficult for those that follow to procure any more. Such proceedings, hostile alike to science and to common honesty, tend to prolong the reign of ignorance and misery, and to stop the progress of the civilization of mankind, and are ten thousand times more criminal, than the conduct of the Dutch spice merchants, who burned a few cargoes of spices to enhance the value of what remained, as they only pinched our artificial appetites in their indulgence in articles which perhaps did us more harm than good; whereas the destroyer of what is absolutely necessary to the propagation of knowledge, becomes the active agent of brutal ignorance, the supporter of despotism, bigotry, cruelty, barbarity, and all the other evils that torment mankind. For these evils originate from, and are sustained and propagated by, ignorance, the source and only root, from which spring all the miseries of the human species.

I trust that no American mineralogists, or even mineral dealers, will follow such disgraceful examples, or permit the love of gain, or any temporary advantage, to tempt them to the perpetration of such crimes.

European systems of Geology not always applicable to American Geology.

Some foreign geological travellers in America, in endeavouring to apply their artificial systems, to our extensive, regularly natural, geological arrangement, fall into such errors, as must awaken our young geologists to a proper sense of their own superiority, and to the vast advantages they enjoy, in the simplicity, regularity, and undisturbed state of the stratification of our field of observation. It will give them a proper confidence in their own powers, and teach them the real value of those European theories, fabricated in cabinets, originating more out of literature than science, and more indebted to the pen than the hammer, perverting the few accurate observations that have come within the sphere of their knowledge, to suit the arrangement of their circumscribed field, distorting and crowding all observations to suit the model formed by their imaginations and squaring the stratification of the globe, by the imperfect knowledge they have acquired of their own districts.

Confidence in theories is generally in the exact ratio of ignorance in practice; some mineralogical travellers in America do not soar above the level of mineral merchants, or perhaps of the agent of such merchants, who, tempted by the vast number and variety of the cabinet specimens discovered by the industry and science of our young mineralogists, make it their great object to form such abundant collections of specimens, as the unsuspicious communications of our observers may enable them to do—(for the number of our amateurs is very great and they are scattered all over the continent;) thus they fill the foreign mineral shops with specimens, and their own pockets with money, perhaps laughing in their sleeves, in the mean time, at our credulity, in taking them for men of science, while under the cloak of that name, their only object was a mercantile speculation.

In sketching some years since, the outlines of our stratification, in the boundaries or limits of the different classes of rocks, I have no doubt, that I may have committed many errors; but the sense of our practical geologists is safe from the delusion of chimerical cabinet systems, formed by speculation on partial and circumscribed localities.

I am, perhaps, warranted in thinking, that the mass of geological facts, already collected, and augmenting every day, puts our students out of the reach of quackery, and of imaginary theories, and that nothing but well authenticated practical facts can have any weight with them.

The thirty or forty cases of geological specimens, which I thought necessary to support my sketch of our geology, (now lodged in the collection of the academy of Natural Sciences in Philadelphia,) will, I presume, remain unchanged by the mutation of names introduced into theories, by the mixture and confusion of the three classes of Neptunian rocks; some denominating secondary, what I termed transition, and calling secondary a great part of what I call alluvial. It is probable that the whole of those three great classes of Neptunian rocks was in the state of alluvial, before cement, affinity, attraction, or some other agent that nature may have employed to bring them into their present state, had consolidated them.

I have never observed any extensive similarity in alluvial or *diluvial* (as it is the fashion of the day to call them) formations, but have rather remarked that every alluvial basin seems to have arisen from the situation of rocks in its vicinity.

The strong appetite which all animals have for licking salt, nitre, &c. found in most caves, naturally accounts for their bones being deposited there."

Improvements in Education—Infant Schools—Mechanical Institutions—Cheap Publications—Mr. Phiquepal—Mr. Owen, &c.

I have been much gratified with the progress of civilization, in all those parts of the British dominions which I have lately visited, and anticipate much pleasure in finding still greater improvements, both moral and physical with you, for there were only two things worth our imitating, viz. Infant Schools, Mechanical Institutions for teaching the young men and apprentices the application of the sciences to the useful arts, and their cheap periodical publications for the industrious productive classes. These are sold at from 1*d.* to 3*d.* per No., of one sheet of letter press, and they teem from the press every week, in editions of 100,000 at a time, with more common sense, and useful information, than would have been found circulating 50 years ago in the most highly cultivated and scientific societies. Infant Schools are an excellent improvement, and a great benefit to society, and that even although they do not here learn them any thing suitable to their years, or the utility of which can possibly be understood by the children; but the congregating of them together in schools of 2 or 300, learns observers how much can be done with children, and at how early an age they are capable of being taught most of the useful arts and sciences; and the advantages will be infinite when ancient prejudices can be so far removed as to teach them all they are capable of learning by instruments and designs, calculated to bring many of even the difficult problems in mathematics within the reach of their comprehension. It will be an immense saving of the most valuable gift of nature, time, and tend greatly to the advancement of civilization. I go in a few days to Paris, where I intend to sell my house, as Mr. Phiquepal goes to Philadelphia, with all his pupils as professors, to teach the ystem he has been perfecting these five years. Thence I go to the south, perhaps to Sicily in the winter, and in the spring to the United States. Mr. Robert Owen, of New Lanark, has just decided to make the United States the field of his future experiments on the facility, utility, satisfaction, self-approbation, and pleasure of rendering the great mass of industrious and productive classes prudent, happy, and wise. He has purchased all the lands upon the Wabash, belonging to the Harmonists, with all the improvements, and goes there to arrange his plans of procuring the greatest sum of happiness to the greatest number. His liberal. philanthropic intentions cannot fail to interest all true friends of humanity, who must join in sincere good wishes for his success.

I have sent the last volume of the Wernerian Society, and the first three Numbers of the Westminster Review, which, thinking it the best and the only one capable of doing justice to our country, I subscribe for, to be sent regularly to the Society, and shall likewise send any of the transactions of the Geological Society that may have been published since you got the last. I remain yours sincerely,

WM. MACLURE,
London, 10th Sept. 1824.

Professor Silliman,
Yale College, New-Haven.

Basalt—Natural History Society at Belfast—Progress of improvement in the British European Domains.

Dear Sir,

I wrote you from Dublin, by the Dublin packet, and promised to send the Geological Society a pillar of articulated Basalt, from the Giant's Causeway, but was prevented by a prohibition by two of the parties and a Bishop, who pretended to have claims to the soil, and who would not permit a rock to be taken from it, or any depredation, as they termed it, to be committed. I now send you a small box of specimens, though imperfect, from the constant rain during my stay at the Causeway. They may serve as a comparison with others, although I do not perceive any great difference from other Basaltic regions which I have seen, except the articulations of the pillars, which are peculiar to the Giant's Causeway. The same arrangement, in ridges long and narrow in proportion to their length, the porous rock always on the summit of the ridge, and the compact Basalt at the bottom. Where they come in contact with any combustible, such as coals, these are charred from three to four feet from the junction, &c. &c. &c. Through all this country the Basalt generally covers a stratum of white limestone, filled with flints, with much the same petrified shells as are to be found in the chalk.

I have left the box W. M. No. 21, with Mr. James M'Adam, a very active member of a society lately established here for Natural History, and supported by a number of industrious young men, who will forward it to New-York, care of Col. Gibbs. If you consider it useful to the Geological Society to have one of the pillars of articulated Basalt, or any other mineral this country can afford, by your forwarding them a few duplicate specimens, desiring them to make a return of what you require, I have no doubt but an exchange mutually beneficial might be established, as it is a society in a state of progressive improvement, which promises much; and being composed of young men, unincumbered with the prejudices of age, more may be expected from them than from old societies confined within the limits of etiquette and formality.

I am highly gratified with the progress of civilization in this country, more particularly in this place, in which the improvement has been, and still continues to be rapid, and which resembles more a town in the United States, for new streets and houses, than any place I have seen in Europe. The attention of many of the most liberal and influential men to the education of the millions of the productive class, is more than I expected to find any where in aristocratic Europe. The improvement of old, and the establishing of new schools, shows a public spirit well directed, that ought to be imitated by no country more than our own. Where the general mass rules, the diffusion of knowledge is positively necessary for the prosperity of social order, and the foundation of general happiness Lancasterian schools are spreading fast over the whole country, and improving by the grafting of a great many of the practical rules of the Pestalozzian system, introducing by little and little to a more direct and shorter road to useful knowledge than has as yet been taken by the old systems, making utility the scale by which to measure the value of all things.—I remain, yours sincerely,

WM. MACLURE,
Belfast, 18*th July*, 1824.

Professor SILLIMAN,
Yale College, Connecticut.

Mr. Phiquepal and the Pestalozzian system.

PARIS, November 9, 1824.

Mr. Phiquepal sailed from Havre a few days ago for New-York in the ship Cadmus, Capt. Allyn, and carried with him about fifty packages of prints, instruments, books &c. &c. necessary to the most easy and rapid development of the faculties, and giving correct ideas to children in the improved Pestalozzian system, without fatiguing their attention or burthening their memories—a little sketch of which I gave you in some of my former letters; and Mr. Phiquepal has a short epitome of the method which I drew up for some of my European friends, which he intends to take off lithographically, as all the boys understand that excellent medium of communicating ideas, and work the press with ease and accuracy. Britain, beginning at last to open her eyes to her real interests, and the great advantage of a good rational education, has adopted, in many of her schools, a great part of the system of Pestalozzi, and new schools are forming every day entirely on the method—so that our colonial prejudices, which made us look up to her for precedents in morals, religion, and politics, and which as yet have been one of the greatest bars to the progress of our civilization, will now, as far as education is in question, be aided by our imitative propensity;—this, joined to the great change in public opinion with us, and the progress already made, with the brilliancy of some of the specimens already exhibited, warrants the expectation that education, trusting to the weight and influence of its own merits, will be enabled to walk alone, when in future, all artificial aid in direction will tend more to retard than advance its natural improvement. I have long thought of the superabundant verbiage of books, and the fatiguing task of readers, to turn over 1000 pages in search of the lines of common sense that might be conained in a few pages, when all that is useless, mysterious, or incomprehensible, was abstracted. I am convinced that, notwithstanding my period of life, I can *begin* such a manufactory, thoroughly persuaded that the geometrical progression of improvement and civilization will support and continue it—it is a distillation to extract the essence of all books, printing them in the most economical manner, and in such forms and bulk as to suit the pecuniary powers of the poorest, which I calculate might easily be done at an hundredth part of the present prices, and with the contemplated improvements of the Steam Engine, and making paper with straw by a short and easy process, as is now in embryo in this country, may perhaps be reduced to a thousandth part of the present expense.

Mr. ———, himself a brilliant specimen of the success of the Pestalozzian system, is now here. The discovery of the Glucine in the cymophane, and of Fluoric acid in the condrodite, after it had escaped the notice of the first European analysts, astonishes the scientific world on this side of the Atlantic, and it is the nature of the system to put the pupils on the direct road to every species of knowledge, strewing it with flowers, and creating new pleasures at every step.

INTELLIGENCE AND MISCELLANIES.

I. DOMESTIC.

1. *Notice of Impressions of Plants accompanying the Anthracite of Wilkesbarre.* *

WILKESBARRE, Pa. Oct. 8, 1824.

To the Editor.

DEAR SIR,

AVAILING myself of the opportunity which the visit of a neighbour to New-Haven affords, I do myself the pleasure of transmitting for your private collection, a few specimens of the vegetable remains accompanying our coal—they are among the best characterized impressions which have been as yet discovered.

No. 1 and 2 are the interior, *moule intérieur*, and the exterior covering of the plant, with the accompanying plate of coal, which allowing for compression, would indicate the thickness of the original vegetable. The specimen sent is one of those inundated plants to which the mass of coal is to be attributed; they bear strong evidence of their having been deposited in a state of great repose, in the waters where they grew, and would prove that the anthracite has been formed from vegetables which have undergone decomposition in water; they are generally found in the floor of the coal beds in immediate connexion with the coal—the matrix is a fine, carbonaceous, black slate, splitting easily into very thin laminæ, and burning *white;* where these plants occurred, or collected in mass, free from the influence of occasional muddy water, nearly all traces of organization are obliterated.

The other large specimen is one of those which are found only in the strata, (above the coal,) formed from the con-

* The Specimens accompanying the letter of Mr. Cist are uncommonly fine, and it would be happy if intelligent men, residing near our various coal mines, would take care to collect similar specimens. The public have been already furnished by Mr. Cist, with a description and plate of the anthracite mines of Wilkesbarre.—See Vol. IV. p. 1, of this Journal.—*Ed.*

torted débris of land and aquatic vegetables mixed with earth and sand, and have evidently been swept over the coal; the matrix in which these have been found is a pale coloured coarse sandy schist, becoming *red* in the fire.

Respectfully, your obedient servant,

ZAC. CIST.

Professor Silliman,
New Haven, Connecticut.

2. *Remarks on the lead veins of Massachusetts, &c. in a letter addressed to the Editor.*

Yale College, July 15, 1824.

Professor Silliman,

In September last, I spent considerable time in the vicinity of the lead mines, in Southampton, Mass. According to Mr. Hitchcock and Professor Eaton, veins from these mines, after appearing in the primitive rocks at Whately, passing under the bed of Connecticut river, the alluvial deposites of Sunderland, and the secondary formations of Mount Toby, are seen again—precisely where we should expect to find them--in the granite and quartz of Leverett. Though I have no doubt that this is a correct statement of the case, yet from some discoveries made in Williamsburgh by a Mr. Nash, it would seem that the lead connected with the Southampton mines is more extensively distributed in that region, than has been supposed. It was found at Williamsburgh in June, and the specimens I have obtained were in quartz, and associated with pyritous copper, though the latter is here by no means so abundant as at the locality on the farm of Mr Field, in Leverett. For a while, very sanguine hopes were entertained with regard to the Williamsburgh vein, and it is probable that future research will prove it to be a valuable one:—owing, however, to the hardness of the rock, few attempts have have yet been made to penetrate far into its interior. Is this one of the veins of Mr. Hitchcock and Professor Eaton? After proceeding in a northerly direction from Southampton, would it, at the northeast corner of Williamsburgh form a right angle, and go directly east, to Leverett? Or, are this and the Whately vein not identified? A more critical examination of the towns in Hampshire and

Franklin counties would doubtless throw much light upon the subject; and it would certainly be desirable to trace the bearings, and fix the limits of the lead in Massachusetts with more precision.

In the neighbourhood of the locality above mentioned, I procured several specimens of a mineral which I have since ascertained to be *serpentine.* They are somewhat harder than those I have seen from the Milford quarry, have a very fine and beautiful grain, and are slightly translucent at their edges.

I have been much pleased and instructed by the perusal, in the Journal of Science, of Mr. Hitchcock's excellent description of the *Connecticut Valley.* He has done the subject ample justice, and himself the more honour, from the circumstance that most of the geological facts which he mentions, are the result of his own accurate observation. What he has described, he has *examined,* and examined *closely;* and it must be no small gratification to this gentleman to reflect, that the section of country which he has with such unwearied assiduity investigated, (I here speak more particularly of Hampshire and Franklin counties,) is becoming, or rather has already become, the rallying point of all the mineralogists in Massachusetts.

Mr. Hitchcock has entered at considerable length into the theory with regard to two lakes, one of which he supposes to have been *north,* and the other *south* of Holyoke. Were further proof necessary to convince the intelligent inquirer, that there must have been, at some period, a vast body of water on the *north* side, at least, of Holyoke, would it go to remove his doubt to tell him, that organic remains have been found in the meadows in Sunderland fifteen or twenty feet below the surface, and that very probably the rocks which form the falls at South Hadley were thrown into their present confused position, at the time the body of water alluded to forced its way through the mountain?

Very respectfully yours,

AUSTIN O. HUBBARD.

3. *Method of Browning Iron.*

[Communicated by Mr. John Duntze, of New-Haven.]

Nitric acid, - - - -	½	ounce.
Sweet spirits of nitre, - -	½	do.
Spirits of wine, - - -	1	do.
Blue vitriol, - - - -	2	do.
Tincture of steel, - - -	1	do.

These ingredients are to be mixed, the vitriol having been previously dissolved in a sufficient quantity of water to make, with the other ingredients, one quart of mixture.—Previously to commencing the operation of browning a gun barrel, it is necessary that it be well cleaned from all greasiness and other impurities, and that a plug of wood be put into the muzzle, and the vent well stopped. The mixture is then to be applied with a clean sponge, or rag, taking care that every part of the barrel be covered with the mixture, which must then be exposed to the air for twenty-four hours, after which exposure the barrel must be rubbed with a hard brush, to remove the oxid from the surface.

This operation must be performed a second and a third time, (if requisite,) by which the barrel will be made of a perfectly brown colour. It must then be carefully brushed and wiped, and immersed in boiling water, in which a quantity of alkaline matter has been put, in order that the action of the acid upon the barrel may be destroyed, and the impregnation of the water by the acid neutralized.

The barrel, when taken from the water, must, after being rendered perfectly dry, be rubbed smooth with a burnisher of hard wood, and then heated to about the temperature of boiling water; it then will be ready to receive a varnish made of the following materials:—

Spirits of wine, one quart,
Dragon's blood pulverized, three drams,
Shell lac bruised, one ounce;

and after the varnish is perfectly dry upon the barrel, it must be rubbed with the burnisher to give it a smooth and glossy appearance.

4. *Recipes furnished by Mr. Eli W. Blake.*

1. *To make a Lacker for Brass.*—Take eight ounces of spirits of wine, and one ounce of arnotto, well bruised—mix this in a bottle by itself. Then take one ounce of gamboge, and mix it in like manner with the same quantity of spirits—and bruised saffron steeped in spirits to nearly the same proportion.

Take seed-lac varnish what quantity you please, and brighten it to your mind by the above mixtures. If it be too yellow, add a little more from the arnotto bottle; if it be too red, add a little more from the gamboge or saffron bottle; if too strong, add spirits of wine.

2. *To make Seed-lac Varnish.*—Take spirits of wine, one quart; put it in a wide-mouthed bottle, and add thereto eight ounces of seed-lac, which is large-grained, bright, and clear, free from sticks and dirt; let it stand two days or longer in a warm place, often shaking it. Strain it through flannel into another bottle, and it is fit for use.

5. *Extract of a letter to the Editor, from Beaufort, South Carolina.*

1. *Remarks on the use of Sulphur in Rheumatism.*—In a letter written by Professor Olmsted, and addressed to the Editor of this Journal, (Vol. VIII. No. 2,) mention is made of a man who was severely afflicted with swellings of the joints, &c. brought on, it was supposed, by his having taken large doses of sulphur,—to which remedy he had been advised to resort by a quack in order to cure a rheumatic affection under which he laboured. Is it not most likely, that the disease in question was caused by rheumatism, and that the swellings of the joints, &c., would have taken place, although the sulphur had never been administered? I am the more inclined to this opinion from the well known tendency which rheumatism has to terminate in this

manner; but I never before heard of sulphur producing such dreadful effects, although I must confess that I never knew it given in such large quantities, and am, therefore, unable to say that it would not. The giving of sulphur, for the cure of gout and rheumatism, is an old and valuable remedy, and it would be worth while to make a little further inquiry into this case, or any other in which it may have been used injuriously.

Sulphur is also made great use of with us after salivation has been produced, and it appears to have a more decided effect than any other medicine, in removing the poison of the mercury from the system—whether by acting as a cathartic, or by its pervading every part of the body, and expelling the mercury from thence by means of perspiration, or by its acting upon the absorbent system. In this manner I have known large quantities to be taken in successive doses, and always with beneficial effects, never producing any affections of the joints, or muscles.

2. *Remarks on the use of cotton-seed for the purpose of affording gas for illumination.*—Professor Olmsted also mentions, that he has procured carburetted hydrogen gas from cotton-seed. I have not the least doubt but very excellent gas might be thus produced; but he is evidently mistaken when, in summing up the cost, he rates the cotton-seed as being worth little or nothing. It may be the case in the part of the country where he resides; but with us it is estimated as being worth at least twenty-five cents per bushel. Sometimes it sells very high, when any accident happens to the crop in the early part of the year. It is used as a manure upon cotton, corn, or potato land, and is accounted the best which can possibly be applied. It is also probable that he speaks of the green seed, or short staple cotton; but the cotton-seed I refer to, is the black, or sea-island. It is sometimes used here as food for cattle, but its value as a manure is so well known that it is rarely applied in this manner.

6. *Meteorological Journal, with miscellaneous remarks*, by Dr. Lyman Foot, of the American army.

Cantonement Brady, (Sault de St. Marie, Lake Superior.)

JANUARY, 1823.

Date.	Thermom. Hour. 7	2	9	Weather.
6			10	
7	17	24	16	Snow.
8	16	25	4	do.
9	25	34	25	do.
10	−2	10	9	do.
11	0	12	16	
12	10	27	10	
13	2	18	7	Snow.
14	18	26	26	
15	25	26	24	Snow & rain.
16	10	28	31	
17	34	52	30	
18	27	32	29	
19	14	52	15	
20	20	47	15	
21	12	37	30	
22	10	28	10	Snow.
23	−6	42	13	
24	20	34	28	
25	31	33	30	
26	28	30	28	Snow.
27	25	33	20	do.
28	20	30	29	do.
29	22	28	25	do.
30	20	30	22	do.
31	−4	18	4	do.

Light snows often not mentioned.

I had no thermometer before the 6th of January. The weather here has been very cold. The sudden changes are somewhat remarkable. Every spot in the river is closed except the falls, over which during these cold nights hangs a dense fog.

Every severe cold night was sure to be followed by a fall of snow. It would often sift down (if I may so say) in very fine scales and stars, apparently without any dense cloud, but the whole atmosphere seemed to be filled with fine flakes of snow. It would continue to snow thus for an hour or two, and the atmosphere become clear. It would then continue comparitively mild through the day. Just at sun-down the thermometer would begin to sink, and the night be clear and cold till just before day. It would then become hazy, and the same thing take place the following day. The evaporation from the falls no doubt is very great. Thus the atmosphere becomes surcharged with vapour, which congeals and gives all its latent heat to the surrounding air.

FEBRUARY, 1823.

Date.	Thermometer.			Weather.
	7	2	9	
1	−13	28	13	
2	2	24	20	
3	−12	−3	−25	−28 at 1 A.M.
4	−21	6	−2	
5	−14	−4	−17	
6	−30	−3	−10	
7	−26	2	2	
8	8	12	4	
9	5	20	13	
10	8	30	10	Snow.
11	16	30	22	
12	10	18	7	Snow.
13	6	20	12	
14	10	22	8	Snow.
15	−13	8	−10	do.
16	−10	12	0	
17	7	14	8	Snow.
18	−10	6	−7	
19	−4	8	7	Snow.
20	−2	28	14	
21	14	32	17	
22	−1	32	22	
23	22	33	24	Snow.
24	5	27	16	
25	20	17	10	Snow.
26	−2	7	−6	do.
27	−24	18	−7	
28	−24	15	6	

During these extreme cold nights I always found a difficulty in breathing in the open air. It produced a dryness of the fauces and a disposition to cough. It brought on pleurisy and other inflammatory complaints among the men. Indeed almost all our diseases here have been inflammatory, which I think is caused by the severe cold. We found it necessary to take every precaution to prevent freezing. Our men would frequently get frosted, but none very badly. The snow, as I should judge, has been about four or five feet deep. It was impossible to go out of a beaten path without snow shoes. There is snow and ice now lying in the cantonment. I have seen it this day where it was covered by chips, &c., a foot or two thick.

L. FOOT.

June 1823.

I have not room to give you my full report of sick, but I will give the total sick during the quarter ending the 31st of March, 1823,

Total sick during the quarter ending the 31st of March, 1823, -	134
Remaining at last report,	11
Total, - - - -	145
Returned to duty, -	131
Remaining sick, - -	14

N. B. − on the left of a figure indicates below zero.

7. *Dr. Cutbush's treatise on Pyrotechny.*

Mrs. Cutbush, widow of the late Dr. Cutbush of West Point, proposes to publish by subscription, a treatise on Pyrotechny by her deceased husband, Dr. James Cutbush, late acting professor of chemistry in the National Military Academy.

From the reputation which Dr. Cutbush sustained, as well as from the ability which his elaborate treatises on these subjects, already published in this Journal, display, (Vol. VI. pa. 302, and Vol. VII. pa. 118) there can be no doubt that this posthumous work will be worthy of the public patronage, which we hope will be liberally bestowed, both on account of the importance of the subject, and of the interests of the worthy family, for whose emolument the work will be published. We understand that in November there were already two hundred subscribers, and that the work will be put to press as soon as the subscription shall justify that step.

8. *American Sculpture.*

We have been recently much gratified, by a production in statuary, of a self-taught artist, Mr. Hezekiah Augur, of New-Haven. Mr. Augur is by profession a carver in wood, and has been, for several years, distinguished in that elegant art; but he had, until recently, never attempted any thing in sculpture. It had never been in his power even to *see* any thing of the kind; he had never in his life, *beheld a statue or a bust*, and had formed his ideas of them, from plaster models only. His friends were therefore much surprised, when they saw him at work, upon a marble head of Dr. Franklin, and they were still more astonished to find that he succeeded in producing a perfect likeness to *his original*, which was a bust of the great American philosopher, carved in wood, and painted white, which, for more than thirty years, stood as a sign, on the portico of the classical book store of I. Beers, (afterwards Beers & Howe,) near the public buildings of Yale College.

Mr. Augur, encouraged by this result, next attempted the bust of Apollo, having for his model, only a plaster cast. He wrought this piece of work from a good block of Carrara marble, the celebrated material of nearly all the modern, and of some of the ancient statues. The writer of this article, does not claim to be a *connoisseur*, but having formed his ideas from a degree of familiarity with many of the finest modern productions of the chisel, and from not a few of the most celebrated marble antiques, he was delighted to see a beautiful bust, executed by this self-taught, and unpretending young man, which might well claim attention, even in Somerset House, or the Louvre. We had afterwards opportunities of viewing the bust in company with gentlemen of taste and experience in this art, and especially with an eminent *artist*, who expressed his astonishment in warm terms, and did not hesitate to pronounce that Mr. Augur, if encouraged, must obtain a high rank in excellence and fame.

As this bust of Apollo is now publicly exhibited in the Academy of Arts in New York, it is perhaps not proper to say more, than that our object is to draw the attention of the American public, to this unexpected production of native talent, executed without previous observation, or instruction, or patronage, and in the intervals of time redeemed from a busy and more lucrative employment.

We have long had much cause to be gratified with the success and the fame of American painters; but, so far as we are informed, Mr. Augur is the first native American, who has successfully attempted sculpture; at least *so successfully*, that his very first production is worthy of a place in a museum of statuary, and his second gives full assurance of the brilliant exertion of taste and talent of a high order.

We should be greatly gratified, if Mr. Augur's native state, or some other state, would give him instructions to proceed to Raleigh for the purpose of copying—(after leave duly obtained) at least the bust, if not the entire figure, of our own Washington, as executed by the great Canova.

9. *Notice of a Mineral supposed to be a Phosphate of Lime from Williamsburgh, Massachusetts, and of the localities of several other minerals.* EDITOR.

July 1824.—This mineral was forwarded to me in June last, by Mr. Morris Dwight, its discoverer. It is imbedded in a rock of gneiss, and bears strong resemblance to beryl, to crysolite, to crysoberyl, and to the phosphate of lime, especially to the variety called spargelstein, or asparagus stone, as it is formed at Cap de Gate, in Murcia, in Spain.

The characters which I have remarked in the Williamsburgh mineral, are—that it is electric by heat and friction, infusible *per se*, but loses its colour and becomes white; with borax it apparently melts, at least the globule obtained is white, and transparent, and to the eye homogeneous. It scratches rock crystal when rubbed on a smooth surface of that substance, and is as easily scratched by the Haddam beryl, and by topaz of Brazil. The fracture of the perfect crystals is both ways conchoidal; the lustre is shining and vitreous in a high degree, both in the natural surfaces and in the fracture.

The crystal, whose colour is a delicate straw yellow, is a prism of six sides, remarkably regular, with slight longitudinal truncations of the solid lateral edges, thus giving the rudiments of a prism of twelve sides; the sides are not striated, but reticularly indented, as if by the mica of the gangue. The specific gravity is 3.2, the thermometer being at 65° Fah. the specific gravity of the beryl is 2.67, of chrysolite 3.4, of chrysoberyl 3.08, of phosphate of lime from 3.02 to 3.21. The Williamsburgh mineral phosphoresces in the dark; on a shovel heated red hot, it emits a yellowish light.

January 1825.—Since the above notices were penned, I have received from Mr. Dwight, other specimens in their gangue; some are massive and some crystallized, the colours are generally shades of pale green, or greenish white; in a few instances nearly apple green. I extracted from the gangue the greater part of a large crystal, split nearly through the diagonal diameter, which was more than an inch in length, and that of the external sides was almost three-fourths of an inch—the specific gravity of this piece, whose weight was 168 grains, is 3.43, the fracture less conchoidal and more approaching to foliated than that of the specimens described above; the phosphorescence was distinct and beautiful, and one end of the crystal was *terminated*, by a flat plane, at right angles to the sides; the other end was broken.

Notwithstanding the points of resemblance between the Williamsburgh mineral and phosphate of lime, it seemed difficult to assign to that species, a substance which *scratched quartz*; and satisfied with that trial, I neglected to apply the point of the knife. Learning, however, from Dr. Porter, that Mr. Nuttall is disposed to regard the Williamsburgh mineral as a phosphate of lime, and from Mr. Dwight that it is dissolved by the acids;* I then for the first time, endeavoured to impress it with a knife, and found to my surprise, that all the varieties were impressed by steel, with little more difficulty than fluor spar.

I relate the circumstance in order to show the necessity of caution, in drawing conclusions especially from the relative hardness of minerals, *for a softer substance, may, by continued rubbing and grinding be made to impress a harder.* Instances of this kind are numerous in the arts, and in the case of the gritty powders used in polishing hard stones. Ropes will wear wood and even stone; wood will wear metals, and metals will abrade earthy minerals; even a soft leather strap polishes and sharpens the hardest steel.

I am disposed to think with Mr. Nuttall, that the Williamsburgh mineral is a phosphate of lime, and as it phosphoresces, we must assign it to the variety *apatite.* This is not the first time that this mineral (strongly resembling several of the gems) has held mineralogists in doubt, as to its nature, and thus justified its Greek name of *the deceiver.*†

We add an extract of a letter from Mr. Dwight, dated June 1, 1824, prefacing it with the remark, that the minerals mentioned by him, are all well characterized, and the plumose mica, and the micaceous iron (especially the latter) extremely beautiful.

"I take the liberty to send you a box of minerals containing the following specimens.

1. Argentine, Williamsburgh,
2. Pseudomorphous quartz, do.
3. Epidote, do.
4. Plumose mica, do.
5. Micaceous oxide of iron, Hawley.

We have recently discovered the locality of argentine. It occurs in large masses of a superior quality—I think some pure masses will weigh tons.

The quartz is found in the vicinity of the argentine. The dog-tooth projections appear to have formed upon the dog-tooth spar originally. Some of these projections however are rectangular; perhaps these were formed upon crystals of sul-

* A fact which I have since confirmed by experiment, and the dissolved mineral was again precipitated by caustic potash.

† From 'Απατάω, to deceive.

phuret of lead, as some lead is found in the rock. We have found but a few of the cubic projections. The dog-tooth formation is found in abundance.

We find the plumose mica in great plenty in this town."

10. *Localities of Minerals on Connecticut River.*

We have inserted in one of the plates of this Number. a sketch of the region near the mouth of the Connecticut. It was furnished some years ago, by Mr. T. D. Porter, for the purpose of illustrating certain localities of interesting minerals in that vicinity, and although not drawn with a view to publication, will probably be acceptable to travellers.

EDITOR.

11. *Officers of the Pittsfield Lyceum of Natural History of the Berkshire Medical Institution, elected September* 9, 1824.

CHESTER DEWEY, A. A. S., *President.*

DAVID HUNT, M. D.
Rev. EDWARD HITCHCOCK,
JOHN P. BATCHELDER, M. D. } *Vice-Presidents.*

HENRY K. STRONG, *Secretary.*

Col. SAMUEL M. M'KAY, *Treasurer.*

JACOB PORTER,
LEWIS C. BECK,
HENRY H. CHILD, M. D.
ORRIN WRIGHT,
HENRY HUBBARD, } *Curators*

12. *American Geological Society.*

The annual meeting was held in the Cabinet of Yale College, on the evening of September 8, when the following persons were elected to the offices affixed to their names.

William Maclure, Esq. *President.*

George Gibbs.
Benjamin Silliman,
Parker Cleaveland,
Denison Olmsted,
John W. Webster,
Robert Gilmour,
Robert Hare,
Edward Hitchcock, } *Vice-Presidents.*

Alfred S. Monson, *Recording Secretary.*

J. W. Webster,
C. Hooker,
John Griscom, } *Corresponding Secretaries.*

S J. Andrews, *Curator.*

C. A. Goodrich, *Treasurer.*

B. Silliman,
G Gibbs,
P Cleaveland,
R Hare,
Eli Ives, } *Committee of Nomination.*

George Gibbs,
J. W. Webster,
James Pierce,
B. Silliman, } *Committee of Publication.*

A paper was read on the gold of North Carolina,* by Professor Denison Olmsted, of the university of North Carolina at Chapel Hill.

Large additions having been made (as heretofore acknowledged in this Journal) to the Cabinet of the Society, since the former annual meeting—the specimens as ar-

* Printed in the present number of this Journal, but, *by inadvertency*, omitted to be credited to the Geological Society.

ranged and labelled in the cases, were exhibited to the Society.

Advices have been received of a box* of minerals from the Giant's Causeway and its vicinity, forwarded from Ireland by the President of the Society, Mr. Maclure.

Mr. Maclure has also forwarded from Paris thirty-five volumes of the Journal de Physique, to complete the set of this great work, presented to the Society by him—and from London the last volume of the Transactions of the Geological Society of London, and of the Wernerian Society of Edinburgh, with the first three numbers of the Westminster Review,—all these are destined for the Library of the American Geological Society.

The Hon. Stephen Van Rensselaer has presented the Society with a copy of Mr. Eaton's Geological Survey of the great New York Canal, and with a box of specimens illustrative of the work.

The Belfast Natural History Society have forwarded a column of the Giant's Causeway, consisting of several articulations; this specimen is one of the two which were contained in their own cabinet; it is now next to impossible to obtain specimens from the Causeway, as it is vigilantly watched.

13. *Mr. Hitchcock's Geological Sketch of the Country on Connecticut River.*

The various memoirs on this subject, heretofore published in this Journal, have been embodied by their author, into a single volume, which, with the accompanying map and other engravings, may now be obtained, as a separate work. There can be no doubt that it will prove a useful companion for the traveller in the region of the Connecticut river, and it certainly affords to the young American Geologist an example highly worthy of imitation.

* P. S. Feb. 10, 1825.—This box has arrived.

14. *Topaz?*

[Communicated by the Rev Edward Hitchcock.]

"This occurs in that rich repository of minerals, the Goshen granite, three miles northwest of the meeting-house, associated with green tourmaline, cleavelandite, spodumene, indicolite, rose mica, and pyrophysalithe. I found a portion of a crystal of this mineral, nearly an inch in diameter; in some specimens of this granite, which I collected for the other minerals they contained. It is perfectly limpid, although when lying in its bed, it has a delicate green tinge, which is occasioned by the greenish crystals of mica that surround it. The fracture in one direction is straight, and exhibits a lamellar structure; in all others, it is conchoidal, and the lustre is vitreous. It exactly resembles the limpid topaz from Rio Janeiro. It scratches quartz, but is itself scratched by the spinelle."

Remarks.

Mr. Hitchcock having given me a specimen of the mineral described above, and requested me to examine it, I have paid such attention to it as has been in my power. Its specific gravity is about 3.—I cannot vouch for the accuracy of the trial, because the weight of the portion which I examined was only 9 gr. and a larger piece might have given it as high as it is usually stated, for the topaz—that is from 3.46 to 3.60.* Mr. Hitchcock's specimen scratches not only quartz, but beryl; it is perfectly transparent and limpid, and so entirely foliated in its structure in one direction, that a little jar causes it to split into thin parallel pieces, with brilliant and beautiful surfaces, while the cross fractures are in every direction conchoidal. On comparing it with a specimen of limpid topaz from Siberia, in Col. Gibbs's cabinet. I could discover no difference, except that it was less brilliant. A very minute fragment when heated, and presented to the fibres of cotton caused a slight movement; but I could not be positive that it was an electrical effect. When exposed to the flame of the compound blow-pipe, it readily melted with strong ebullition, and produced a glistening white enamel. It will be remembered that this was precisely the effect which I produced by the compound blow-pipe upon the Saxon topaz in 1812, several years before Dr. Clarke's experiments were made.—Editor.

* I found the specific gravity of a perfectly limpid white topaz from Siberia, the weight of which was 431 grains, to be 3.59—from Col. Gibbs's cabinet, the same mentioned above.

15. *Note or addendum to the letter of Professor Robert Hare to the Editor "on some improved forms of the Galvanic Deflagrator."* pa. 99. Vol. VIII.

Since this letter was published, I find that my friend Dr. De Butts of Baltimore, has, in one apparatus, availed himself of that alternation of surfaces, that omission of insulation, which I had first used in one of my Calorimotors ;* in another more numerous series of smaller plates, he employs the principle of simultaneous immersion, originally used, with respect to an extensive series, in my Deflagrator. His plates differ from mine, in being semicircular—and there are more pairs in the series, and fewer large plates in each pair, than in the Calorimotor.† In his apparatus, the plates by a quarter revolution enter the acid: in mine, a similar movement in the trough throws the acid on the plates.

I often contemplated the mode which he has adopted, as it seemed sufficiently convenient; but for several reasons, preferred the methods which I have employed. Cutting the sheets semicircularly, is very wasteful of the metal—and I have never seen sheet zinc for sale in the circular form, nor copper either, unless for bottoms, which are too heavy and expensive. Plates of cast zinc cannot be used advantageously, as they are too heavy for large apparatus, and are soon made rough by corrosion, which diminishes their energy; whereas the rolled zinc may be eaten down as thin as paper, and still be efficient. The rationale of this difference, is to be found in the crystalline texture of the cast zinc, which rolling destroys. That solution, to a certain extent, tends to expose the angles of crystals, has been fully shown, in the decrystallization of alum, first observed, I believe, by Mr. Daniels. I have recently seen it strikingly exemplified.

Experience demonstrates the importance, of encasing each zinc plate, especially if uninsulated, in the copper of the pair,

* Of which a plate is given at the end of the book.

† I consider two heterogeneous metallic surfaces, as for instance, one surface of copper and one surface of zinc, when associated by metallic contact, or a metallic strap passing from one to the other, as a Galvanic Pair—whether the surfaces be in one sheet of zinc, and one sheet of copper, or, consist of several sheets of zinc, and several of copper ; one metallic communication uniting all the zinc sheets—and another uniting all the copper sheets.

which succeeds it, in the series. In the form adopted by Dr. De Butts, the copper cases cannot be made, without a much greater expense in the workmanship. Those which I have used, are formed by machinery, so that they are very handsomely finished, with great rapidity, and all of one size and shape.

In consequence of this contrivance, a workman has undertaken to furnish Deflagrators, at forty-five or fifty cents for every Galvanic pair (seven inches by three) contained in them. This is much lower than the Paris prices, for apparatus far less powerful.

I cannot discover the motive of Dr. De Butts, for having the legs of his apparatus of glass—while, from the construction of his troughs within, he evidently sanctions my plan of omitting insulation. Had I seen the glass legs, without being aware of the internal construction of his battery, I should have expected to find the inside partitioned by glass.

Dr. De Butts speaks of the coils of Col. Offerhaus and Mr. Pepys, as if that form of the Galvanic battery had originated with them; whereas this was one of the forms, first contemplated by me—it was afterwards actually made by Dr Patterson and Mr. Lukens, and in a much larger form by Mr. Peale and Mr Wetherill,* at least a year, I believe two years, before it was resorted to, either by Pepys or Offerhaus.

II. Foreign.

Foreign Literature and Science, selected and translated by Prof. Griscom.

1. Sweden.—*Mutual Instruction.*—There are now in Sweden sixty-seven schools of mutual instruction; in which the Lancasterian system is practised. Twenty-two of these schools have been established since the commencement of 1823; there are thirteen in the capital.—*Rev. Encyclopedique.*

* See memoir on a New Theory of Galvanism, Silliman's Journal, Vol. I. page 118—also Memoir on the Deflagrator, page 41.

2. *Deaf and Dumb.*—The Canton of Berne contains nearly one thousand deaf and dumb persons. A few Christian philanthropists conceived the idea of forming a normal school for the instruction of these unfortunates, and undertook the execution of it in the beginning of the year 1822. The Bernese government granted them about 4500 francs (=$900) for the first year's expenditure; and it has just voted a similar sum for the second year. Eleven pupils have been confided to the care of an intelligent and zealous master, Mr. John Burki. One of the objects of this Institution is to simplify the method of instruction so that the teachers of ordinary country schools may be charged with the instruction of the deaf and dumb.—*Idem.*

3. Russia.—*Gold Mines.*—The Cronstadt Gazette gives very interesting details relative to the gold mines, discovered a short time since in *Mount Ouralo* (Ural Mountains) in the vicinity of Catherineburgh. It is known that some of the houses of that town are constructed with a very rich mineral, and a considerable quantity of gold has been extracted from the earth of which the bricks were made some years ago. In beginning to explore the mines, whence these materials have been drawn, small masses of native gold, some of them weighing as much as three-fourths of a pound, were found, and the whole quantity obtained in opening the galleries, amounts to more than three thousand pounds. The discovery of these mines and their prodigious wealth, are facts not less important than unexpected; and if there is no exaggeration in the statement, we may conceive what consequences such an event must produce upon the relative value of gold and silver, upon the commerce of Europe, and perhaps even upon the political balance of its different states.—*Idem.*

4. *Copenhagen.*—The late Count de Moltke, minister of State, has, by his will, enriched the University of Copenhagen, for which he has done much during his life. He has bequeathed *sixty thousand crowns*, to be given in premiums to the professors of natural history, and in rewards to the authors of memoirs on questions proposed by the Universities; *ten thousand crowns* to the Academy of Fine Arts, and a *hundred thousand crowns* to support at the schools and universities the

children of those public functionaries who shall have left their families in poverty. Besides these donations, Count de Moltke has enriched many benevolent institutions.—*Idem.*

Mutual Instruction obtains great success in this country. They count one hundred and forty schools in which this method has been introduced.—*Idem.*

5. *Steam-Boats.*—In the month of October (last year) the steam-boat *Francis*, the first which has navigated the Danube, made its first passage from Vienna to Pesth, and from Pesth to Vienna, with a cargo of 1500 quintals.—*Idem.*

6. *Prussia.*—The population of the Prussian states, which in 1719 was 10,799,954, gave in 1822 a census of 11,494,173 inhabitants.—*Idem.*

7. *Prague.*—This city contains 96,618 inhabitants of whom 80,794 are Christians. 7824 Jews, 6500 soldiers, and 1500 are foreigners. In the year 1820, there were in the city. 736 marriages, 4199 legitimate births, and from 1400 to 1600 illegitimate; 3683 deaths, among which 191 were still born; 1328 died within the first year, 6 suicides, and 14 deaths only by small pox. The most common maladies are rheumatisms, diseases of the lungs, dropsies, apoplexies, and mental alienations.—*Idem.*

8. Weimar.—*Goethe.*—On the 28th of August, 1823, the friends of Goethe celebrated the 74th anniversary of this great poet, and on the same occasion his happy recovery. Auguste Goethe, his son, occupied at this fête a place of honour. Several poets brought their tributes in stanzas and sonnets, in which they expressed their enthusiasm for the talents of their friend and master. The two physicians who attended Goethe during his dangerous illness, were crowned by the company.—*Idem.*

9. Switzerland.—*Zurich.*—This city possesses eight societies, each of which, at the epoch of the new year are in the habit of publishing a memoir on some subject appertaining to the natural, civil, or literary history of the country.—*Idem.*

10. Rome.—*Anatomy.*—Joseph Trasmondi, while engaged in verifying the existence of a new muscle, found in the human eye by Dr. Horner, of Philadelphia, discovered two nerves extending over the same muscle. He has given a detailed description of them in his school at Rome, where he is professor of practical anatomy.—*Idem.*

11. Brussels.—*Society of Elementary Instruction.*—The members of this society celebrated at a banquet, on the 12th of January, the fourth anniversary of its foundation. This useful institution, founded in 1819, under the protection of the hereditary prince, consists of a great number of members, who by an annual subscription of twenty francs, or a donation of two hundred francs, possess the right of recommending three children to be placed in the free schools. The boys' school established by the society, now contains 400 pupils. The convent of *Minimes* in which the government allowed the school to be placed, having been given up to be transformed into a military hospital, the society has decided upon constructing, on a fine tract of land which has been ceded to it by the state in the Rue des Minimes, two schools, the one for five hundred boys, and the other for five hundred girls, with the necessary dependencies. The building advances with rapidity, and is said to be very beautiful and appropriate. The subscription amounts to nearly two-thirds of the requisite sum. The royal family, and various other dignitaries, have subscribed liberally.—*Idem.*

12. Friburg.—*Public Instruction.*—The R. Père Girard, founder and director of the college of St. Michael, and of the French school of Friburg, a man as virtuous as he is enlightened, has just been deprived of his employment, and removed from the establishment to which he had so faithfully devoted himself. The regrets of his fellow-citizens and universal esteem accompany him to his retreat; and the censure of every good man brands his persecutors.

The college is definitively replaced in the hands of the Jesuits, with the enjoyment of the estates which formerly belonged to it. These estates are estimated at three millions of francs. It ought to be stated, in justification of the canton, that the partizans of these measures are few in number; but an invisible power gives them the requisite force, and they brave with impunity the indignation of the majority. Until now the German cantons have apparently disapproved of the operation of this occult power, which must become more fatal to the Helvetian Republic than the oppression of Bonaparte. It tends to relax the federal bond, to alienate the government from the affection and esteem of the citizens, and it degrades Switzerland in the eyes of Europe.—*Idem.*

13. Rome.—The clergy of Rome consists of 19 cardinals, 27 bishops, 1450 priests, 1532 monks, 1464 religieux, and 332 seminarists. The population, without including the Jews, was, in 1821, 146,000 souls.—*Idem.*

14. *Faune Française.*—A work is now in progress at Paris under the title of *Faune Française*, or natural history, general and particular, of the animals found in France, permanently or periodically, at the surface of the ground, in its waters, and on the borders of the seas which surround it, by M. M. G. A. Desmarest (the mammiferes, reptiles, hemipteres, nevropteres, and orthopteres); L. P. Vieillot (the birds); C. Prevost (the fish); M. Ducrotay de Blainville (all the invertebral animals, except insects and the arachnides); M. Serville (the coleopteres, hymenopteres, and dipteres); M. Lepelletier de Saint-Fargeau (the lepidopteres); M. A. Walckenaer (the arachnides). The work will consist of 80 numbers, each containing 10 plates, and three sheets of descriptive text. The whole will form 12 volumes, comprehending 3840 pages with 800 plates. Price, with plates uncoloured, 320 francs; coloured, 880 francs.—*Idem.*

15. Warsaw.—*University.*—The commencement of this university was in 1807. A faculty of medicine was at that time established, and in the following year a school of law was founded. The Emperor Alexander gave a definitive organization to the university in 1816, and the courses commenced in 1817. Several edifices have been successively granted for its library, collections of natural history, laboratory, &c. The number of its students has gradually increased. In 1819 there were 396; in 1820, 496; in 1821, 507; in 1822, 576; and in 1823, 609. The number of professors is 44. Prizes have been founded to excite the

emulation of the students. They, as well as the professors, wear a uniform, which has been fixed by an imperial decree.—*Idem.*

16. *Rural School.*—In the month of March, 1822, a school was founded near Berlin in Prussia, by C. de Treskow, a benevolent gentlemen, for the purpose of educating twenty poor children. In their instruction, domestic economy, &c. the founder has adopted the Principles De Fellenberg's *ecole des pauvres.* The experiment has been very successful, and the founder thinks that the whole annual deficit for the twenty scholars will not exceed five hundred crowns (about three hundred and fifty dollars).—*Idem.*

17. Lisbon.—*Elementary Instruction.*—M. J. J. Le Cocq, who had been sent by his government to Paris, to study the method of mutual instruction, has been, since his return to Portugal, charged to introduce it into the elementary schools. The government has assigned for this object a large hall in the Foundling Hospital, capable of accommodating four hundred children, and has ordered to be printed the collections of tables adopted in France for reading, writing, religious instruction, calculation, &c. It is in view to introduce this beneficent method into the different parts of the kingdom.—*Idem.*

18. France.—*Charity.*—The amount of donations and legacies which the ecclesiastical establishments of France received from 1802 to 1823 is 15,300,714 francs, equal to $3,060,000, nearly; and the valuations of the charities bestowed upon the poor, and upon houses for the aged and infirm, from 1814 to 1823, is stated at 27,505,256 francs, equal to about $5,500,000.—*Idem.*

19. Lille.—The Society of the Amateurs of science, agriculture, and the arts of this city, in its programme of prizes for 1824 and 1825, offers on the subject of public health a gold medal of the value of sixty dollars for the best dissertation on the means of ameliorating the health of the labouring classes of the city; and on the subject of physique, a gold medal of the same value to the inventor of a *Photometer*, that shall be *sensible*, *comparable*, and of *easy*

and *certain manipulation*, dependent upon a standard of light of constant intensity, and easily reproduced in all situations.—*Idem.*

20. *Ioduret of Potassium.*—This substance being now employed in medicine, the following method of preparing it, as stated by Caillot, *Pharmacein*, of Paris, may be of some importance. "I take four parts of iodine, two of iron filings free from rust, and about twenty of water; I put the three substances in a capsule of glass or porcelain, commencing with the iodine and water. I keep stirring until the liquor, which soon acquires a deep brown colour, becomes colourless; then I place the capsule over the fire, and when the liquid boils, I pour in by degrees, stirring it each time, a solution of pure subcarbonate of potash, until there is no longer a precipitate; or rather I add a slight excess of carbonate of potash, which I saturate with hydriodic acid, after filtration. I decant upon a filter, and I wash the residuum as long as the water which passes through it occasions a precipitate, with the deuto-chloruret of mercury: I then reunite all the liquors and evaporate to a pellicle.

The same procedure may be applied to the preparation of the Iodurets of sodium, magnesium, calcium, barium, and strontium,—that is to say, in boiling the ioduret of iron with magnesia, lime, barytes, strontian, or the subcarbonates of these bases.

We may likewise prepare the ioduret of mercury, by decomposing the proto-nitrate of mercury, and the deuto-chloruret by the ioduret of iron, which, as has just been shown, may be extemporaneously prepared.—*An. de Chimie, Feb.* 1823.

21. *The Camera Lucida* of Dr. Wollaston has been so modified by J. B. Amici, a professor of Modena, as to remove the difficulty experienced by most persons in their first attempts to employ this ingenious and useful instrument. All the varieties of the Camera Lucida may be obtained of Lerebours, optician to the Bureau of Longitude, place de Pont-Neuf, à Paris.—*Idem.*

22. *Compressibility of Water.*—This experiment has been tried by the distinguished Danish philosopher Œrsted, by an ingenious apparatus of his own invention. The result is thus stated. " Agreeably to the mean of a great number of experiments, a pressure equal to that of the atmosphere produces in water, a diminution of volume of 0.000045. In all the trials with my apparatus, from the pressure of $\frac{1}{3}$ to that of 6 atmospheres, I have the compression of water to be in the ratio of the compressing force. Canton had obtained, in the greater number of his experiments, 0,000044 for a pressure equal to that of the atmosphere, which differs only by one millionth from my result. The ingenious experiments of Mr. Perkins, made with several hundred atmospheres, give 0.000048 for each atmosphere. I am induced to attribute this difference, in itself very small, to a compression which the sides of his vessel (being of metal) may have sustained. Another circumstance ought perhaps also to be taken into consideration, viz. that water seems to lose a little of its compressibility after several compressions. I dare not, however, aver this to be the fact, not having subjected it to a rigorous trial.—*Idem.*

23. *New process for obtaining Elaine from Oils*, by M. Peclet.—This process is founded on the property which stearine possesses of becoming saponaceous in the cold by strong lyes, which property does not belong to elaine. To separate these two substances, pour upon oil a concentrated solution of caustic soda, stir the mixture, heat it slightly to separate the elaine from the soap of the stearine, pour it on a cloth, and then separate by decantation the elaine from the excess of alcaline solution. I have always succeeded in this process with all the oils, except with those that are rancid or have become changed by heat. The elaine obtained by this process is perfectly identical with that procured by the processes of Chevreul and Braconnot.—*An. de Chimie, Mars* 1823.

24. Soap.—*M. Chevreul*, in a memoir on the causes of the difference which is observable in soap, with respect to its degrees of hardness and softness, and its odour, arrives at the following conclusions :

1st. That the discovery of a small number of species of fat bodies, susceptible of uniting together in indefinite proportions, explains the differences of fusibility, odour, and taste, which are found in the prodigious quantity of tallows, fats, butters, and oils, which are met with in organized bodies, and at the same time, it reduces to the laws of definite combinations, an entire class of substances which seemed to be withdrawn from it. It is evident that stearine, oleine, butirine, phocenine, piscine and cetine, are to the tallow, fat, butter, and oil, which they constitute, what those metals, which, (like tin and lead, tin and copper,) are capable of uniting in indefinite proportions, are to their alloys.

2d. That the species of fat bodies which I have established, form in organic chemistry a new class of substances which present groups extremely distinct from each other: thus we have fat bodies which are acids, and fat bodies which are not so. Among the former are found, 1. the stearic, margaric, and oleic acids, which, relatively to the manner in which they are affected by heat, correspond with the benzoic acid; 2. the volatile acids, of which I have spoken in the memoir, which correspond with the acetic acid. Among the fat bodies not acids, there are some, as cholesterine and ethal, which experience no alteration by the most powerful alcalies, whilst others, as stearine, oleine, butirine, phocenine, and hircine, are all converted, under the alcaline influence, into a mild principle on the one part, and into fat acids, fixed or volatile, on the other part; and it is not impossible that this last species may be constituted immediately by the same acids, and a mild anhydrous principle, which performs the functions of a base. However this may be, we cannot avoid considering the substances which produce odoriferous acids by saponification, as resembling others, which are regarded as compounds of acids and alcohol. It is very probable that *butirine* such as I have prepared it, is a union of several species of immediate principles, each of which is characterized by the property of wines reduced, under the alcaline influence, into a mild principle, and a single volatile acid.

3d. That the differences which soaps present, in respect to hardness and softness, inodorous and odorous, are now explained. In analysing a greater number of soaps than those which are prepared for the wants of life, I have reduced them to a small number of saline species. I have shown that the type of hard soap is the stearate of soda, while the type of soft soap is the oleate of potash; that consequently, a soap with a base of soda is the harder in proportion to the excess of the stearic over the oleic acid which it contains; and a soap with a base of potash is the softer in proportion to the oleic, over the stearic or margaric acid. The various odours of many kinds of soap, are due to principles quite different from stearic, margaric, and oleic acids, since the latter may be completely isolated from the former.

4th. That we may not only fabricate soaps, more hard or more soft than those now in commerce, but also, by saponifying mixtures of stearine and oleine, derived from fat bodies extremely different from each other, imitate perfectly the soap of any given kind of fat; and I have already good reasons for believing that industry will make a happy application of these discoveries.—*Idem, Mai* 1823.

25. *Ammonia in the Rust of Iron.*—M. Vauquelin informs us that being called upon by one of the Judges of Paris, to determine whether certain red spots found upon the blade of a sword, which it was suspected had been employed in a case of murder, were produced by blood, he detached with the point of a penknife a small portion of the red matter, and heated it in a bent tube closed at one end, and into which he had introduced a strip of tournsol paper reddened by an acid, and moistened. A vapour arose from the heated substance which changed the red of the paper to blue. A second experiment made with a similar material taken from the blade of a knife which it was thought had been used for the same purpose, produced exactly the same effect. A physician who was consulted on the subject did not hesitate to affirm that the red matter on these instruments was blood, but this excellent chemist having still some doubts as to its nature, thought best to treat a little common rust in the same way, and a piece of iron found by chance in the cabinet of the judge supplied the means.

This rust, of the purity of which, none had any doubts, submitted to the same experiment, gave exactly the same result, and thus, by destroying the suspicions relative to the spots on the instruments, furnished a fact as useful to justice, as interesting to chemistry. It proves that the rust which is found in the interior of houses is susceptible of absorbing the ammoniacal vapours which are so frequently disengaged from animal substances, and retaining them with considerable force. M. Laugier confirmed this result with rust found in his laboratory. Toward the end of the operation he perceived traces of sulphurous acid. The rust of iron also absorbs animal vapours, for in these experiments, vestiges of a brown oil are constantly perceived on the sides of the tube. —*Idem. Sep.* 1823.

26. *Roman Cement.*—A letter from M. Clement to the president of the French Academy of Sciences, states, that his friend M. Minard, engineer of the canal of the centre, who has been occupied five or six months in an inquiry on this subject, has found in the department of Saône and Loire, several quarries of calcareous stone, which yield Roman cement as good as the English. In one of the quarries is a bed of this limestone five mètres in thickness. Several of the specimens exactly resemble those which had recently been brought from the left bank of the Thames. Some of them when properly calcined, produced a cement which would set under water much quicker than the English, and attain an equal degree of hardness. Others harden more slowly but become more solid.

M. Minard has further discovered that the property which he Roman cement possesses of setting under water, belongs to almost all calcareous stones. Certain limestones, employed from time immemorial in the production of lime, give, *at pleasure*, a Roman cement which sets in a quarter of an hour, another which requires four or five days, and also a rich lime which will not harden at all. To this effect the stone must lose, 8, 12, or 30 per cent. by calcination. M. Vical, to whom we are indebted for so many new facts with respect to mortars, has recently published one which perfectly agrees with the general remark of M. Minard, which is, that chalk feebly calcined gives a mortar capable of setting under water.

Various experiments induce M. Minard to presume that Roman cements owe their quality to a subcarbonate of lime, produced by the action of fire upon the natural carbonate. The happy consequence which he has drawn from his numerous experiments, that Roman cement may be made in almost every place where limestone is found, appears to me beyond all doubt.—*Idem.*

27. *Electricity.*—It has been announced to the French Academy that M. Becquerel has demonstrated that there is a sensible developement of electricity during the ascent of liquids in capillary tubes.—*Idem, November* 1823.

28. *Capillary action of fissures.*—M. Dobereiner, having filled several air jars with hydrogen and placed them over water, found that in one of them the water had risen so as to fill one third of its volume. No other reason could be assigned than an extremely small crack in the side of the vessel. Upon further trial he found that hydrogen would escape from vessels with extremely small fissures, and that if the same vessels were covered with a bell glass or filled with atmospheric air, oxygen, or azote, no change could be observed in the volume of the gas. This he considers as a proof that the atoms of hydrogen are smaller than those of other gases, though surrounded with a larger atmosphere of heat. He considers it desirable that some one should treat this phenomenon mathematically, and calculate the volume of of an atom of hydrogen from experiment. There are probably fissures which will allow azote to pass, but not oxygen; others which will admit the escape of oxygen but not of carbonic acid, &c.

Another experiment was favourable to this hypothesis. Wishing to fill the bulb of a thermometer, through a capillary opening in the stem, by heating the ball, and plunging the fine point in the liquid, he found the alcohol did not enter as the ball cooled. On heating the ball again, fresh bubbles of air were disengaged, but the liquid refused again to enter on cooling. On taking the stem out of the alcohol, the air rushed in with a hissing sound. He ascribes the effect to the fineness of the opening—too small for the atoms of alcohol, but large enough for those of the air which it contains. An explanation is thus offered of a fact discovered by Mr. Faraday, viz. that alcohol becomes concentrated by leaving it in a bottle covered tightly by a bladder. The pores of the bladder suffer the atoms of water to escape, but not those of the alcohol.—*Idem.*

29. *Meteoric Iron.*—It was announced by M. de Humboldt to the French Academy, in October last, that, agreeably to a letter from M. Boussingault dated at Santa Fe de Bogota, this traveller had found, between Tunja and the high plain of Bogota, several masses of meteoric iron, very ductile. The weight of one of them is about 3000 lbs. M. Boussingault, conjointly with M. Rivero, has taken levels of the whole mountainous country between Caraccas and Santa Fe.—*Idem, Dec.* 1823.

30. *Rain.*—The quantity of rain which fell at Paris in the year 1823, as measured in the yard of the Royal Observatory, was 20.4 inches. The quantity which fell upon a terrace at an elevation of about 92 feet above the yard was 17.98 inches. The number of days of rain was 175.—*Idem.*

31. *Muriate of lime.*—M. Dubuc, an apothecary of Rouen in France has discovered that muriate of lime is a very active *manure* or *vegetable stimulant.* He dissolves about two and a quarter lbs. of the dry salt (chloruret of calcium) in about sixteen gallons of water, and with this solution waters the plants at distant intervals. He sprinkled a light soil with this fluid, and eight or ten days after planted it with maize, and from time to time during the season watered the corn with the same solution. Another portion of corn, at six feet distant, he watered with common water. The former yielded double the produce of the latter. A grand variety of plants and garden vegetables were tried in the same manner and with similar results. The sun-flower, (helianthus,) which in that place rises only to six or eight feet, grew by this treatment to the height of twelve or fifteen feet, with flowers whose disks were eighteen or twenty inches in diameter, producing seeds which yielded half their weight in oil *good to eat,* and exuding from its centre a transparent vein of turpentine, very odorous, and drying easily in the air. Potatoes were also tried. They were planted on the 1st of May, 1822, in two squares six feet asunder ; the one was watered with the solution, and the other with water from the cistern. They were gathered on the 10th of No-

vember. The bed which had been watered with the solution, and only three times during the season, produced potatoes six inches long, twelve in circumference, and weighing nearly two pounds. The others were in general only half as large, and their stalks in the same proportion. Three or four waterings of this fluid at distant periods, are considered sufficient. Its action is ascribed by M. *Lemaire-Lisancourt*, who communicates the account, to what he calls *electro-organic* influence. When applied to animal organization, it is said to arrest gangrene and ulcers, and to favour the cicatrization of wounds.—*Idem, Feb.* 1824.

32. *Diamond.*—It appears, from specimens which now exist in several European cabinets, that the veritable gangue of the Brazilian diamond is a brown oxide of iron.—*Idem.*

33. *Atmospheric tides.*—It appears, agreeably to the discoveries of Colonel Wright, that in the neighbourhood of the equator the diurnal rise and fall of the Barometer (twice in twenty-four hours) are so regular that it might almost serve as an instrument for measuring time. Various other philosophers, particularly Godin, Bouguer, Lacondamine, and Humboldt had noticed this diurnal movement long before.—*Idem, Mars* 1824.

34. *Liquefied sulphurous acid.*—M. Bussy states that he obtains this acid in a liquid state exempt from water, by passing the gas, first through a tube filled with fragments of melted muriate of lime, into a matras surrounded with two parts of pounded ice, and one of marine salt. The gas is liquefied completely under the simple pressure of the atmosphere, and at a temperature not below eighteen or twenty degrees centigrade. Thus obtained, it is a colourless, transparent and very volatile fluid, heavier than water. It boils at ten degrees centigrade, but may be preserved liquid, without extraordinary pressure, because the portion which volatilizes reduces the temperature far below the point of ebullition. Poured on the hand, it produces intense cold, and volatilizes completely. Poured into water, a portion flies off, and another dissolves and at length collects at the bottom, in drops like a heavy oil. If it then be touched with a rod, it is reduced to vapour, and occasions a kind of ebullition; the

temperature of the water falls, and its surface becomes covered with ice. If the ball of a thermometer be wrapped in cotton, plunged in this liquid, and swung in the air, (when the temperature of the room is ten degrees centigrade,) a diminution of volume takes place, corresponding with the temperature of fifty seven degrees centigrade, and if the thermometer be placed in a receiver, and exhaustion produced, a degree of cold equal to sixty-eight degrees is easily produced. Mercury may thus be frozen in the open air by spontaneous evaporation ; but more strikingly by putting a little into a cup, adding to it a quantity of the liquid, and exhausting the air from around it. Alcohol at thirty-three degrees, and below, has thus been frozen.

This mode of cooling has been applied to the liquefaction of other gases. The gas is first dried by passing it through a tube containing muriate of lime ; to this tube is adapted a tube bent at right angles ; the horizontal branch, swelling into a thin ball which is surrounded with cotton, and moistened with sulphurous acid, and the vertical branch plunging into mercury. In this way the author has condensed chlorine, ammonia, and cyanogen. The latter has even been obtained crystallized and solid. He now proposes to employ this last substance to the condensation of gases which resist the former method.—*Idem, Mai* 1824.

35. *Artificial incubation.*—An ingenious apparatus for this purpose has been invented by Mr. Barlow, near London, in which the requisite heat is maintained by the circulation of steam. It consists of a box or oven constructed of iron plates, divided into a great number of compartments, each of which is warmed to the temperature required. The eggs are first placed in that which is the least heated, and are gradually removed to that which is of the highest temperature. The more difficult part of the process consists in regulating in a uniform manner the heat of each compartment. The inventor has accomplished this by placing valves, fitted with thermometers, so as that they admit or exclude the steam by the force of the heat itself. It may readily be conceived that, in an apparatus containing fifteen hundred eggs, aqueous vapours would arise so copiously as to injure the success of the operation, had not means been devised of absorbing them. A hydrometer of a particular construction is destined for this purpose.

The natural incubation of chickens and other domestic fowls, and of partridges and pheasants, continues ordinarily twenty-one days. Ducks, geese, and turkeys. require thirty-six. The artificial process in Mr. Barlow's oven is of the same duration, and it would be injurious to accelerate or retard it. As soon as the chicks have broken their shells, they are placed in a cage beneath the oven, the temperature of which is at eighty degrees Fahrenheit. Here they are left three or four days, during which the temperature is gradually diminished. They are then exposed to the open air, and in general they are as robust as those that are hatched under hens.

Mr. Barlow states the progressive developement of the germ, from actual examination, to be as follows :

The egg has been exposed to the oven scarcely twelve hours, when the form of the embryo is distinctly perceived. The second day, the heart begins to beat; on the third, appear two vesicles full of blood, the pulsations of which are very sensible : the one is the left ventricle, the other the base of the great artery. On the fourth, the wings are distinguished, and on the head two protuberances for the brain, one for the bill, and two for the anterior and posterior parts of the head. The fifth witnesses the developement of the auricles of the heart. About the sixth the liver is distinguished. The first voluntary movement of the embryo is manifest at the end of the 131st hour. At the 138th are seen the lungs and the stomach, and on the seventh day, the intestines, the kidneys. the upper jaw, and two drops of blood in place of the one before observed; the brain acquires some consistence. On the 8th day the bill opens, and the breast is covered with flesh ; on the 9th the ribs issue from the spine, and the gall bladder is perceived; on the 10th the bill becomes green, and if the animal is disengaged of its integuments it can move itself sensibly. On the 11th the feathers begin to shoot, and the skull to be solidified. On the 12th the eyes appear, and the ribs acquire their developement. On the 13th the spleen approaches the stomach, and on the 14th and 15th it augments in volume. On the 16th the bill opens and shuts, and about the 18th the chick utters the first cry. From this time the animal gradually increases in strength until it breaks the shell.

About 24 hours before the shell is broken, the yolk of the egg, which till then remains entire, passes into the intestines, and affords nourishment sufficient for 30 hours after the animal is hatched.—*Bulletin d'encouragement.*

36. *Patents.*—The number of Patents for new inventions, or improvements on former ones, taken out in 1822 were, in

France, -	161
England, -	124
and in 1823, in	
France, -	197
England, -	168
United States,	164

37. *Syphon.*—An improvement on this instrument has been made in Paris, by M. Buntem, instrument-maker, quai Pelletier, No. 26, so as to save the necessity of suction. Near the top of the outer and longer branch, just below the bend of the syphon, a ball is blown, forming part of the stem itself, and of a suitable size. On filling this branch, (together with the ball,) with a fluid, stopping the end of the tube with the finger, and then immersing the short leg in the liquor to be drawn off, the operation will go on at pleasure.

The same artizan has improved the common or domestic barometer, so as to prevent the possibility of air getting into the tube, by a variation of its position.—*Bulletin de la Soc. d'encouragement.*

38. *Art of Baking.*—A machine for accelerating the fermentation of flour, has been invented at Lausanne in Switzerland. It consists simply of a round box of pine wood, a foot in diameter, and two feet long, placed upon gudgeons, and put into motion by a handle or winch, resembling exactly the cylinder used for burning coffee. An opening is made on one side for receiving the dough. The time necessary for fermentation, depends on the temperature, the rapidity of its motion, and many other circumstances; but when the paste is properly raised, the operator discovers it, by the hissing sound of the fixed air, as it rushes out of the machine. It never fails to work well, and requires at

most, half an hour's attention. The labour is nothing, as a child can turn the machine. If made longer. and divided into compartments, it would serve for the preparation of several kinds of paste at the same time. This machine offers the double advantage of raising paste expeditiously and to the exact degree required.—*Rev. Ency. Feb.* 1823.

39. *Light-Houses.*—One of the most recent applications of the study of the properties of light, is that which is now made in France in the establishments of dioptric light-houses. We give this name to those in which the light of the flame is not reflected, but transmitted through lenses which render the rays parallel. The flame is placed in the centre of eight similar lenses, and the whole system turns on its axis, so that all points of the horizon are successively enlightened. The light appears alternately strong and feeble; and this intermission of splendour, weakness, and disappearance, distinghishes and diversifies these lights. M. Fresnel has succeeded in forming lenses of large dimensions, by composing them of several pieces, and suppressing all the thicknesses which would contribute only to the waste of light, a remarkable disposition which Buffon was the first to employ.

It was especially necessary to place in the centre of illumination a very strong light. Messrs. Arago and Fresnel invented for that purpose a lamp of concentric flames, the light of which is probably equal to 150 wax candles. The latest experiments have proved that these lights, even in unfavourable weather, are easily perceived at a distance of more than eight leagues. Such is their splendour, that they were even employed as signals in a geodesic operation, in which Messrs. Arago and Matthieu and Messrs. Kater and Colby, of the Royal Society of London, were engaged. These signals were seen with a telescope, more than 16 leagues distant, an hour before sunset; and an hour after sundown they were easily distinguished by the naked eye at that distance.—*Fourier Rapport sur les progrès des sciences mathematiques.*

40. *Comets.*—The comet seen in 1822 is evidently that of 1785, 1795, 1805, 1819. The duration of its revolution round the sun is 1202 days. It was seen at the New Ob-

servatory, erected by General Brisbane at Paramatta in New South Wales, during the month of June 1822. The elliptic elements of this comet have been calculated by M. Enke. It offers this important advantage, that it may be observed ten times in 33 years. The ellipse which it describes is comprised in the interior of our solar sytem. Its least distance from the sun is about three times less than that of the earth, and its greatest distance is about 12 times greater than its least distance.

This comet is probably destined to furnish us with new knowledge relative to the singular nature of these bodies which have so little mass, and seem to consist only of condensed vapours. They cause no sensible perturbation in our planetary system, but they undergo themselves very considerable disturbances. Their courses cannot be fixed, if their masses gradually change, or are divided, or dissipated. As long however as the mass subsists, these bodies are subject to the known laws of gravity, so that there are none of them, the observance of which do not afford a new proof of the truth of the principles of modern astronomy —*Idem.*

41. *Natural History.*—We are indebted to Mr. Bradley for a curious observation. He discovered that two sparrows carried into their nest forty caterpillars per hour. The birds appeared to him to reside in their nest only twelve hours in the day. This would produce a daily consumption of 480 caterpillars, which in one week amounts to 3360, by a single pair of swallows.—*Rev. Ency. Mai* 1823.

42. *Canals.*—Great-Britain enumerates 103 canals, of which 97 belong to England, 5 to Scotland, and one to Ireland. In this number none are included which are not more than 5 miles long. The total extent of these canals is 2682¼ miles, of which 2471 are in England, 149¾ in Scotland, and 69½ in Ireland. Thirty millions sterling is the valuation of the cost. The stock of some of these rose in a few years to 15 or 20 times its original value. These various canals present 48 subterranean passages, 40 of which have an extent of about 32 English miles. None of these works, important as they are, were projected prior to 1755. The patriotic and enlightened zeal of the Duke of Bridgewater, and the talents of Brindley, gave the first decisive impulse to their improvements in 1759. There is now scarely a point of importance in England, that has not a water communication with every other.—*Idem.*

43. *Pyroligneous Acid.*—Mr. Schultze, a surgeon of Kasan, has frequently used this acid in the cure of phagedænic ulcers of the feet, and with constant success. The surface of the ulcer is washed once a day with the acid by means of a fine brush or hair pencil, and then covered with lint, and a digestive ointment. The bad smell of the ulcer soon ceases, the sanies loses its corrosive nature, a good pus is formed, and a healthy action is rapidly induced.—*Bul. Univer. Feb.* 1824.

44. *Chlorate of Potash*, according to Dr. Geiger, may be obtained more abundantly by exposing the solution of subcarbonate of potash, saturated with gaseous chlorine, in a cool place during several days.—*Idem, Mars* 1824.

45. *Test for Iron.*—Ficinus, of Dresden, pretends that muriate of gold is preferable as a test for Iron, to all others hitherto employed. It is well to add a little carbonate of soda to the liquor suspected to be ferruginous —*Idem.*

46. *Excellent test for Copper* by Witting.—After having dissolved a grain of sulphate of copper in 24 ounces of distilled water, the author dips into it a fragment of phosphorus suspended by a thread. A blue colour is soon manifest, and at the end of a few hours there is a brown deposit on the surface of the phosphorus, sufficient to leave no doubt of the presence of copper, though it existed in the liquid only in the porportion of $\frac{1}{35000}$.—*Idem.*

47. *Blowpipe Experiments.*—The difficulty of subjecting very small particles of a mineral to the action of the blowpipe is much increased by the want of a suitable support for such small portions of matter. J. Smithson has prescribed an excellent method. He flattens the end of a platina wire, and spreads over it a little paste made of porcelain, or pipe clay and water, and applies this to the powder or particle to be acted on. It dries and adheres in a few minutes, and may then be fully exposed to the flame.

If the clay should affect the desired action of the flame unfavourably, a paste may be made in many instances of the fine powder of the mineral itself, and used as a substitute.—*Tech. Repository*, 15.

48. *Ink.**—The bark of the chestnut (Fagus castanea) is said to contain twice as much tan as that of the oak, and gives with sulphate of iron a beautifully black ink. The colour which this tan produces is less liable to change by the sun and rain, than that produced by sumac.—*Precess. Monatsblatt. Jan.* 1822.

49. *Watchmakers' Oil.*—The best oil for diminishing friction in delicate machinery, is that which is entirely deprived of every species of acid, and of mucilage, and is capable of enduring intense cold without congealing. The oil, in fact, should be pure *elaine*, without any trace of *stearine*.

Now it is no difficult thing to extract the elaine from all fixed oils, and even those from seeds, by the process of Chevreul, which consists in treating the oil with seven or eight times its weight of alcohol, almost boiling hot, decanting the liquid, and exposing it to cold. The stearine will then separate in the form of a cristalline precipitate. The alcoholic solution is then to be evaporated to the fifth of its volume. What is left is the elaine, which ought to be colourless, insipid, almost without smell, without any action on the infusion of tournsol, and having the consistence of white olive oil, and with difficulty coagulable.—*Bulletin Univ. Feb.* 1824.

50. Paris.—There are in this city 520 *Watchmakers*, who employ about 2056 workmen, and produce annually 80,000 gold watches, 40,000 silver watches, and 15,000 clocks, the whole worth about 19,765,000 francs.

In the same city there are thirty *tanneries*, in which 300 workmen prepare every year at a medium, 45,000 ox-hides, 4,000 cow-hides, 8,000 horse-hides, 60,000 calf-skins, and employ in this operation, 11 millions of pounds of tan, 97,000 pounds of alum, 500 pounds of tallow, and the same quantity of salt. The produce of this branch of commerce is estimated at 3,726,000 francs. The number of houses sold annually in Paris is about 4,200.

Of *printing establishments* there are 80, occupying 3000 workmen, moving 600 presses, and employing yearly 280,800 reams of paper, which yield a receipt of 8,750,000 francs.

* See Mr. Sheldon's notice, Vol. 1. pa. 312 &c. of this Journal.

The royal printing office, which employs 80 presses, 295 workmen, and from 70 to 80,000 reams of paper, is not included in this estimate.

Of the books printed annually in France, it is estimated that there are of theological works seven per cent., of jurisprudence five, arts and sciences twenty, politics sixteen, belles-lettres twenty-eight, and history twenty-four.—*Bulletin des Sciences, Geographiques, Statistiques, &c., Mars* 1824.

51. *Rapid evaporation.*—Professor Oersted has pointed out a method of considerable utility in the evaporation of liquids. He fastens together a great number of fine metallic rods, or wire, and puts them in the bottom of the distillery or evaporating vessel, and by this means he distils seven measures of brandy with the same fuel, which without the rods would distil only four.—*Bulletin des Sciences, Physiques, &c. Avril*, 1824.

52. *Steam Engines.*—The French Institute have subjected to a careful investigation, the various circumstances connected with the explosion of steam boilers, and an ordinance of the king, founded most probably upon the conclusions of the Academy, decrees: 1st. That no high pressure engine shall be established without a license. 2d. That every proprietor shall declare before the proper authority, the degree of pressure with which his machine is intended habitually to act. 3d. That no high pressure engine shall be erected without having its strength previously determined by the hydraulic press, that every boiler shall be able to sustain five times the force under which it is to act, that the intended pressure shall be stamped upon it, and that no boiler shall be erected until it receive this stamp. 4th. That two safety valves shall be adapted to each boiler, so large that either of them can disengage the steam with sufficient rapidity, one of them to be at the disposal of the fire man, and the other covered with a grating, locked, and the key kept by the proprietor. 5th. That two round plates shall be inclosed in the boiler, one of which to be at least equal in diameter to the safety valve, and to be composed of a mixture of metals which will melt or soften at a temperature of 10° centigrade, above that of the boiler; the other of double the diameter, inserted near the locked valve, and of such a composition as to soften at 20°

centigrade, above the heat of the boiler. These plugs to be stamped with the degree at which they are fusible.—*Bulletin Univers. Avril* 1824.

53. *American Geography.*—A Geography of the United States has just been published in Germany, in one volume, of 1200 pages, in which the author has availed himself of the latest information, such as the geographical and statistical atlas of Carey. The work concludes with an alphabetical table of 130 pages. "This table," says the reviewer, "shows how fond the Americans are of particular names. We find that there are already in the country, twenty Fairfields, ten La Fayettes, without reckoning two Fayettevilles, six Frankforts, eight Lancasters, nineteen Monroes, forty-two Franklins, and fifty-five Washingtons! What confusion will one day arise, when all these places shall have acquired some importance? It will be necessary to recommend to correspondents to mark their letters with the name of the state and the county, and it is impossible that 55 Washingtons shall not confound geographers, and set the clerks of post-offices into an ill humour with the great man who has left his name to so many towns and villages."—*Rev. Ency. Jan.* 1824.

54. *Georama.*—An establishment under this title has been erected in the boulevard de la Chaussée d'Antin, Paris, consisting of a hollow sphere of forty feet in diameter, within which is laid out a general map of the world, executed by the best artists. A spiral staircase ascends to three circular and insulated balconies, whence the spectators can view every part of the sphere, even in it most minute details.—*Bul. Univers.*

55. *Deaf and Dumb.—Observations de deux sourdes et muettes*, &c or "observations on two deaf and dumb persons who hear and speak, proving that many of the deaf and dumb may enjoy the same benefit." A pamphlet under this title, published in Paris, forms the *fourth memoir* relative to diseases of the ear, by Dr. Deleau, jun. of the faculty of that city. It consists chiefly of a report made to the Academy of Sciences by M. M. Pelletan and Percy, in December 1822, and of two observations made upon two young girls, one nine, and the other eleven years of age, cured of deafness, and restored

to speech by the process of Dr. Deleau. The reporters, members of the Academy, after having noticed those physicians who have been particularly engaged in similar researches, acknowledge that this young operator has surpassed all his predecessors, that his instrument in their opinion ought to be generally adopted, and that they have been personal witnesses of the happy results which Dr. Deleau has obtained. One of the young patients thus cured, says the author, manifested the most extatic delight on hearing the sounds of a musical snuff box, which was opened and held to her ear. One of the great advantages of this curative method of Deleau is that it may be applied to persons of every age.—*Rev. Ency. July* 1823.

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OTHER SELECTIONS AND NOTICES.

56. *Bulletin Universel des Sciences et de L'Industrie.*—The first eight numbers of this magnificent work have been forwarded by the principal editor, the Baron de Ferussac, to the editor of this Journal. The plan proposed for this work appeared almost too extensive to be successfully executed. Who would have thought that a periodical work, of from five to six hundred closely printed octavo pages, could be issued every month from the press! The plan has, however, been carried into effect, with a success highly honourable to its conductors, and propitious to the cause of learning. A nation, that can originate and successfully conduct a work like this, surely has reason to be proud of its enterprise. Never did France, by her proudest martial achievements, gain such honour, as she is now gaining by the labours of her learned men. What indeed can be more grand than the combined efforts of great minds, associated to elevate the dignity of human nature by the promotion of learning! The work in question is aided by no inconsiderable part of the talent of France, and affords honourable evidence of industry and research. This Bulletin may be considered as a general record of the progressive labours of the human mind throughout the world. Publications of merit from all parts of the globe are noticed, usually

with a general outline of the plan of each publication, and with an exposition of those parts which are remarkable for originality or importance. Perhaps the journal would be more interesting, if, in some instances, more detailed analyses were given. If this may be considered a defect, it is one which arises necessarily from the vast number of new publications: for so numerous are the monthly journals alone, that each can receive but a brief notice in this voluminous work.

From a cursory perusal of some of the first numbers, we have observed no appearance of prejudice or partiality. The publications of every country are treated with perfect candour. Besides the general direction of the Baron de Ferussac, there is a double security against the introduction of any abusive or improper remarks, the matter for each *section* being subject to the revision of its *redacteur principal*, and every notice bearing the signature of its author.

The success of this invaluable work may without doubt be secured by the continued zeal of its conductors, distinguished no less for perseverance than talent.

57. *Mr. Perkins's Steam-Engine.*—The great power of Mr. Perkins's engine he has recently illustrated by some singular experiments. He has constructed a small apparatus, which, when connected with the generator, has been found to discharge ordinary musket-bullets at the rate of two hundred and forty in the minute, and with such tremendous force, that after passing through an inch deal, the ball, in striking against an iron target, became flattened on one side and squeezed out.—*Edinb. Phil. Journ.* Vol. X.

58. *Artificial mahogany.*—The following method of giving any species of wood of a close grain, the appearance of mahogany, in texture, density, and polish, is said to be practised in France with such success, that the best judges are incapable of distinguishing between the imitation and mahogany. The surface is first planed smooth, and the wood is then rubbed with a solution of nitrous acid. One ounce and a half of dragon's blood, dissolved in a pint of spirits of wine, and one third of an ounce of carbonate of soda, are then to be mixed together and filtered, and the mixture in this thin state is to be laid on with a soft brush. This pro-

cess is repeated, and in a short interval afterwards the wood possesses the external appearance we have described. When the polish diminishes in brilliancy, it may be restored by the use of a little cold-drawn linseed oil.—*Lond. Jour. Arts*, Vol. IV. p. 107.

59. *New Pyrophrous of Tartrate of Lead.*—In determining the composition of tartrate of lead, Dr. Friedmaun Gobel of Jena, observed that this salt when heated in a glass tube, formed a fine pyrophorus. When a portion of the deep brown mass is projected from the tube, it instantly takes fire, and brilliant globules of metallic lead appear on the surface of the substance in ignition. The effect continues much longer than in other pyrophori.—*Edinb. Phil. Journ. Vol. X.*

60. *On the corrosion of the Coppering of Ships.*—At a meeting of the Royal Society on the 22d January, Sir Humphrey Davy read a paper on the cause of the decay and corrosion of the coppering of ships, which he ascribed to a constant, though feeble chemical action of the saline parts on the surface of the copper. This action he considers as galvanic; and it is known, that some copper suffers comparatively little corrosion to that which takes place where the copper contains a small quantity of zinc or any other metal. In order to remedy this great practical evil, Sir Humphrey Davy has shown, that if a very small surface of tin is brought in contact with a surface of copper one hundred times its size, it will render the copper so negatively electrical, that the sea-water is no longer able to corrode it. The same effect was produced when a small piece of tin was made to communicate with a large surface of copper by means of a wire. We are informed by a friend (who saw the result of the experiment) that when a piece of Mr. Mushet's patent copper, a piece of common copper, and a piece of the one rendered negatively electrical by zinc, were subjected to the action of salt water, the common copper was highly corroded, and the patent copper less so, while the negatively electrical copper was not affected at all. This elegant invention of Sir Humphrey Davy, will, we doubt not, be duly appreciated by the government and the public.—*Ibid.*

61. *Purple colour of Glass increased by light.*—M. Faraday has found that by the exposure of plate-glass with a purple tinge to the sun's rays, during nine months the purple tint had increased considerably, while pieces of the same glass kept in the dark had suffered no change.—*Quart. Journ. No.* 31.

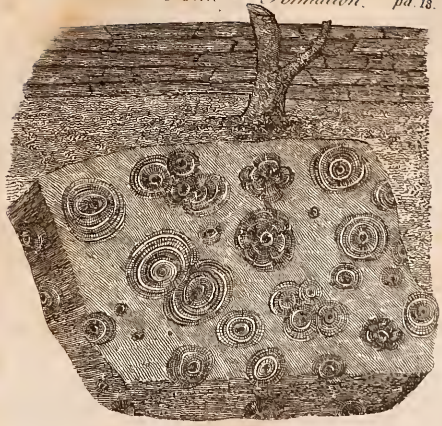
62. *Flora of the Greek Archipelago.*—A full and extensive *Flora of the Greek Archipelago, and the shores and islands of the Euxine*, by M. Dumont D'Urville of the French navy, has appeared among the transactions of the Linnæan Society of Paris. Those countries, so long under the semi-barbarian power of the Crescent, have never, until now, been botanically explored since the days of Hippocrates, and of the Grecian botanist Theophrastus, save partially by that patriarch of the natural sciences, Tournefort. M. D'Urville was well acquainted with Grecian literature, and has affixed to each plant its own Hellenic denomination, as given in ancient classical authors.—*Dr. Pascalis's Address.*

63. *Effects of an earthquake on the vegetation of wheat.*—It is a remarkable circumstance, that since the great earthquake of 1687, no wheat will grow on the coast of Peru. In some places, indeed, a little is raised ; but it is very unproductive. Rice, on the contrary, yields a great return. Before the earthquake, one grain of wheat yielded two hundred grains.—*Edinb. Phil. Journ.* Vol. X.

64. *Maize grain remarkably retentive of the power of Germinating.*—It is worthy of notice that the maize which is found in the graves of the Peruvians, who lived before the arrival of Europeans in that country, is still so fresh, that when planted, it grows well, and yields seed.—*Ibid.*

Rocking stone. pa. 27.

Oolite Formation. pa. 18.



Singular Conformation of Limestone. pa. 19.

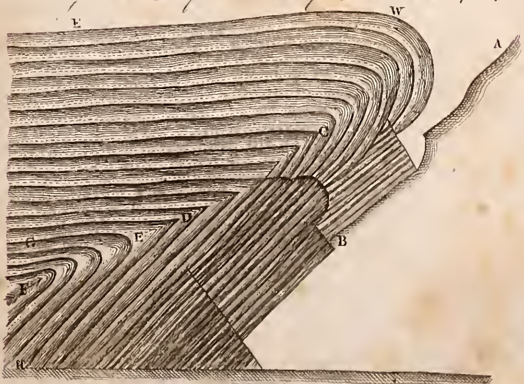
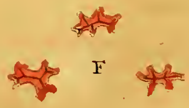


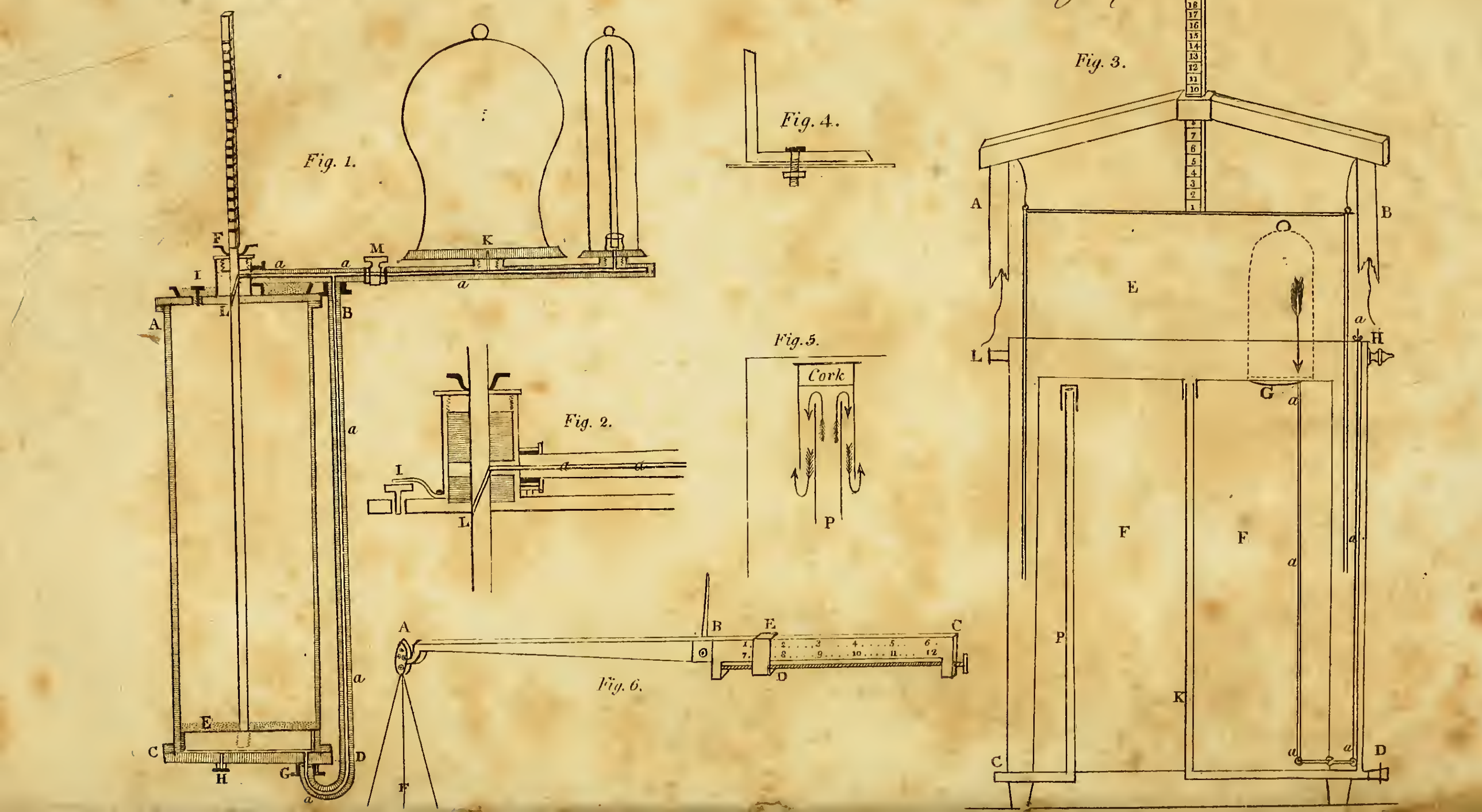
PLATE III.



Gyropodium coccineum.

PLATE IV.

Mr Patten's Air Pump and Gazometer.



THE

AMERICAN

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GEOLOGY, MINERALOGY, TOPOGRAPHY, &c.

Art. I.—*On Earthquakes—their causes and effects.* By Isaac Lea.

The nature of an earthquake is so well known, that I will describe it only as a vibrating or balancing motion of the soil on which we tread, extending to various depths beyond our knowledge, and sometimes to an enormous extent. The wide-spreading devastation and ruin, which sometimes accompany them, bring the mind to the contemplation of one of the most astonishing efforts of nature. The imagination, in seeking for its original cause, is lost in the labyrinth of its own efforts, and we find ourselves, after a fruitless labour, but a short distance from the threshold at which we entered.

My object is to endeavour to show what are the probable sources from whence such large supplies of combustible matter are drawn; and to prove the identity of the volcano with the earthquake; by this I wish to be understood that I believe earthquakes to be the effect of volcanic eruptions, which accompany them as the thunder accompanies the action of the electric fluid, and that the motion is produced by a pre-existing cause. I also deny that lightning has the power to produce the earthquake, as has been supposed—first by Dr. Stukely in 1749, and since by many philosophers. The electric fluid is frequently, nay most generally seen in connexion with an eruption of the volcano, but it is called into action by the unusual excitement of heat, and is therefore an effect and not a cause. Dolomieu denies the agency of electricity; he says, "J'exclue l'electricité, qui ne peut pas s'accumuler, constamment pendant un an de suite, dans un païs environné d'eau, ou tout concourt a mettre ce fluide en équilibre. Il me reste le feu."

When we undertake to give a history of the eruptive state of the bowels of the earth, we must commence that history with the actual existence of their inflamed state; for, although many volcanoes (which may be termed pores or eruptive canals of the earth) are not in an active state, and have been slumbering for hundreds of years, yet we have others that are seldom or never dormant—that of Stromboli has been throwing out unremitted flames for two thousand years.

The earliest historians have given relations of many earthquakes. Those of Pliny are among the best authenticated. In A. D. 79, Herculaneum was covered with lava seventy feet thick. Notwithstanding this continued ebullition, we find the surface of the earth but little changed by this agent, except in the immediate vicinity of volcanoes.

We have very strong reasons to believe that a considerable portion of the interior of the earth is in a constant state of incandescence. In South America the bursting forth of one volcano is frequently followed by that of others, in the chain of the Andes at a great distance. So distinctly has this happened, that Humboldt considered this chain composed, not of different volcanoes, but of one immense volcanic wall stretching from north to south. The existence of this being before our eyes, it is easily to be supposed that larger and more extensive channels may exist at greater depths. It is difficult, the same author says, "not to admit the existence of cavities between the oxided parts of the globe—parts abounding in metalloids." The extensive ranges that earthquakes frequently take go far to prove the existence of great channels of communication. Boyle, in the following quotation, expresses this opinion.

"'Tis the more likely that this earthquake shook great tracts of land beyond those places to which the fired matter, passing from one cavity to another, could reach in so short a time."—*Boyle, Vol.* I. *p.* 479.

And Newton, in no less unequivocal language, says,

"We may learn that sulphureous steams abound in the bowels of the earth, and ferment with minerals, and sometimes take fire, with a sudden corruscation and explosion; and if pent up in subterraneous caverns, burst the caverns with a great shaking of the earth, as in the springing of a mine."—*Newton's Optics*, p. 353.

The existence of those extensive cavities satisfactorily accounts to us for the fact of earthquakes being severely felt at great distances from volcanoes; such was the case in 1811 and 1812, when the shores of the Mississippi, near New Madrid, were literally torn to pieces, the vibration being felt in many parts of the United States. I was at that time driven from my bed in Pittsburgh by the alarming motion. If we look round for the cause of this in a volcano we find the nearest one to New Madrid to be about one thousand miles distant, there being but five in North America—Orizaba, Popocatepetl, and three minor ones, all in Mexico. In 1755, when Lisbon was destroyed, the motion was felt over an area of four millions of square miles. It extended to Spain, France, Africa, the Azores, West Indies, &c., and persons on board ships forty leagues off St. Vincent were thrown from their feet. In 1601 an earthquake was felt in Asia, Thrace, Hungary, Bohemia, Germany, Italy, and France. To account satisfactorily for such extensive effects, we must admit of deep-seated channels of communication stretching from one portion of the globe to the other, through which the explosive gases pass with an instantaneous motion, accompanied by a rumbling or terrible noise, peculiar to earthquakes. That these channels have communication with the sea, there is no disputing; for volcanoes frequently throw up salt water and fish from the ocean; this has been the case with Vesuvius and I believe with some of the Cordilleras. It has been observed that previous to an eruption of Vesuvius, the sea retires from the shores until the mountain bursts, when it returns to overflow its usual boundaries. Ætna has thrown out boiling water with sea-shells, (1755,) and during the great earthquakes of Peru, in which Riobamba, Quero, &c., were destroyed, with sixteen thousand persons, fetid water issued and filled up the valleys one thousand feet deep and six hundred broad. The source of this water could be no other than the ocean. It should here be recollected that all the known volcanoes are situated near the sea. Cotopaxi is said to be farthest from it, at one hundred and forty miles distance. Thus it is that islands are so much more prolific of volcanoes than continents. In Europe there is but one on the continent, and twelve on its islands; in Asia eight, and on its islands fifty-eight; in America ninety-seven, and on its islands nineteen. Water therefore is an essential portion of the volcano, and we may safely conclude that it is its most powerful agent. We are all acquainted with the astonishing elasticity of this fluid when surcharged with caloric, and may imagine with what an enormous power it must act through the subterraneous channels. The immense and numerous masses ejected to an enormous height, fully illustrate this. A rock ejected from Vesuvius has been found to measure twelve feet long and forty-five in circumference. During an eruption of Vesuvius a hill one thousand feet high was thrown up in one single night.

Whether the earth was created with its internal mass in an ignited state, or whether the action of fire commenced since that period, we are not to decide,—we must examine it as we find it, and endeavour to show how this fire is kept up.

In descending through the exterior strata of the earth we find the heat to increase as we recede from its surface, and if it continue to increase in the same ratio beyond the depth man has been able to attain, we should have at a comparatively short distance, a state of ignition almost beyond our conception. If such be really the fact, the centre of this mass must assume a fluid form presenting a heterogenous mass of metalloids; but it is difficult to suppose that it could remain in a state of ignition without a large supply of air: yet, on the contrary, the great density of the earth's mass urges strongly in favour of such a belief. Dr. Maskelyne has proved this density to be 9 *a* 2 water, and 9 *a* 5 common stone.

If we admit of channels extending to, and connecting volcanoes, and branching into countries not possessed of them, they must be independent of, and superincumbent to the fluid mass. They may be considered, in fact, as a species of horizontal volcanoes, their walls and roofs furnishing them with combustible matter, aided by oxygen supplied by the influx of the sea. That volcanoes are connected with the ocean, cannot admit of a reasonable doubt. Independent of what I have said on the subject, we have sub-marine volcanoes, which show themselves by throwing up large quantities of water into the air, and are in a state of action in concert with those at a considerable distance. A continuance of those eruptions frequently produces islands, some of which again disappear suddenly, as though they were the apex of a huge crater falling into its own bowels. Of this description was the island of Sabrina, among the Azores. In June 1811, it made its appearance where the sea was sixty fathoms deep, and was nine hundred toises in diameter. Many of the West India Islands experienced an earthquake at the same time, at a distance of eight hundred leagues.

It may be objected to this theory that rocks do not burn! In answer I state, that when rocks are decomposed, their metallic bases, calcium, silicium, aluminum, magnesium, &c., are highly incandescent, and prove a never failing source of matter for combustion.

If there should be an accumulation of gaseous vapours in one of those channels, and it should be unable to pass in consequence of some obstruction, to a liberating volcano, it forces another opening, and causes, by passing through a distant channel, an earthquake at a considerable distance from whence it originated. Something of this nature took place when Riobamba was destroyed. The volcano of Pasto, which had continued to eject smoke, ceased at once; at that moment the city was destroyed at the distance of thirty-five leagues south.

Earthquakes frequently occur without any symptoms of connexion with volcanoes. These may be accounted for by supposing that in consequence of a slight influx of the sea to one of those channels, the water, meeting with an ignited mass, is suddenly converted into elastic vapour, and expands itself throughout its openings, causing a concussion or trembling of the superincumbent strata. Dolomieu, in his examination of Calabria, says, "La force motrice paroit avoir residé sous la Calabre elle même." He afterwards informs us that the motion appears to have advanced progressively along the chain of the Appenines, from the south to the north. The action of an earthquake was almost instantly communicated from Chili to Guayaquil, a distance of six hundred leagues. If Humboldt's idea, that the Cordilleras form a vast volcanic wall, be correct, the pulsation must have been communicated with amazing rapidity through a channel similar to those described.

The many remarkable eruptions of volcanoes are well calculated to prove the agency of the ocean. The mud-volcanoes of Macalouba in Sicily, Modena and Bologna in Italy, and those of the Crimea, of Java, and Iceland, must be caused by water, drawn from this source and ejected with the soil, intimately mixing with it on their passage to the summit of the crater.

Eruptions have taken place of dust only. A most remarkable one of this kind happened very recently, 1815, at Tamboro, near Java, when such showers were thrown up as to produce total darkness a great distance. It continued to fall three hundred and thirty miles distant, for nearly a whole day. This must have been the sudden extrication of a slumbering mass which may have been accumulating for years in the bosom of the mountain.

The air-volcano of Cumacatar described by Humboldt presents an anomaly, and is not easily accounted for, except on the supposition that it may be an old volcano, so nearly extinct as to have heat enough only to cause a continued draft or current of air.

Of the irregularity of eruptions of volcanoes and occurrences of earthquakes, we have many curious instances. An ejection of ashes for a few minutes, is sometimes succeeded by a calm of ten years. In 1766 the city of Cumana was entirely destroyed in a few minutes, and shocks were hourly felt during a period of fourteen months. In 1692, Port-Royal, Jamaica, was destroyed, and the inhabitants were obliged to remain on board of vessels for two months, on account of the continued concussions experienced there. In this earthquake persons were swallowed up, and by another effort of nature exhumed. Dr. J. W. Webster, in his description of St. Michael, informs us that thirty-one shocks were felt in the city of Ponta Delgada, in the space of a few hours. In some parts of the chain of the Andes, eruptions take place regularly every thirty or forty years.

It has been the anxious inquiry of many geologists, in what formation do volcanoes exist? is it necessary they should be nourished by any particular stratum? In answer to these queries, it may be said that those persons who judge from the exterior of a burning mountain, which may be porphyry or any transition or secondary rock, that it necessarily belongs or originates in that formation, commit an error of judgment, and conclude the mass to be of the same nature with that part which is sensible to the sight. The base of the mountain and bosom of the volcano, may, and is most likely to be, of primitive formation, underlying of course the more recent strata.

If we admit of the extended existence of subterranean fires, it is far more reasonable to suppose they have their origin in the most deeply seated rocks, frequently exhibiting their destructive fires through a formation of their own creation.

Humboldt informs us that during an earthquake near Guanaxuarto, in Mexico, the sound was confined to primitive schist. The same able naturalist tells us that earthquakes occur in the granite of Lima and Acapulco—gneiss of Caraccas—mica-slate of Araya—primitive clay-slate of Tepecuacuilco, Mexico—secondary limestone of the Appenines, Spain, and New Andalusia—and the trappean porphyries of Quito and Papayan. Thus we have earthquakes exhibiting themselves in almost all formations, though more frequently in the primitive, and better defined there; but it does not follow, although we may be sensible of the motion in a secondary soil, that it has its origin in that formation. I hope I have proved satisfactorily the great *probability* of the existence of subterranean channels, communicating with each other, and stretching out to great distances—some communicating with the ocean, and others very likely underlying it. Judging from the facts produced, I think the deduction may be fairly made.

In conclusion, I have to observe, this is a subject that admits of great latitude in speculation, and if I have been fortunate enough to add one new idea to the stock of knowledge, I shall rest satisfied that my labour has been rewarded.

ART. II.—*An account of the Earthquakes which occurred in Sicily, in March*, 1823. By Sig. ABATE FERRARA, Professor of Nat. Philos. in the University of Catania, &c. &c.

[Translated for the Boston Journal of Philosophy and the Arts, by W. S. EMERSON.]*

ON Wednesday, the 5th of March, 1823, at 26m. after 5 P. M. Sicily suffered a violent shock of an earthquake. I was standing in the large plain before the palace, in a situation where I was enabled to preserve that tranquillity of mind necessary for observation. The first shock was indistinct, but tending from below upwards; the second was undulatory, but more vigorous, as though a new impulse had been added to the first, doubling its force; the third was less strong, but of the same nature; a new exertion of the force rendered the fourth equal on the whole to the second; the fifth, like the first, had an evident tendency upwards. Their duration was between sixteen and seventeen seconds; the time was precisely marked by the second hands of a watch which I had with me. The direction was from north-east to south-west. Many persons who ran towards me from the south-west at the time of this terrible phenomenon, were opposed by the resistance of the earth. The spear of the vane on the top of the new gate connected with the palace, and upon which I fixed my eyes, bowed in that direction, and remained so until the sabbath, when it fell; it was inclined to the south-west in an angle of 20°. The waters in the great basin of the Botanical Garden, as was told me by an eye witness, were urged up in the same direction by the second shock; and a palm tree, thirty feet high, in the same garden, was seen to bow its long leafless branches alternately to the north-east and south-west, almost to the ground. The clocks in the observatory, which vibrated from north to south, and from east to west, were stopped, because the direction of the shock cut obliquely the plane of their respective vibrations; and

* It was our intention to have procured a translation, for the American Journal, of this memoir, of which a copy, in the original Italian, was transmitted to us by Professor Ferrara, but we gladly avail ourselves of that which has already appeared in the Boston Journal for September 1824. EDITOR.

the weight of one of them broke its crystal. But two small clocks in my chamber kept their motion, as their vibrations were in the direction of the shock. The mercury in the sismometer* preserved in the observatory, was put into violent motion, and at the fifth shock, it seemed as much agitated as if it were boiling.

To the west of Palermo, within the mountains, the earthquake retained little of its power; since at Morreale, four miles distant, trifling injury only was sustained by the (benedictine) Monastery of S. Castrense, the house of the P. P. Conviventi, and the Seminary dei Cherici. At Parco, six miles distant, Mary's College, the Monastery, the parish Church, and a few peasants' cottages, were all that suffered. At Piana, the battlements of the tower were thrown down. But more of its power was felt in places on the sea-coast, as appears from its effects at Capaci, four miles distant, where the Cathedral and several houses were ruined, and at Torretta, fourteen miles, where the cathedral, two storehouses, and some dwelling-houses, were destroyed. Beyond, its power continued to diminish; and at Castellamare, twenty-four miles, the state-house alone had the cleft, which was made in 1819, enlarged.

In maritime places east of Palermo, the shock was immense. At Altavilla, fourteen miles from Palermo, the bridge was shaken. At Trabia, twenty-one miles, the castle, and at Godiano, the cathedral and some houses, were destroyed,—enormous masses from Bisambra, a neighbouring mount, were loosened, and fell. At Termini, twenty-four miles, the shocks were very violent, exceeding all that had happened within the memory of its inhabitants. Those of 1818–19 were very strong, but the city received at those times no injury; now the convent of St. Antonio, Mary's College, and various private houses, felt its effects.

The warm waters, as well those of the baths as those from the neighbouring wells, which proceed from the same subterranean source in the mountains along the coast of Termini, increased in quantity and warmth, and become turbid; consequences that always succeed convulsions of the earth, by

* An instrument, apparently, for the purpose of showing the violence of the shock of an earthquake.—Tr.

which their internal streams are disordered. The clay tinged the fluid with its own colour, and equal volumes of the water yielded a greater quantity of the clay than before, when the colour was deeper.* Most of the houses in the little new town of Sarcari, two miles from the shore, and consisting of less than a hundred houses, were rendered uninhabitable; the walls were thrown down, and the more lofty buildings were all damaged. The effects of the earthquake are found to be greater in proportion to its advance eastward.

Forty-eight miles from Palermo, at Cefalu, a large city on the shore of a promontory, the effects were various and injurious. Without the walls, two convents, a storehouse, and some country houses, were injured, but no lives were lost. The sea made a violent and sudden rush to the shore, carrying with it a large ship laden with oil; and when the wave retired, she was left quite dry; but a second wave returned with such immense force, that the ship was dashed in pieces, and the oil lost. Boats, which were approaching the shore, were borne rapidly forward to the land, but at the return of the water, they were carried as rapidly back, far beyond their first situation. The same motion of the sea, but less violent, was observed all along the shore, as far even as Palermo. Pollina, a town with nine hundred inhabitants, occupying an elevated position at a little distance from the sea, was injured in almost every building; particularly in the church of St. Peter and Nunciata, in the castle, the tower, and in other places. Nor did Finale, a little nearer the shore, suffer less; five of its houses fell in consequence, on the eleventh of March.

Beyond the towns which have been mentioned, towards the interior of the island, the shock was vigorous to a certain extent; but kept decreasing as it proceeded, throughout the whole surface. At Ciminna, south of Termini, a statue was shaken from its place on the top of a belfrey in front of the great church, and a part of the clock tower falling, killed one person, and badly wounded another. In Cerda, the shock affected the great church, some houses, and half of

* The warm and mineral waters of St. Euphemia, in Calabria, which sprung up after the memorable earthquakes in 1638, presented the same phenomena in those of 1783. Grimaldi descr. dei trem. del. 1783.

one of the three forts, placed near the city to support the earth on the side of a great declivity.

The only church in Roccapalomba, which is situated at the top of an acclivity, was ruined. The parish church, and some private houses in the little town of Scillato, were overthrown. In Gratteri, a large town south of Cephalu, injury was sustained by the church of St. James and other houses. Considerable damage was sustained by various churches, and many private houses in Colesano, a town containing two thousand inhabitants, and situated on an inclined plain, on the eastern side of the mountains of Madonie. One of the Colleges de Maria was rendered uninhabitable. The hospital, a grand fabric, was made a heap of ruins. The loss is calculated at about thirty thousand onze. In the vicinity of Pozzillo and St. Agata, through a large extent of land, many long fissures and caverns were made. Similar caverns and fissures in argillaceous chalk, were opened near the little town of Ogliastro, sixteen miles south-east of Palermo. At Isnello, at the feet of the Madonie mountains, the injuries which were received in 1819, were increased; Geraci, among the same mountains, suffered a like fortune in the ruin of the cathedral; Castelbuono, and St. Mauro, within the same regions, were damaged, both by the former, and by the last convulsions; by the last, the cathedral, the church of St. Mauro, and five private houses suffered much. The damage done to Castelbuono is reckoned at twenty-one thousand onze.

The northern coast of Sicily, towards Cape Cefalu, after bending to form the eastern part of the great bay, included on the west by the mountains to the left of Palermo, extends into the sea towards Eolie, (the Lipari islands) and presents, towards them, a hollow front, the western part of which is formed by cape Orlando, and the eastern by cape Calava. Places situated about this bay, suffered the most violent convulsions. Nato, containing four thousand souls, and situated on an elevation, was almost entirely laid waste, and a great number of private houses destroyed; the monastery, hospital, the churches of St. Peter, anime del purgatorio, St. Demetrius, and the cathedral, were in a great measure overthrown. The Quartiere del Salvadore suffered less. A transverse cleft was made in the earth, and fears were entertained, lest the whole elevation upon which the city is built, should be overthrown. Only two persons lost their lives;

for the people, warned by a slight shock which was felt some hours before, had all fled into the country. Directly in front of Vulcano, one of the isles of Eolie, Patti, a city built on the declivity of a mountain, and at the distance of half a mile from the eastern extremity of Cape Calava, had its cathedral, bishop's palace, convents, and many private houses, injured. With the copious showers of the fifth, fell some roofs; various houses in the country were ruined. Pozzodigotto, Meri, and Barcellona, were injured a little. At Barcellona, a wide cleft was made in the belfry of the church, and threatened its ruin. The shock at Milazzo, on the sea, was violent, as also at St. Lucia, six miles from it, situated on an eminence; but without any bad consequences. Some damage was done to the hospital, several churches, and private houses at Messina. In the interior of Sicily, the motion was communicated as if it were far from the centre of force; in some places towards the south, some buildings which were old and out of repair, felt the effects; particularly at Caltauturo; and at Alimena, in the cathedral and convent of the reformed. The shock gradually wasted itself as it advanced; and at Catania so slight was the impression made on the people, that they went to the theatre the same evening. It was perceived by a few persons only in Syracuse, and in some of the neighbouring towns. In the district of Modica, towards Cape Passaro, scarcely one felt it. No bad effects were produced by it in the southern parts of the island; in the western it was felt, but without injury. It was pretty strong at Alcamo, but slight at Trapani.

Injuries at Palermo.—The ancient city of Palermo was founded upon a rocky tongue of land, between two large and deep bays. The extremity of this point constitutes at this day the centre of the modern city. Matter, transported thither by the water from the interior, and thrown up by the sea, together with the labour of men, has gradually filled up the lateral spaces, and extended the peninsula with this transported and alluvial earth, and formed the present soil. It is now composed in part of calcareous rock, and in part of mud or alluvial earth; both are traversed by canals and large conduits for the circulation of water for common use, and by common sewers communicating with the neighbouring shore. The adjacent parts present a surface composed of calcareous tufa, and an earthy aggregate, tender and friable; but deeper down, it is more durable, and partly siliceous. The facility of cutting, and the cheapness of the tufa, have caused its adoption as a building-stone, contrary to the custom of our ancestors, as appears from the immense excavations and pits about Syracuse, Girgenti, and some others of the ancient cities of Sicily. Till lately, the common cement was composed of a fat earth, to which ashes were sometimes added; it was called tajo. Within a few years, lime and sand have been used. But they do not always employ for lime that stone which it hardest and most proper; nor that which requires an equal degree of heat in calcination; nor are all the pieces white. It is not slaked methodically, nor mingled with that patience which caused the ancients to say, that lime should be tempered by the sweat of the brow. And here, indeed, this labour is the more indispensable, as Palermo is destitute of puzzolana, and of those ferruginous earths, which render such valuable service to those volcanic towns of the island, which can obtain a cement so adhesive and durable.

The soft rock of the surface serves, in large masses, for a foundation upon the clay. But the brittleness of the rock, and the instability of the earth, its readiness to change from a level at the least motion, or by the action of moisture, which the air and soil of Palermo make permanent, render the foundation very far from firm. I have seen pieces of the foundation of large edifices, so entirely reduced to earth, as to be removed with a spade. This inconvenience exists even when the rock in its natural situation serves as the base. Where a building is raised upon a soil, the parts of which are of different natures, it must suffer much from the unequal resistance of this soil. The right side of the royal palace, has for several years been inclining from a perpendicular, in consequence of its having been placed on the ancient alluvial formation, while the remainder of the building rests on a rock. Sometimes we see buildings raised on an inclined plane, with one part of the base more elevated than the other; in this case, it is evident that the oblique pressure is compounded of two forces; one, perpendicular to the resistance, and which is overcome by it; the other parallel with the resistance, but which, not entering into the action, operates in its own direction. The equilibrium is thus destroyed, and the stability of such buildings cannot be of long duration.

Our author goes on to speak of the necessity of having acute angles to many of the streets on account of their crookedness, and how liable buildings are, from this circumstance, to be thrown down; that regular foundations are not very much used; and even when used, are soon destroyed by the action of the atmosphere, by water, and many other causes. He finds fault with the forms of the stones used in building; with the cement, its want of adhesion; and compares houses constructed in this manner with those of ancient Tyndaris, many of the walls of which, standing on the top of some of the highest mountains, were so well balanced, the pieces so nicely cut and jointed, even without any cement at all, that they have stood firm for a thousand years.

Upon foundations so infirm, and with materials so frail, buildings are raised to the height of four or five stories. He next remarks on the disproportion of the thickness of the walls to the weights they sustain. Though diminishing exceedingly in thickness from bottom to top, they are still very much weakened by the great number of windows, are overburdened by immense cornices, and little chambers, and kitchens, projecting fearfully beyond the sides; and by terraces and balconies, loaded with enormous vases of stone. The beams which support the floors, can scarely touch upon the walls, are not charred nor faced with lead, to defend them against the moisture, and are almost always injured by the lime in which they lie. Many particulars of this kind, our author has mentioned, all tending to show the great want of prudence in the manner of building.

In the night of the 1st of September, 1726, continues Professor Ferrara, an earthquake destroyed, or very much injured, all the buildings situated on the muddy soil; and many, which were out of repair, or badly constructed, placed on rock. Earth of the nature of the first, is less capable of receiving motion from a shock than the last, since it possesses less resistance. But facts show that this advantage is more than compensated by want of stability in edifices raised upon it. At Messina, in 1783, all the buildings upon a plain, and upon earth thrown up by the sea, were destroyed; while those on the neighbouring hills were not moved. The same happened at Calabria, and in 1805, in the district of Molise. In this account we should notice the cavities made in the earth. They were esteemed by the ancients as preservatives against earthquakes, not by affording an outlet to the subterranean vapours, as some have thought; but by interrupting or diminishing the course of the shock.

The houses were rebuilt in the same situation, and after the same mode; the fissures of those which were damaged, were as we now observe them, only covered over on the outside by a slight coating of lime. These very places, and precisely the same houses, were this year laid waste; and so they will always be in future, unless a more prudent and more reasonable method shall regulate new buildings and new repairs.

Professor Ferrara proceeds to give a very particular account of effects of the shock upon buildings in different situations, which it would be hardly interesting to repeat here. Most of the injury, he says, was done by the second impulse of the shock, when the spear of the vane on the new gate was bent, and the water in the basin in the Botanical Garden was forced violently up one side. Immediately after the shock, he remarks, the apparent injuries were not very great; but the blow was given; and the long and abundant showers of rain which succeeded continued to develop and increase the injuries, and now, though not very many buildings are entirely destroyed, yet there is scarcely one which has not received some damage. Here follow some notices of the dreadful consequences which befell many of the inhabitants, from the falling of the timbers and stones and walls; of the vases from the piazzas into the streets and many other things which it is unnecessary to mention more particularly. Nineteen persons were killed and twenty-five wounded; in the earthquake of Sept. 1, 1726, four hundred were killed and very many wounded.

In the close of this chapter he remarks—do not these sad facts impress us with the necessity of every attention in the construction of new edifices? Already have the zeal of the governor, the facilities offered by the senate, and the concern of the active citizens, given a strong impulse to the reparation of the disasters. Soon will the shadow of the past calamity pass away, and the grand city of Palermo will be still more beautiful. When we reflect upon the immense list of earthquakes which Sicily has suffered, and the possibility of its increasing every moment, we feel the inevitable necessity of holding ourselves strongly prepared to meet the sudden assaults of so powerful an enemy. Messina, which suffered so much in 1783, although violently moved by this last shock, experienced from it no bad effects; for this noble city has risen from her ancient ruins, robust and majestic. Catania, in 1818, was convulsed in a terrible manner, but its inhabitants were enabled to contemplate without a tear all the little injury sustained by their beautiful fabrics.*

Succeeding Shocks.

After the shock of the 5th, the black clouds which covered the heavens on the north and west, formed a dark band, measuring from the zenith towards the horizon 60°, and extending from north to south. It was terminated at base by a circular line, passing from north to south, through the west, and elevated at the southern part about 30° above the horizon. The sky itself was very clear, and its extreme brightness was increased by the contrast with the dark band above, and by the sun just on the point of setting. A little below the band were two other lines, parallel and perfectly regular. This mysterious appearance inspired with fear the

* After the fatal earthquake of 1693, in Catania, by which eighteen thousand persons perished, the people began to build of one story, and always after the plan of barracks. But, as the fear passed from their minds, they raised their houses two stories, and sometimes even three, and not with much solidity. Since the middle of the last century, the excellent materials served them by Ætna, the good method and prudent regulation of the stories, have promised long duration to this city. It may possibly be injured, but cannot be easily ruined, although at the foot of the most formidable volcano in the world. After the catastrophe of the 5th of March in Palermo, the lieutenant, the pretor, senators, and police exerted all their zeal. They obliged proprietors to prop up their houses within twenty-four hours; or to demolish them if they were not susceptible of propping. The senate took upon themselves the charge of repairing the houses of poor proprietors, together with the expenses.

minds of the people, who are always seeking in the heavens for signs of future events. But it prepared a tempestuous night, which followed, with torrents of rain, with thunder, snow, hail, and wind.*

On the night of the 6th, at forty-five minutes past one, in St. Lucia de Millazzo, six miles from the shore which looks towards Vulcano and Stromboli, a severe shock was felt, and afterwards, at various intervals, horrible noises were heard, four distinct times, rumbling fearfully beneath them; and finally, at half past three o'clock, the shock was repeated. Both were felt at Messina, but without any subterranean noises. Nothing of it was felt at Palermo, or in any places in the west. At fifty-six minutes past ten, in the night of the 7th, another shock was felt at Palermo, suffi-

* In all times signs have been mentioned as announcing earthquakes near at hand. People read them in the air and upon the earth; and some philosophers even have given them credence. The frequent occurrence of these signs, without the expected phenomena, is a sufficient argument against them. But less uncertain are those which accompany the phenomena, as rain and thunder. To that of 1693 such fearful storms succeeded, that for many hours, at Catania, the groans and voices of the miserable wretches buried under the ruins, were drowned by the roaring of the torrents of rain and the tremendous thunders. The same circumstances took place at Calabria in 1783; and we were witnesses of the same on the night of the 5th of March. An extraordinary quantity of electric fluid is developed, and being conducted from the deep cavities of the earth to the surface, by the force of equilibrium, produces there extraordinary vaporization, when hygrometers have shone extreme dryness. The atmosphere, charged beyond measure with vapours, will give room to their decomposition, which changes them into vesicles, and then into rain. Fiery meteors will be produced by the electric fluid, liberated by the passage of the vapours to water. If hydrogen gas escape from the earth, it may be inflamed by the electric spark and present the appearance of fires. I should mention here, that in volcanic regions, signs may sometimes precede earthquakes; but this happens there by the proximity of the place of the subterranean operations to the surface of the earth, which circumstance connects the internal phenomena with those of the adjacent atmosphere. On the morning of the 8th of March, 1669, at Pidara, a town on the side of Ætna, the air became obscure, as by a partial eclipse of the sun; soon after the earth began to shake, and continued so until the 11th, when an immense fissure opened near Nicolosi, a neighbouring town, a sparkling light appeared over the fissure; and on that very day, while the terrible shocks were levelling Nicolosi with the ground, an enormous burning river, amidst horrid rumblings, roarings, and explosions, was belched out, which flowed fifteen miles, covering a great extent of land, and for four months spreading terror over Sicily.—*Bor. de. inc. Ætn. Ferr. Descr. dell 'Etna,*

ciently strong to put in motion the pendulum of a small clock, which I had stopped that I might regulate it in the morning. Its vibration from north-east to south-west showed me with certainty the direction of the shock. Light ones were felt on the 26th. On the 31st, at fifty-two minutes past two, P. M., one was felt at Messina, moderately severe, of five or six seconds duration, and undulating. Two others on the 1st of April, and one at Costelbuono on the 28th. I should add that they mention a slight one there on the 16th of February, but they are more certain of those of the 5th of March, one at one P. M., the other at three. These were they, which induced the inhabitants of Naso to leave their habitations and flee into the country, where they were when their city was laid waste. Here the professor mentions many other places, in which small shocks were felt, in July and August; but as no important remarks are made, we pass over them to his more interesting chapter of physical observations.

Physical Observations.

When the people about Ætna perceived their houses beginning to shake, they turned their eyes towards the volcano, and waited in expectation of an immediate eruption And while they looked, fearful apprehensions filled their minds, and they prayed that the event, be it what it would, might take place at once.

The philosopher, who observes the phenomena of nature, for the sake of reducing to the same class those of an analogous origin, and thence to deduce them from the same cause, observes the link which connects earthquakes with volcanic operations, and sees with the ignorant vulgar, those mighty forces preparing in the subterranean furnace which are able to put in motion immense masses of the solid globe, and to agitate them as water is agitated by a violent wind. The eruption of Ætna in 1811 was interesting from the grandeur of the spectacle which it presented, and no less so, from the instruction which it conveyed to the naturalist. A new opening was made on the surface of the mountain. Explosions of tremendous force preceded the emission of immense columns of smoke and inflamed masses of matter, which were incessantly belched out towards heaven, and whose approach was announced by horrid roarings and explosions which filled the air to a great distance. Each explosion was accompanied by shocks ; and as the interval between them was of but a few minutes duration, the city and country to a vast extent were in a continued undulation. For many days at Catania, eighteen miles distant, we were rocked as though we had been upon the sea. Some of the shocks were very violent. The door of my chamber which I left purposely ajar, kept a continued beating against its side posts. The shocks lasted as long as the volcano was in operation, that is, for more than nine months ; and when the external phenomena disappeared, the internal fire not being yet extinguished, deep subterranean rumblings and explosions were heard, and shocks felt at each report.

When the fire invests substances, it rarefies their masses to a great degree ; the acquisition of new volume produces a proportionate expansion ; and under the action of an enormous accumulation of inflamed matter, a passage is made for it with sudden and fearful energy. The expansion of water, for example, under a medium pressure of the atmosphere, is 1728 times its first volume, and it increases in the ratio of the heat. At 110° of Rea. the pressure is equal to four atmospheres only. The explosion of a single barrel of powder, shocks and overthrows the whole vicinity. If, then, a subterranean stream of water happens upon places where volcanic fires are burning, it is at once converted into steam, acquires a density proportioned to the resistance of the mass of earth above it, circulates about, and agitates the most solid mountains and great tracts of land, until losing its heat in the cavities of the earth, it returns to the state of water, without having given any external marks of its existence. It seems that the return of the terrible phenomenon is owing to the flow of water into places on fire—of water, the streams of which are determined only by accidental causes.

The vast furnace in the interior of the earth being inflamed, the fire attacks every thing exposed to its influence, some are liquified, while others are converted to vapour ; these, developing their volumes, form a system of force moving with immeasurable power. The subterranean cavities, little able to contain them, are violently convulsed in all their dimensions ; and this effect is transmitted by the solid earth, to distances proportioned to the quantity of force, to the transmissive power of the body moved, and to various local circumstances favourable, or otherwise, to the propagation of motion. After having combated with the obstacles which oppose, roaring under the earth, like the winds of Eolus, to find an outlet from the places in which they were produced, they circulate in various canals, until a cold temperature deprives them of the heat which gave them such power, and they sink into their former state. Often, however, they drive before them the matter which the heat has liquified; and urging it towards the ancient mouths of volcanoes, belch it out in flaming rivers in the midst of the terrible phenomena which they themselves produce.*

Urged by the passion for observation, I have often descended into the horrid cavity of the crater, and approached near the blazing brink of the new orifices which have vomited forth streams of fire in my own time; I have seen immense torrents of aqueous vapour urged from the vast chimney, whose base is lost in the deep furnaces below; I have been bathed in the water, to which the vapour was reduced by the low temperature of the atmosphere into which it entered; often have I seen it fall in fine showers all around me. Having penetrated into the recesses of the globe, it is in this manner forced out again by the heat to which it is exposed. I have observed the hydrogen gas; one time, burning with its peculiar colour; at another, bursting forth with a loud, deep explosion; the sulphuric and muriatic vapours, whitening the immense clouds of smoke, and filling all the air with their suffocating breath; or, seizing upon the solid substances around, remaining fixed upon them. Fused substances, forced up by the elastic vapours, are disgorged from the same mouths, spread about in torrents of fire, and consolidated by the contact of the air. Is it not possible that the seat of

*In my "Description of Ætna," I have proved that the furnaces to this volcano cannot be under the foundation of the mountain, but at various distances from it. The immense vaults, which must have been formed after so many ages of conflagration, would, at the first violent shock, have swallowed up the whole mountain; and the combustible materials would have been exhausted in so small a circumference. The inflamed matter in different situations, from causes established by long usage, flows towards Ætna, and is ejected by it. Seneca acknowledged this truth; ignem in ipso monte non alimentum, sed viam habere.—*Epis.* 79.

these products may not be extremely deep, and that yet they may reach the surface? Who knows but in other places, those grand laboratories of nature, from causes which will always elude our investigation, may be so deeply seated, that their productions never arrive at the surface, and that no other evidences of their existence, no other effects of their action are perceptible, but the shaking of the earth, and the rumblings which the aëriform elastic vapours make in the cavities of the earth.*

Three principal furnaces have their outlets on the three sides of Sicily, and each with a force proportioned to the circumstances which supply it with combustible matter. Ætna on the eastern side, by the immensity of its power, rules the whole island. When in full action the island trembles to its foundation, and feels the mighty power which has borne rule there from time immemorial. Its roarings are heard from one extremity to the other; but the parts most agitated are those in its neighbourhood, and those between it and Cape Passora, a space of about a hundred miles.

The mountain of Sciacca, on the southern shore towards the west, seems to cover a place where the elements have been in ceaseless operation for ages. From dark caverns, which open in the more elevated parts, torrents of water, in the form of heated vapour, with sulphurous gases, are ejected. Having penetrated into the internal recesses, but unable to extinguish the fermentation, the water becomes invested with fire, is converted into vapour, and thus exhaled into our atmosphere. The extrication of the steam causes in the internal caverns, a deep roaring, and often fearful convulsions, felt at a great distance. At such times, Sciacca, at the foot of the mountain, experiences the most violent commotions. In 1578 it was reduced to ruins. In 1652, for fif-

* The deficiency of volcanoes in any place, ought not to be made an argument against the existence of igneous fermentation under that place, since it may be plead at a great depth, or at least not sufficiently large to form an eruption. And indeed, notwithstanding the numerous volcanoes which have burnt at one time or other, in almost every region, may it not be possible that there is still but one great reservoir of fire, the remains of that which in remote ages has burst out in Portugal, Spain, the South of France, Italy, the Islands of Great Britain, Germany, Bohemia, about the Bosphorus, on the coasts of Asia, and in many other places.

teen days, it suffered the most severe and unremitted shocks. For some months in 1724 the earth was so frequently and violently agitated that all the inhabitants fled into the country. In September 1726, all the western part of Sicily was shaken with the greatest severity; and in Palermo at that time many lives were lost, and many edifices destroyed; in June of 1740, Siracca felt twenty-two shocks, with injury to buildings and loss of lives; that of the 25th was of such immense force, that it extended as far as Palermo. After the middle of December 1816, the inhabitants heard extraordinary rumblings under the mountain, and in January of the succeeding year, the shocks were so frequent, that twelve were sometimes counted in one day. and so violent, that it seemed that the foundations of buildings must be rooted up—the rumblings and explosions under the mountain became fearfully loud—and the sea dashed in great waves against the shore at its foot. Sambuca, fifteen miles distant, suffered much injury. A strong odour of sulphur pervaded the air all about Sciacca. While nature was in this agitation in the western part of the island, the eastern was enjoying perfect quiet. Over against Sciacca at the distance of seventy miles, Pentellaria rises from the sea, and presents the same phenomena: an island of lava, and other burnt matter, and streams of heated vapour of water, and of sulphur issuing incessantly from its cavities, show a great fermentation in the deep caverns under the sea, and to which little is wanting to renew its ancient conflagrations. Off the northern coast of Sicily, is situated a chain of islands extending from east to west, and terminating with Ustica at the distance of forty-two miles from the western shore of Palermo. All of these islands, sons of volcanic fire, which has raised them from under the depths of the sea, bear the impressions of the terrible element; and some are still burning, and serve as outlets to the subterranean furnaces. Vulcano, twenty-two miles from Cape Milazzo, burns, roars, thunders, and belches out continually immense columns of smoke and flame. Stromboli ceases not a moment in vomiting forth smoke, flame, and streams of vapour, which, rushing from the inflamed mouth, produce a horrible roaring, spreading terror among all the Eolian islands and the adjacent coasts of Sicily and Calabria. Lipari still preserves in its baths, a part of that heat which one day fused into glass the matter of which it is formed. The action of these islands has almost always troubled Sicily. Early one morning in February, 1444, enormous masses of heated matter, amidst huge volumes of smoke and flame, were raised from the summit of Vulcano, hurled about the sea to the distance of six miles, while strong shocks agitated this island and Sicily.* Other flaming masses were thrown out on the 24th of August, 1631, which, driven by the wind passed over Naso in Sicily, directly in front of Vulcano, and on the next day this unhappy city, by the violence of the convulsions of the earth,was entirely laid in ruins. Many persons were injured. A cleft was made in the soil from which a very strong odour of sulphur issued.† On the 22d of April, 1717, at dawn of day, a deep subterranean murmur was heard, accompanied by a severe earthquake, the shocks of which were felt all along the northern shore, even to Messina. But the places which suffered most were those nearly over against Vulcano, as Milazzo, Pozzodigotto, Castrorealo, twenty-six miles distant from it. The last city was entirely ruined.‡ Shocks were renewed in the same places in 1732; and with much greater force in 1736, when the whole northern coast was violently affected, particularly Palermo, Ciminna, which was much damaged, and Naso, which suffered still more.§ On the 4th of May, 1739, about 5 o'clock P. M. the inhabitants of St. Marco, a town back of Naso, saw thrown from the mouth of Vulcano immense clouds of smoke and burning matter, which, driven by the wind, came roaring and thundering over Sicily, letting fall perpendicularly into the sea and on the neighbouring shore, flaming matter which gave out on every side bright sparks and struck with fearful crashes. It passed over Naso and St. Marco, and went on wasting itself in the interior. Such phenomena were unlucky omens to these unhappy towns. At 12 o'clock on the 9th, a dreadful howling from Vulcano was followed by a violent shock, which after a few moments was repeated with many explosions; more than a hundred were counted within six days, and another on the twenty-first. Great rocks were detached from the mountains in the vicinity. Another flaming mass on the 9th of June, darted from Vulcano and passed over Sicily; shocks were felt till the 22d, accompanied by howlings and numerous

* Faz. dec. 1.

† Carr. Dial. il Bonan.

‡ Bott. de Trin. ten. Mess. 1717.

§ Mong. Stor. dei trem.

explosions fron the burning mountain. St. Marco suffered exceedingly, but Naso was entirely destroyed.* The volcanoes of Eolie contributed much to the earthquakes of Calabria and Messina in 1783. Stromboli was almost always in great commotion. For many days it seemed like a mad bull, which, raised above the waves, by his roaring filled Calabria and Sicily with terror. Vulcano often accompanied it, and its deep rumblings, and vast columns of smoke and flame, were terrible.

After the violent earthquake of Sciacca in 1816, the same evil fortune happened to other parts of the island. On the 15th of April, 1817, a severe shock terrified the people of Caltagirone in Valdinoto, and of the neighbouring places. One happened at Catania in October, and another on the 20th of February of the following year, 1818, which was enormous. All the towns about Ætna were ruined, and many lives lost. Catania felt its injurious effects. It was felt all over the island, since at Palermo it produced three undulations. Others which followed it, and which continued to agitate Catania and the neighbouring region until April, were felt with greater force. All these shocks were the precursors of the grand eruption of Ætna, which burst out on the 27th of May, 1819, and which lasted until August. While Sicily was trembling, the volcano was making its preparations in silence. The effects of the operations of Ætna, are felt in places at a great distance from the mountain. After the troubles of February and April, Catania and its vicinity enjoyed repose until the 8th of September, when all Madonia was convulsed. Other shocks succeeded in October and November. On the 25th of February, 1819, a very severe one was felt, which extended to a great distance. At Palermo three motions were produced, the last of which was very violent. The shocks in the whole of the vast extent of the mountains, where so much injury was done to the houses of the numerous inhabitants of these regions, were always preceded and followed by subterranean murmurs, and distant explosions. Under these places it seems that those substances were deposited, which Ætna inflamed and ejected from its mouth in the following May; because after the eruption commenced, Madonia was left in quiet; while Ætna,

* Amico Auct. ad Faz. Mong. 1. c.

which till this time, and during the agitations of Madonia, had remained perfectly calm, became convulsed with earthquakes. They accompanied the eruption.

With the extinction of the conflagration in August, all the phenomena ceased, and the earth was no longer agitated. But in 1822 Ætna showed that the fermentation within its furnaces was again at work. On the 5th of April, rumblings and continued explosions were heard, which were followed by great clouds of smoke violently driven from the crater by the impetuous current of elastic vapours. A shower of sulphurous ashes fell all around. On the 6th a violent shock convulsed all the towns between Ætna and Madonia, Capizzi, Cesarà, Sperlinga, Troina, Gangi, Gagliano; but in the midst of these, Nicosia seemed the centre of impulse in all the shocks which followed throughout the month. Its soil appeared on the point of being torn up by force, many buildings were destroyed, and its inhabitants fled in consternation to find an asylum in the country. The immense clouds of smoke and earthy ashes which were ejected from June to October; which covered the more lofty part of the mountain with a gray stratum; which filled the atmosphere, and gave out through the whole region a strong odour of sulphur, clearly prove that all these commotions were produced by forces collected in the recesses of Ætna.*

* From June to October, 1822, Ætna emitted great quantities of volcanic ashes which were scattered all over the mountain; on the plain about the crater it fell to the depth of a foot. From the mouth of the crater, and through fissures near the mouth, so dense a smoke, and such copious streams of aqueous vapour were given out, that when they were condensed by the lower temperature of the air, the ground about these orifices was drenched with water. The vapour which was still suspended by the caloric imparted to it by that already condensed, fell soon after in the form of a brine, acidified by the mixture of sulphurous vapour contained in the smoke, and to which was owing the odour of sulphur given out by the ashes wherever it fell. All the ashes about the crater were saturated with this brine. The vapour of water is always found in the smoke of Ætna, but in much greater quantities at the time of an eruption. In my relation of that of 1792, I mentioned, that at a little distance from the crater a new orifice was made by the force of the vapour, from which for a long time, pieces of old lava, and scoriæ, and argillaceous earth saturated with water, were ejected; that standing there to observe it, I was continually bathed in the brine which fell from the smoke. This phenomenon of Ætna in 1822 has been much altered in foreign Journals, which say, that in the recent eruptions of Ætna, the earth opened at a great distance from the crater, and that a muddy substance which is not lava, was thrown out. As this important error, should

While Nicosia and the whole space between Madonia and Ætna were in such commotion, Sicily to the west and all the northern coast enjoyed perfect quiet; but a sad reverse was preparing. In October Ætna ceased throwing out sulphurous ashes and sand, and with it ceased all its noises, and shocks, and all was calm. In February in the beginning of the next year, small motions of the earth were felt along the northern side of the island, which were the preludes to the scene that presented itself in March.

The direction of the motion was from N. E. to S. W. as

it gain credit, would be injurious to science, I make all haste to correct it. In 1822, neither at a great nor at a small distance from the crater, the earth opened; and the matter thrown out is volcanic ashes, perfectly like that which has usually been expelled by this volcano; at least for the forty years that I have studied it. It did not come out in the form of mud, but in exceedingly fine dust, which afterwards became wet with the vapour condensed within the very edges of the fissures, or which fell in brine. It is a long while since any of the writers on volcanoes, wishing to establish the theory of "eruptions of mud," have named that of sea-water and shells in 1755; a popular credulity, which I have been compelled to do away, by every possible proof. This new error of 1822 might recall their arguments and lead on to other errors. I have given with much pleasure, a true detail of the fact to the illustrious M. de Humboldt, who wrote me on the subject, with that ardent zeal which characterizes him, and which has rendered him, as he is proclaimed in both hemispheres, one of the greatest observers of nature. With respect to the nature of this volcanic ashes, although I am convinced that it differs not at all from that which has always been ejected, yet I wished to consult the oracle of Chemistry upon it, since it is his delight to discover the composition of bodies; I mean the illustrious Vauquelin, whose noble interest in me has conferred on me so much honour. My first packet, much to my regret and that of the eminent chemist who was expecting it, never reached its destiny; but I renewed it, and the results shall have place in my continuation of the history of Ætna from 1818 where I left it, which I shall soon publish. I will add to finish this note, that the "muddy eruptions" so called by our Macalubbi are not such, even according to the imaginary ideas of Plato, who admitted rivers of mud in the interior of the globe, to which end he alleged such eruptions in Sicily. Nothing comes up from the depths of the earth but streams of carburetted hydrogen gas, which finding above, the argillaceous chalk, of which the soil is formed, loosened away by rain water, it forces it up and causes it to flow in muddy streams. In times of drought, dust only is forced up, and in its passage a whistling is made like an impetuous wind. Even of our Lake of the Palici, they believe that the water comes from the interior of the earth, and wonder that it never overflows. Why do they not observe that in dry years it entirely evaporates, and that nothing comes out of the chinks at its bottom but currents of air, which give to the water the appearance of boiling when it collects there from the rain?

was proved by all the phenomena mentioned in the beginning. I will not be guided by the injuries suffered in different parts, for these spring from a complication of causes; from the soil, its greater or less capacity of receiving and communicating motion; from the manner in which it presents itself to the progressive motion, and from the state of the edifices. These circumstances may sometimes produce anomalies which easily deceive those who do not bestow in the examination of them the attention which they deserve; but without fear of error I may say, that in general the shock was much the most forcible on the northern shore, and at a little distance from it; and that *it* went on gradually diminishing towards the interior. The moving force, then, must have been in operation somewhere under the sea opposite this part of the Island. Naso was almost entirely ruined; Patti, and all the towns about Capes Orlando and Calava, and which are nearer Eolia were considerably dama ed. Some very small, thinly inhabited towns lost little, because they had little to lose; others were in some measure defended by their situations. Palermo, at the bottom of a bay which curves towards these burning islands, and surrounded by large and high mountains on the other side, was exposed to the whole force of the motion against it; this it was, together with the degraded state of its buildings, which brought such ruin upon this beautiful city. Every thing seemed then to announce to us, that the most expansive vapours which proceed from the burning furnaces of Eolia, in developing their immense volumes, urged against the sides of those cavities which once contained the matter of which all these islands are formed, produced the motion that struck obliquely against Sicily, and moving along the shore towards the west, spread despair throughout Palermo. After the shock of the fifth, their motion was more free; and they were heard murmuring under the soil near our island, seeking an outlet from the obscure caverns in which they were generated, but not propagating their motion to any considerable distance. The course of that of the seventh was in the same direction with that of the fifth; but that of the thirty-first was in a direction directly opposite, since it was felt at Messina, and not at Palermo The undulations were determine by the horizontal direction of the motion; the perpendicular shocks, by a force acting from below upwards, which supposes a much greater depth in the situation of the acting force, than the other, without ever being in any case nearer the surface. Every one may easily distinguish the difference which subsists between the superficial motion caused by the rapid passing of a heavy carriage, or by the sudden combustion of a large quantity of confined powder, which would cause the darting of a large accumulation of electric fluid to restore the equilibrium between the earth and the atmosphere were it possible for it to collect in the midst of so many conducting bodies which seem designed to restore the equilibrium instantly; between this motion and the deep, heavy earthquake, armed with such terrible power, which agitates so violently a great extent of the globe, which sometimes seems ready to tear it from its very foundation, and which has all the characters of an effect sprung from most wonderful degrees of force, and of force which, placed deep in the earth, moves and convulses those great masses lying between it and the surface.

The idea of forces and effects like these, fills with fear the miserable mortal who creeps upon the face of the earth, and brings his pride down to the dust. When he sees the earth reel, and the great fabrics which he has raised with so much confidence, rushing to ruin, he despairs of finding any where one firm support to his frail existence.

The chinks and fissures formed in many places, and to which the vulgar attribute much importance, are in consequence of the quaking of the soil, and to which the softness of the earth and the loss of its internal support have given place. The country of Bosco about Ogliastro, of which I have already spoken, became furrowed with diverse, long, tortuous, deep clefts, the sides of which in some places sunk down; in other places, portions of the surface passed down over inclined plains below them, and took new positions; the olive-trees which some of these carried with them, were much injured by the breaking and displacing of their roots. This land is formed of an immense deposit of argillaceous chalk, more than a hundred feet deep. The water which penetrated it (and the winter there was very rainy) loosened away the earth, and carried a great part of it into the internal cavities below; the surface, thus wanting solid support, under the shock of the earthquake became filled with depressions, caverns, and inequalities. The same may be said of a great aperture made in the vicinity of Colesano, which dilating itself day after day threatened to render those places inaccessible. Copious showers alone produce such effects in the chalky land of many parts of Sicily. This want of firm bases frequently causes the overthrow of great rocks at the time of earthquakes. Well do we remember, that in the earthquake of the fifth of February 1783, a mountain, a mile to the south of Scilla, and which was a mile and a half in length, fell over into the sea of Calabria and formed two new promontories.

Phenomena observed in the Eolian Sea.

If all these facts induce us to locate in Eolia the causes of the physical events of the past March, it is necessary to inquire if these islands exhibited, at that time, any phenomena, which may corroborate our opinion. I will mention therefore, in this place, many facts, about which there can be no uncertainty, and which will be of the greatest importance should any one wish to push the suspicion which I have announced in this memoir, to certain evidence.*

Since September of last year, the daily quantity of smoke from Vulcano, has been much greater than usual; and flame has often been visible in the evening. Explosions have been frequently heard on the neighbouring coasts of Sicily. But Stromboli has exhibited the greatest activity for almost fourteen months without intermission. Shocks have been very frequent, and so strong as to fill the islanders, although accustomed to them, with great apprehensions. The island, with the blazing mountain itself, seemed often on the point of being torn up from its foundation. The volcano opened two new mouths on the side which looks towards the sea, and belched out from them fearful clouds of sand, and burning rocks, which after darkening the air, fell to the earth. Fortunately their direction was not towards any of the little habitations, or cultivated fields of the island. One forest only on the side of the mountain, suffered some injury. The inhabitants often found themselves enveloped in thick clouds of black smoke

*The external phenomena of a volcano, show that the effects of the fermentation have come to the surface ; but nature operates often in the dark recesses of the earth, without exhibiting any external visible effects of her operations; elastic vapours may form there, shake the soil, and return to their concrete state. When eruptions happen from the inflamed mouths, it is because these subterranean forces have met with substances which may be thrown out, thus giving certain proof of the existence of these forces.

and ashes, which the wind drove among them. But only one man was struck by the burning rocks hurled through the air with immense violence. The scoria and ashes did much damage to the cisterns of the island, and to the terraces which serve as tiles over them. Torrents of black smoke, ashes, and sand were often ejected and thrown to various distances. The greatest shocks were sometimes followed by a thick dry cloud, which filled the air of the whole island.

The shock of the fifth of March was very strong at Stromboli, at Saline, formerly Didime, and at Lipari. The inhabitants of Lipari did not doubt that their houses would this time be reduced to ruins; and they have not yet ceased giving thanks to heaven and their protecting saints, for defending them from utter destruction. They affirm that a moment after the shock, all their thoughts were turned upon the disasters which might happen to places on the neighbouring coast of Sicily and at Palermo ; towards which the direction of the motion seemed to be. Lipari lies between us and Stromboli. Since April the parts of our island which were before agitated, have been left in repose ; but shocks are still frequent at Stromboli, and keep the poor inhabitants there in continued fear. The subterranean furnace seems to have lost much of its power, as the elastic vapours generated there shake but a very limited space, and the new apertures of the mountains, emit now and then but a very small quantity of fine sand, which is always the last product of an expiring conflagration.

From what I have laid down, it is just to conclude, that the fires of Eolia are those which have for a long time been preparing the event of last March ; that it was produced by motions generated in those mighty furnaces, and that those motions were propagated to great distances. If Sicily then is so often shocked, the powers which agitate it must exist in volcanoes that burn within its own bosom, and in the surrounding sea. Situated in the midst of such grand operations of nature, Sicily must be exposed to all the effects which such powerful causes are capable of producing. The chemical subterranean operations require that the earth should every where be traversed by vast cavities and canals, running in various directions ; and the forces of the operations act on the different parts of these cavities. But it is natural to believe, and many facts in this memoir demonstrate the truth of it, that places in the vicinity of the three great volcanic outlets ordinarily feel the force with the greatest violence. In this respect the situation of Palermo is very advantageous; since it is distant from Ætna, and from Eolia, and is near to Sciacca only, which is the least energetic. And this grand and respectable city would be less exposed to such grievous disasters, than all the other cities of Sicily, did its edifices possess that character, which they might easily be made to possess, which constitutes true solidity and resisting firmness.

Art. III.—*Remarks on the moving rocks of Salisbury.*

TO THE EDITOR.

Dear Sir,

In the winter of 1822, I sent you an anonymous communication respecting the moving rocks of Salisbury, which was published in the 5th volume of the Journal of Science and Arts. In the last number of your Journal I observe some remarks on the same subject, by the Rev. J. Adams, Principal of Charleston College, South Carolina. I have no wish, as your correspondent intimates, to shrink from the responsibility attached to the communication, which I have now acknowledged.

The facts which I then stated, however marvellous and extraordinary they might appear, I can now substantiate by my own observation. The cause, which was then a mere matter of surmise, has for the last two years been generally known in this vicinity. Being fully convinced that the rocks were moved by the agency of the ice, in the month of December, 1823, I took the distance of one of the largest, to a tree on the shore. In the month of January, 1824, there were several very cold nights, during which the ice was heard to roar, not unlike the discharge of a cannon. I visited the spot immediately after, and was no longer in doubt respecting the true cause of the movement of the rocks. On most of them the ice was piled up several feet in height, projecting from the side of the rock, next to the main body of the ice, towards the shore. Some which did not oppose so strong a resistance were evidently displaced, and the one in particular which I measured, was moved several inches, although very firmly fixed in the stones and gravel. During the past winter the rocks have moved but very little, owing to the mildness of the season. From December 1823, to February 1825, the rock above mentioned has moved two and a half feet, which is much less than in former years, for the same reason; besides it has now become more deeply imbedded in the gravel, and the full force of the expanding ice is not exerted upon it.

Since the attention of the public was called to this subject in 1822, many similar facts have been observed in different parts of New England. In the mountain pond in this town, the rocks within reach of the ice are annually moved toward the shore, forming an artificial dike of considerable extent. The same has been observed in ponds in Sharon and other places. There is no longer any doubt or dispute on the subject, and the cause is as obvious as that of any natural phenomenon which occurs.

The remarks on this subject by J. Wood, Esq., in the last number of the Journal are highly ingenious and plausible, but I fear wholly unsupported by evidence. I have never seen ice "grappling a rock" in the manner he mentions, and I believe it is the general opinion that ice first melts *around the rocks*, leaving them, when the ice breaks up in the spring, untouched by it. Your correspondent remarks that, "as the earth contains a greater portion of caloric than the water, the ice dissolves most rapidly nearest the shores of the pond." I think it might with the same propriety be added, that as stone is a tolerably good conductor, the rocks serve as conducting media, conveying the caloric from the adjacent earth and water to the ice and surrounding atmosphere, thus melting the ice around their edges. At any rate, the moving rocks of this town are generally of such shape that they can not well be "grasped" by the ice, being very *shelving;* and that they are not supported in this manner, and thus driven about by the winds and waves, is evident from the fact, that the ice thaws around them (it being near the shore) before it does in other parts of the pond. It is however undoubtedly true that rocks of considerable size are sometimes moved by large bodies of ice being driven forcibly against them.

The expansive power of freezing water has been so ably treated by Mr. Adams in the last number of the Journal, that it is unnecessary to dwell upon it here. It has been found, from experiments performed at Edinburgh, to burst the strongest shells and cannon. Indeed, as we have reason to believe that there is no force capable of confining it, it certainly is not unphilosophical to suppose that rocks of a very large size are often moved by it.

I remain yours respectfully,

CHARLES A. LEE.

Salisbury, April 6, 1825.

ART. IV.—*Notice of the flexible or elastic Marble of Berkshire County*; by Professor C. DEWEY.

SOME account of this marble was given to the public by Dr. Meade, in Bruce's Mineralogical Journal. A considerable quantity of this substance has since been found, and a notice of some large *slabs* of it was published a few years since by Dr. Mitchill. Till lately it has been found chiefly in West Stockbridge and Lanesborough. It is now found in New Ashford in a quarry extensively wrought. I have procured three fine specimens of it, in slabs from five to six feet in length, and seven inches in width. Its flexibility and elasticity may be shown as it stands upon one end, by applying a moderate force to the middle or the other end. Its flexibility is seen too by supporting the ends of it in a horizontal position upon blocks.

This marble has various colours—nearly white, with a reddish tinge, gray, and dove-coloured. Some of it has a fine grain; other specimens are coarsely granular, and have a loose texture. It is not uncommon for one side of a large block to be flexible, while the other part is destitute of this property. It takes a good polish, and appears to be carbonate of lime, and not a magnesian carbonate.

It is well known that Dolomieu attributed the flexibility of the marble he examined to its *exsiccation*, and that Bellevue ascertained that *unelastic* marble might be made elastic by exsiccation. The flexible marble of this county, however, loses this property in part on becoming *dry*. When it is made thoroughly wet by the operation of sawing or of polishing, it must be handled with great care to prevent its breaking, and the large slabs of it cannot be raised with safety unless supported in the middle as well as at the ends. The existence of this property is doubtless dependent upon the same general causes in marble as in other dense bodies.

From the extensive view of marble given in Rees' Cyclopædia, flexible marble appears to be a rare mineral. One of the specimens I have lately obtained is to be sent by the Austrian Consul, to the Imperial Cabinet of Vienna. As more specimens may doubtless be obtained at a reasonable expense, I would gladly aid those mineralogists who desire to procure specimens for their cabinets.

Williams College, Jan. 1, 1825.

Art. V.—*An account of some new and extraordinary minerals discovered in Warwick, Orange county, N. Y.;* by Samuel Fowler, M. D.

Since the minerals of Franklin, first described by Mr. Nuttall, drew so much attention, and appeared so interesting to naturalists, I have endeavoured to collect as many specimens as possible, both for my own amusement and that of others. With this view I have attended to the peculiar formation, in which they are found, and have endeavoured to explore it in all its extent. It is almost unnecessary to repeat that every thing extraordinary in the valleys of Sparta, Franklin, and Warwick, belongs to the formation of crystalline limestone, which, perhaps, has no parallel in any other region of the world. Even Arendal and Wtoe are inferior in mineral riches to this crystalline calcareous valley.

While recently exploring this formation, I made a discovery in the township of Warwick, Orange county, N. Y. of minerals, the most extraordinary for magnitude and beauty, which have ever yet come to notice. What will be thought of *Spinelle pleonaste*, the side of one of whose bases measures three to four inches, or twelve to sixteen inches in circumference? These crystals are black and brilliant, sometimes aggregated, at other times solitary; at this locality seldom or ever less than the size of a bullet. Some are partly alluvial, their matrix decomposing, but when unaltered they are found associated with what has never yet been described, namely *crystals* of serpentine. slightly rhomboidal prisms of a magnitude parallel with the crystals of spinelle, often greenish and compact, at other times tinged yellow by an admixture of brucite.

These crystals bear not the smallest resemblance to the *marmolite* of Nuttall, erroneously referred to serpentine, on the mere ground of chemical affinity, by Mr. Vanuxem.

In the same mass also are associated very large prismatic crystals of *chromate of iron*, at least so they appear to be, by the beautiful green colour which they impart to nitrate of potash, having a *specific gravity* of 4 30. Some of these prisms are an inch in breadth and two inches in length, with two lateral faces, broader than the rest.

The imbedding matrix of the whole is, as usual, crystalline carbonate of lime, with mica and some appearances of hematitic iron. . A few greenish spinelles occurred near the same place, and the neighbourhood abounds with small black and blackish *gray spinelles.* Not far from the same locality also is found, associated generally with a fine green and crystalline serpentine, the *red spinelle* of various shades and degrees of translucence; when dark it passes into reddish brown, but when smaller and more bright, it approaches to *rose red.* These are from a line in diameter to three quarters of an inch on each side of the bases; now and then they occur, in hemitrope—but are seldom or never emarginated, like the green ceylanite of Franklin.

At Byram also, a few miles from Sparta, the *red spinelle* has been found by William Ingliss, Esq. Some of these, approaching to a chocolate brown in colour, give a base of one inch and a quarter on each plane. At the same place we have also found the green ceylanite though much inferior in colour and translucence to that at Franklin.

The magnitude of other crystals at this place (Warwick) is equally surprising as that of the spinelles. Crystals of *scapolite*, terminated, are to be found, each of the six faces of the prisms measuring four inches—or a circumference of twenty-four inches, or even more. They are of course rough and corroded; but the smaller prisms, often with narrow replacements on the edges, are very perfect and almost transparent—all of these slightly tinged with green.

Of the *amphibole* genus we meet with several varieties finely crystallized, the black with six-sided prisms, each face sometimes is an inch in breadth. Actynolite in short and confused prisms, and a *chocolate* brown finely crystallized variety, both in large and small crystals, of the usual form, and also of an extraordinary form, having the obtuse angle sometimes replaced by a broad face. Near Franklin I have found a most beautiful mass of greenish white *tremolite* of this form also, the lustre of these crystals is like that of silk.

Crystals of *augite* abound here, of gigantic magnitudes; and sometimes when smaller, of considerable perfection of form; they are generally grayish green. Brucite also occurs here of a beautiful *orange* and of a palish yellow colour; the paler coloured variety is occasionally crystallized in apparently modifications of the rhombic prism, but hitherto unmeasured. The orange coloured are imbedded in a bluish limestone. The blue *limestone* also occurs in this vicinity in globular concretions loosely aggregated, very similar to the blue limestone of Vesuvius and the Bannat.

In a very singular bed, subordinate to, and indeed in the crystalline limestone occurring in the form of a breccia of the old red sandstone, red graphic granite, and white feldspar, I have found partly diaphanous, softish, green octahedral crystals of considerable magnitude for which I know of no ascertained character. They appear almost similar in substance to *steatite*, being easily cut by a knife. They are not however found, as the *spinelle* of this locality, in carbonate of lime. Considering therefore this mineral as new, I propose to call it *Pseudolite*, in allusion to its affinity to the pseudomorphous crystals of steatite.

In addition to the numerous minerals which have been found at Franklin and Sterling, I would mention the following as occurring at Franklin.

Masses of *actynolite*, of a bright silky lustre, containing short and much modified crystals, the acute lateral edge being in some replaced by three faces and the obtuse angle obliterated. This mineral is sometimes associated with phosphate of lime and scapolite.

Red spinelle, in small scattered crystals, associated with *brucite*, *beryl*, and *phosphate of lime*, found near the mill-dam. Parallel, or nearly so to the same ledge, it was also found by Mr. Nuttall in a small specimen which was not ascertained at the time of his publication.

Amorphous pale yellow *blende* in a brecciated rock accompanied by carbonate of *lime*.

Carbonate of manganese, a somewhat friable reddish gray stone, forming a thin bed in the franklinite at the summit of the mine-hill, and apparently in near connexion with the red siliceous oxide of manganese observed recently by Mr. Nuttall.

Amianthus, connected with the hornblende rock which serves as the matrix of the magnetic iron ore near the furnace. Near the same place green foliated *steatite* well characterized with yellow garnet.

Green *phosphate* of lime, of various shades, associated with brown garnets in the primitive form in six sided prisms, with flat terminations.

The mineral which has been called dyshnite (and which I first found at Sterling) occurs in connexion with slightly rhomboidal prisms of what we suppose may prove also siliceous oxide of manganese.

Also at Sterling—White *blende* found by Mr. Vanuxem and myself at the same time.

Red oxide of titanium, lustre metallic, in rounded six-sided prisms, longitudinally striated.

Very fine crystals of *yellowish brown tourmaline* and *gray spinelle.*

Serpentine and *steatite* disseminated in the carbonate of lime, and granular franklinite in an old excavation made for copper.

Fine crystals of green *ceylanite*, sometimes of considerable magnitude occur here in hornblende rock, and sometimes in massive hornblende and jeffersonite.

Phosphate of *iron* with red manganesian *garnet*, and what has hastily been announced as *yttro-cerite*, hitherto found exclusively by myself in an iron mine at Franklin mountain, procured at the depth of seventy-five feet, and very rare.

Sulphuret of molybdena at the same place with iron ore.

Art. VI.—*Miscellaneous Localities of Minerals.*

1. *By Messrs. Carpenter and Spackman.*

1. ***Horn stone.*** A beautiful variety of this mineral occurs in rolled masses, of a very compact texture, fracture conchiodal, and the mass strongly translucent.—Chesnut Hill, Delaware.

2. *Carbonate of lime.* A variety of this mineral, composed of lenticular crystals and fibres, running parallel, and sometimes diverging, resembling the fibrous arragonite, and forming veins in the limestone quarries.—Near Downingstown, Penn.

3. *Phosphate of lime.* In compact feldspar in hexaedral prisms from $\frac{1}{10}$ to one inch in diameter of a pale green colour.—Near Wisahicon, 6 miles from Philadelphia.

4. *Feldspar.* A beautiful variety of a green tinge.—Occurs on Dickson's farm, Wilmington, Del.

5. *Jasper, red and blue,* occurs in detached masses, loose and imbedded in the soil, at Chestnut Hill, Del.

6. *Laumonite* in hornblende rock forming thin veins of laminated masses; it is very friable and by exposure to the air disintegrates and falls into powder.—New Port road, 1½ miles from Wilmington.

7. *Green quartz.* This mineral occurs crystallized in calcarious quartzose rock, and also with it hyalite, in small white specks and in botryoidal and mamillary masses—same locality abounds with fine drusy quartz.—Chesnut Hill, Delaware.

8. *Oolite* occurs in aggregated globular masses about the size of mustard-seed; discovered by Dr. Samuel Fowler on his farm, Franklin, New-Jersey.

9. *Cyanite* in small blades or imperfect flat prisms of a blue and white colour in mica slate.—Germantown, 6½ miles from Philadelphia.

10. *Asbestoid actynolite.* This variety occurs in talcose rock in very delicate fibres, diverging or radiating from a centre of a fine silky lustre, its colour usually grayish white or pale green. On the Wisahicon, 6½ and 8 miles from Philadelphia.

CARPENTER & SPACKMAN,
294 Market st. and 301 Arch-st., Philadelphia.

2. *By Thomas H. Webb.*

1. *Globules of water in amethyst.* Among some specimens of this beautiful mineral from Bristol, R. I. there was one detected having a considerable sized globule of water in it. It was presented to the Franklin Society of this place by Mr. Crawford Allen, and is now deposited in their cabinet. It is contained in a cavity situated a little beneath the surface of one side of a hexaedral prism, and extending to-

wards the angle formed by this side, and one side of the terminating pyramid. What adds to the interest of the specimen is, that by carefully inclining the crystal, so as to make the enclosed bubble of air approach the angle, the property of double refraction is distinctly seen, and we have presented to us two bubbles instead of one. By an attentive examination of specimens in my possession, I had the good fortune to find several pieces, most of which contain one each, and several three globules. Mr. Mason has since found other similar specimens among those belonging to the above named society, and among some in his own collection. One of these has an undulating motion, rising in about the centre of the cavity, so as to form a curve, and again descending on the other side ; resembling in its movement, that of a boat over a wave. One in my possession, instead of passing backwards and forwards, will, when the crystal is kept revolving, describe a trapezium ; two others perform circuitous courses ; in one crystal there are two cavities parallel to each other, containing globules that move simultaneously in the same direction. With but one exception, none of the cavities hitherto noticed, are straight, which renders it necessary to change a little the position of the crystal, in order to facilitate the passage of the liquid. Most of these specimens have been found among such as were rejected on account of being too pale for good cabinet-specimens, which will therefore enhance the value of many, that have heretofore been considered as uninteresting. Some of these present every appearance of containing globules ; but they are not moveable, in any position of the specimen. One of these apparent globules, is so situated as to exhibit the refractive power of the amethyst, equally well as the one first noticed.

Crystals of quartz, containing similar globules, are occasionally found at Cape Diamond, near Quebec, which locality I believe has never yet been mentioned.

It is probable that such specimens occur more frequently than is generally supposed, and our ignorance of their existence may be fairly imputed, in part at least, to our not examining specimens from different localities, with that caution which we should ; for many of them are so placed, that a partial or superficial examination, would never enable us to detect them.*

2. *Carbo-silicate of Manganese ?* Considerable quantities of a mineral occur at Tower Hill, in Cumberland, which we judge to be the above named variety of manganese. It is mostly massive, having generally an uneven cross fracture, though sometimes it is nearly smooth. The colours are various shades of red, yellowish brown, &c. Some of it is of a delicate pale rose red, has a crystalline laminated structure, is translucent, and presents somewhat the appearance of feldspar. The massive, when broken in a longitudinal direction, is found associated with, calcspar, sulphuret of iron, prase, and actynolite ; the latter often terminates with it in narrow stripes and bands, giving to the mass a fibrous appearance. The whole is covered with a black substance, often of considerable thickness, and mostly crystallized, which is also probably manganese. Both of these will be more particularly examined.

3. *Jasper ;* somespecimens of a very fine deep green colour were obtained by Mr. John Pedrick and myself, while on an excursion through Saugus, Mass.

I am sir, very respectfully, yours, &c.

THOMAS H. WEBB.

Providence, March 11, 1825.

3. *By Charles U. Shepard.*

1. *Anthophyllite.* Mr. Alonzo Chapin has lately presented me with specimens of a mineral, that he has discovered, in considerable abundance, in the town of Blandford, (Mass.) which I find to be very well characterized anthophyllite. The following is a description of it. It occurs in a green talcose rock, having a slaty structure, with veins of blackish serpentine running through it, occasionally, in various directions. It is both massive, and in long acicular prisms, which are generally disposed in a radiating form. Its masses possess a highly crystalline structure, and very

* Should any gentlemen desire a specimen of this, and wish to exchange minerals, for such as occur in this State, by forwarding a box, for me, to the care of Peter Grinnell & Son, South Main-street, or for Mr. Owen Mason, No. 10 North Main-street, they will meet with a suitable return.

readily admit of cleavage parallel to the lateral planes of a rhombic prism, of 125° and 55°. There is also a cleavage apparently perpendicular to the axis of the prism ; but it is attended with some difficulty, and the planes produced by it are not very brilliant or perfect. Its colour is hair-brown, of various shades. It possesses a shining, pearly, pseudo-metallic lustre, is translucent, and scratches fluate of lime, and glass; the latter, however, with difficulty. Before the blow-pipe it is infusible.

2. *Pseudomorphous Quartz* is found at the Southampton lead-mine, in crystals having the form of hexaedral prisms, with triedral terminations. They probably received this form from carb. lime, which has since decayed, and left them hollow. They occupy cavities in quartz, and are grouped together, lying in every direction. They are quite small : none of them being more than half an inch in length, or one quarter of an inch in diameter. Their colour is uniformly a brownish yellow—when viewed with a good microscope, their outer surface is perceived to be covered with exceedingly minute six-sided pyramids.

3. *Carbonate of Lead* is found at the Southampton lead-mine, crystallized in right rhombic prisms of 117° and 63°—its primary form. The following varieties of this mineral occur at the same place. *Green Carb. of Lead.* The colour is uniformly diffused through the mass, or crystal, and is occasioned by the infiltration of green carb. of copper. *Earthy Carb. of Lead.* Its colour is reddish brown. It occurs massive, and disseminated. Its fracture is uneven, and presents a somewhat resinous lustre. It is usually opaque. In dilute nitric acid it effervesces. Before the blow-pipe, it splits with decrepitation, and is immediately reduced to the metallic state.

Amherst, March 22, 1825.

4. *By Dr. E. Emmons.*

Carb. Manganese, Cummington, (Mass.)

Colour red, varying from flesh colour to rose red. Externally gray, grayish black, and black. The purest specimens possess the hardness of phosphate of lime. The recent fracture soon changes to a dark colour, on being exposed to moisture.

Chem. Characters. Effervesces strongly in the mineral acids when in a fine powder. Nitric acid, with the assistance of heat, dissolves it entirely, except a small portion of silex. Before the blow-pipe it immediately changes brown, but scarcely fuses.

Form. In large amorphous masses, showing no tendency towards crystallization. It is found in many places in Cummington, but principally near the meeting-house. It has been called by some mineralogists, *red oxide of manganese;* by others, siliceous oxide of manganese, and gray oxide of manganese. All the specimens I have examined effervesced in acids, both the red and gray varieties. It is much mixed with masses and particles of quartz, magnetic iron, and sometimes carb. lime.

5. *By George W. Benedict.**

1. *Augite* or *sahlite* in very perfect crystals—translucent—foliated parallel to the base.

Var. a. Grayish green; eight-sided with a variety of terminations; of all sizes, from a twentieth of an inch to 4 or even 6 inches in diameter. (Greenwood.)

b. Dark bottle green; eight-sided with a diedral summit, having the terminal edge usually replaced by a third plane. Found adhering to coccolite. (2 miles east of Greenwood.)

c. White; abundant and large, but not so perfect as the others, being mostly exposed to the weather; white and green crystals occur on the same specimen and sometimes the one protruding from the other. (About a mile east of the two ponds.)

2. *Coccolite*, or coarsely grained sahlite; grains foliated from the size of a pin-head to that of one inch in diameter—extremely beautiful.

Var. a. Emerald green; in great abundance; translucent in a high degree. (Greenwood.)

b. Leek green; bottle green; greenish and reddish white, of all shades and sizes, semitransparent, the white transparent very splendent. (2 miles east of Greenwood.)

3. *Actynolite;* dark green in perfect rhombic prisms with diedral terminations. (2 miles east of Greenwood.)

* Some of these minerals have been noticed in a former number, but it is thought that a succinct account of the whole may be interesting.

4. *Hornblende.*

Var. a. Crystallized in six-sided prisms with diedral summits—but few specimens found. (Greenwood.)

b. Carinthin—not abundant. (Greenwood.)

c. Granular—very handsome. (Between the two ponds.)

5. *Mica.* Dark bottle green, and finely crystallized. The crystals lie contiguous to each other in a vein a foot wide, presenting a tessellated appearance. Between the sides and ends of the crystals there is generally a thin layer of prismatic filaments easily removed by the nail. The surfaces thus exhibited are sufficiently smooth for the reflective goniometer. On removing the outer pellicle, a dendritic iridescence of great beauty is usually exhibited. I have never seen so perfect and beautiful crystals of mica from any other locality. The following forms occur:

Var. a. A doubly oblique rhombic prism from half an inch to 4 or 6 inches in diameter, and from a third of an inch to four inches high. This is the common form.

b. The same with the two acute *angles* replaced by triangular planes parallel to each other and forming obtuse angles with their bases respectively. The bases are thus rendered hexagonal; but the crystal is not a hexaedral prism.

c. Triangular pyramids—rare.

d. Oblique four-sided prisms with rectangular bases—rarest of all. (Greenwood.)

6. *Calcareous spar.* Flesh coloured; containing small white and green crystals of augite, and mica; in many places —very handsome between the two ponds.

7. *Ceylanite;* in small octohedrons, sometimes macled—occasionally in rhomboids with brucite in carbonate of lime. (Between the two ponds.)

8. *Sphene.*

Var. a. Dark brown, in crystals, laminated and granular masses so disseminated in the white augite as to give it a porphyritic appearance.

b. Light brown, occurs abundantly about $1\frac{1}{2}$ miles east of the two ponds, on the road to West Point. It is disseminated in a beautiful green sahlite, generally delicately laminated—laminae sometimes so small and irregular that it appears granular. I have one specimen weighing about a pound—it is made up of the granular and laminated, and contains also distinct crystals—oblique four-sided prisms with the two obtuse edges replaced. This locality had been visited by others previous to our going there. I am not, however, aware of any notice of it having been published.

9. *Magnetic oxide of iron.*

Var. a. Crystallized in beautiful octohedrons in cavities of the masses of the ore, at the ore beds about four miles west of the furnace.

b. In occasional masses of various sizes near the augite crystals; structure crystalline; on being fractured, the edges of octohedra appear on the whole surface.

10. *Asbestus.* In the same vicinity; straw yellow; filaments short, but often unusually beautiful.

Newburgh, April 28, 1825.

6. *By Emerson Davis.*

Fibrous Limestone (satin spar) is found in West Springfield at the falls of the Aggawam river, forming veins in red sandstone slate. The veins are perpendicular to the strata, from $\frac{1}{4}$ to $\frac{1}{2}$ an inch in width. The sand-stone is of a fine texture, and probably calcareous.

Roof Slate, at the same falls, is thrown upon the shore apparently by the force of the water. There are only two or three large blocks, but many small fragments. I am not able as yet to find it in place, but I suppose it to form small beds in the sand-stone. The green stone range crosses the river one mile west of the falls, and still further to the west, in Westfield, the red sand-stone again appears though of the conglomerate kind.

Amethyst is found forming veins in the green stone.

Calcareous Spar attached to green stone, sometimes in veins and sometimes *imbedded* in amethyst.

Prehnite in the green stone, filling small cavities or geodes. It is in green radiating fibres. . It is in a decaying state, the specimens are not very good.

Serpentine, the foot of the mountain west of this village.

Cyanite is abundant to the north and west of the village, of the green and blue varieties—green in quartz, and blue in mica slate. The crystals of the blue variety are not perfect.

Actynolite is occasionally found; fine specimens. *

Westfield, April 27, 1825.

* Any of the above, together with the Southampton minerals, I will exchange for other minerals with those who may wish.

EMERSON DAVIS.

Art. VII.—*Geological Systems.—Geological Maps.—Chatoyant Feldspar.*

Extracts of letters to the Editor, dated at Paris January 10, *and March* 14, *from William Maclure, P. A. N. S. and P. A. G. S.*

Your observation that some subdivision in the nomenclature of rocks would be useful to geology, is perfectly just, although I doubt whether our present knowledge is adequate to it Were we to judge by the diluvial and tertiary, these doubts may perhaps be confirmed. The first is a division of the alluvial class, without any distinct line of boundaries. Whether a hill of sand, gravel, or clay, has been aggregated by gravitation, from deep, still water, as a sea, lake, flood, &c. which they wish to call diluvial, or thrown together by the action of a river, or the waves of the sea-shore, which they wish to call alluvial, is almost impossible to distinguish; for in both cases. the mass still remains a bed of sand, gravel, or clay. The terrain de transporte of the French geologists, applied to all rocks whose parts are rounded by attrition, includes almost the whole of Werner's alluvial. The tertiary, including all rocks above the chalk, applies exactly to the basin between France and England, from which the name was perhaps derived, but cannot well define a geological position where no chalk has been found.

One may perhaps be warranted in supposing the existence of a period, when there was, on the surface of the earth, only the primitive, the oldest of the five classes of Werner's, the other four classes appearing to be formed by fire, water, &c. out of the materials composing this first and most ancient class. As we have not yet seen the laws of nature actually operating, to form any rocks similar to the primitive, we are left to conjecture the mode of formation; the total absence of organic remains would lead to the supposition that it was constructed before their existence; the organic remains, and a structure in the rocks similar to that which is actually exposed to the evidence of our senses, warrants the supposition, that the four other classes were formed at some period in the progress of time. The primitive and transition have a fixed character of universal origin in all parts of the globe where they are found: they have a regularity of stratification, inclination, and structure, which proves the extension and similarity of their formation.

The secondary and alluvial, consisting of the wreck of more ancient rocks, vary with the locality and nature of the rocks from which they originate, and have nothing fixed or generally characteristic of a universal formation. Depending on the accidents of declivity, &c., of the foundation on which they are placed, without any regular direction of the stratification, each basin has its own relative position; and as they touch each other at the sides, they are not subject to any over-lying stratification that can fix the relative period of their different formation.

Smith, in his Geological Map of England, (if I recollect well, for I have not seen it for many years,) places the secondary of the west on the primitive and transition of the Cumberland mountains, and in the section which he gives, all the secondary of the east overlies them, by which he indicates, that all the chalk of the east overlies the coal of the west: an order on which others have built their theories, and which I rather think is not correct. The Vulcanic class is a little more irregular. It certainly alternates with the alluvial and secondary, and I think with the transition, so that its formation has been coeval with the three Neptunian classes.

Perhaps the most useful classification, in the present state of the science, would be to retain Werner's five classes as being well defined, that is, as well as the graduated variety of nature will permit, (for one species runs into another by such small and imperceptible degrees as scarcely to leave a footing for our artificial divisions) and to make some subdivisions in each class, without deranging the system already best known, or the ideas of those who follow it. Werner, in placing his newest Floetz Trap in the secondary class, commits a great fault, for these rocks alternate with the alluvial secondary and most probably even with the transition, and are mostly ancient Vulcanic rocks. It is probable that the secondary is the most defective class in his system, for like all system-makers he copied what he saw, and the Erzgebirge, the field that produced his system, has little or no secondary, but with the exception of the newest Floetz Trap it is the most natural and least complicated or confused geological formation I have yet seen. To collect facts, without being warped by an attachment to system, is the surest mode of advancing geology, as well as all other sciences; and it gives me pleasure to see our young geologists so far on the right road. They have proved that they are fit to walk alone, and to make the best use of their senses. It is probable they may be forced to make a system for each of the valleys or basins filled with alluvial or secondary, and after that, it appears to me doubtful, whether any one of them will apply either to our immense alluvial on the shores of the Atlantic, or to our extensive secondary of the basin of the Mississippi.

Extracts of a letter to the Editor from William Maclure, Esq. dated, Paris, January 10, 1825.

GEOLOGICAL MAPS OF PORTIONS OF CONTINENTAL EUROPE.

"Even at this time, there is no geological map of a whole country on the continent of Europe, and the maps of all the partial basins and patches of mountains yet published, would scarcely cover the surface of the state of New-York or Pennsylvania.

A critic in the Bulletin des Sciences considers me as inaccurate, because I have not found coal under chalk, limestone, or the old red sand-stone. The impression that coal may be thus found, originated, as I suppose, from Smith's map of England. This author takes it for granted, because the primitive rocks emerge on the west side of the island, that all the secondary of the east lies upon the secondary of the west, and consequently that the chalk and limestone of the east repose upon the coal and coal measures of the west, agreeably to the section which he gives of the island. This is contrary to the observations I have been able to make, all of which tend to convince me, that secondary basins do not overlie one another, but touch only at their borders and sides—a different order of stratification occurring in each, agreeably to the nature of the surrounding heights, with the particles proceeding from whose decomposition the basins were originally filled.

I have still my doubts, notwithstanding what the critic has said, whether the argillaceous oxide of iron; so common in coal mines, is a carbonate of iron. I have also my doubts, whether the chalk forms a good foundation for what is called the tertiary class of rocks, of which class I am unfortunately as much at a loss to conceive where it begins, as I am to conjecture where it is to end. It seems to be composed in part of Werner's alluvial and secondary, but the limits to which it is confined appear to me undefined and speculative, resting on the distinction between depositions accumulating on the bottom of deep water and those rolled and left on the borders of either a sea or lake—a distinction difficult to make at this distance of time from the operation.

If sand or rolled masses are the criterion, all the transition puddings and sand-stone would become tertiary. I am unable at present to investigate the grounds of those speculative opinions, and no reasoning but that elicited by the stroke of the hammer can throw light on the subject.

CHATOYANT FELDSPAR.

Since I arrived in this city, I am induced, on inspecting specimens of the feldspar in granite called moon-stone, and of the Labrador feldspar, both of which present changeable colours, to conclude that the phenomena are, in both cases, caused by the infiltration of water under crystalline layers which form the surface, and I am confirmed in that opinion by finding in the river below Shafhausen a granite pebble, the feldspar of which had the same properties as the Labrador feldspar.

BOTANY.

Art. VIII.—*Caricography*; by Professor Dewey. Continued from Vol. IX. p. 73.

[Communicated to the Lyceum of NaturalHistory of the Berkshire Medical Institution.]

39. Carex *longirostris*. Torrey.* Tab. C. Fig. 10.

Spicis distinctis; spicis stameniferis ternis brevibus, suprema pedunculata, media sessili, infima pedunculata et cum bractea ovata cuspidata instructa; spicis fructiferis binis vel ternis tristigmaticis cylindraceis pendulis subsparsifloris subdistantibus longi-exserte pedunculatis bracteatis; fructibus ovatis subglobosis inflatis glabris longirostratis bifidisque, squama lanceolata vel ovato-cuspidata paulo longioribus.

Culm 15—30 inches high, triangular, scabrous above, rather slender, stiff; leaves linear-lanceolate, flat, scabrous on the edges, much shorter than the culm, striate, sheathing; sheaths striate, glabrous, with a concave stipule; staminate spikes generally three, short, erect, rather small, highest and lowest pedunculate, the lowest supported by an ovato-cuspidate bract and sometimes pistillate at its base; staminate scale oblong-lanceolate, hyaline, brownish on the keel; pistillate spikes 2—3, cylindric, rather loose-fruited, drooping, on long slender scabrous recurved bracteate peduncles, the highest sometimes staminate at its summit; bracts lanceolate, nearly the length of the culm, scarcely sheathing the peduncles; fruit ovate, nearly globose, sometimes a little three-sided, glabrous, nerved, with a *long*, *slender*, bifid beak; pistillate scale lanceolate, sometimes ovato-cuspidate, white on the edge, green on the back and keel, and a little shorter than the fruit, stigmas 3.

Flowers in May. Found in Westfield in woods on the bank of the river—Mr. E. Davis. Also, near Boston. Grows in great abundance in a light soil on the border of the *interval* of the Housatonnuc, Sheffield, one mile south of the meeting-house.

* Schweinitz. "Analytical Table of Carices," in the Annals of the New-York Lyceum, Vol. I. p. 71.

This is a distinct, beautiful, and finely characterized species, and is very appropriately named by Dr. Torrey. I had named it C. Sprengelii, but the other name *must have the preference, as it was first published.*

40. C. *polytrichoides.* Muh.
Muh., Pursh, Eaton, Pers. no. 9.
Schk. tab. Iii fig. 138.
C. *microstachya.* Mx.

Spica solitaria terminali oblonga, superne stamenifera; fructibus tristigmaticis sub-quinis oblongis alternis sub-triquetris glabris emarginatis, squama ovata obtusa et raró mucronata duplo longioribus.

Culm 4—12 inches high, very slender, triangular, scabrous above; leaves subradical, linear, setaceous; shorter than the culm; spike single, pistillate below; staminate flowers 3—7, with an ovate subacute scale, green on the keel, and tawny on the margin; fruit 3—8, oblong, somewhat lanceolate, *emarginate* and entire at the orifice; stigmas three; pistillate scale ovate, obtuse, sometimes mucronate, scarcely half the length of the fruit: colour of the plant yellowish green.

Flowers in May. Found in cold, wet situations in meadows—very common.

Our plant seems to be larger and to bear more fruit than the specimens observed by Muh. in Pennsylvania. It is a very distinct and beautiful species. Though it belongs to a very natural division of the species of this genus, it is not closely allied to any of them except the following species.

41. C. *Wildenowii* Schk.
Muh., Pursh, Eaton, Pers. no. 5. and Ell.*
Schk tab. Mmm. fig. 145.

Spica solitaria oblonga terminali, infra fructifera; fructibus tristigmaticis lanceolatis triquetris subsenis subacuminatis subglabris, squama ovata acuminata duplo vix longioribus.

This species has rarely, if ever, been found in N. England. My specimens are from Pennsylvania, where it grows in dry woods, and flowers in June, according to Muh. It is closely related to C. *polytrichoides*, but differs from it in its fruit and scale, as well as in its place of growth. It is not so slender a plant, and its leaves are considerably wider and also more flat

* Elliott's *Sketch of the Botany of South Carolina and Georgia.*

and grassy, its culm varying from 6 — 12 inches in height. Like the preceding species, it varies much in the number of its fruit. The whole plant has a light green colour.

42. C. *pedunculata.* Muh.
Muh., Pursh, Eaton, Pers. no. 31.
Schk. tab. Ggg. fig. 131.

Spicis subquinis tristigmaticis trigonis distantibus longe pedunculatis, superne stameniferis; fructibus obovatis triquetris, apice recurvatis, vulgo glabris, squama oblonga vel obovata mucronata paulo longioribus.

Culm 4—8 inches high, triangular, scabrous above, rather procumbent, reddish-brown at the base; leaves chiefly radical, stiff, rather flat, carinate, longer than the culm, striate; spikes mostly androgynous, triangular, short, on rather long exserted peduncles, the lowest sometimes wholly pistillate, and the highest sometimes having the staminate flowers in a distinct spike just above the pistillate; stigmas 3; staminate scale ovate, mucronate, reddish-brown; fruit obovate, three-sided, somewhat recurved at the apex; pistillate scale oblong or obovate, mucronate, reddish-brown, green on the keel, and a little shorter than the fruit. Colour of the plant light green.*

Flowers in April. Grows in open woods—common.

This singular and beautiful species delights in the warm and sunny sides of hills and open woods, and is the first of the grasses to show its flowers in the spring. Its fruit may often be found of full size early in May.

43. C. *virescens.* Muh.
Muh., Pursh, Eaton, Pers. no. 93.
Schk. tab. Mmm. fig. 147.

Spicis ternis tristigmaticis oblongis erectis alternis, supremâ pedunculata inferne stamenifera, cæteris fructiferis subsessilibus bracteatis; fructibus ovatis obtusis costatis pubescentibus, squama ovata pubescente mucronata longioribus vel subæqualibus.

Culm 15—24 inches high, rather slender, triangular, leafy, scabrous above, often reddish-brown at the base; leaves li-

* Prof. Dewey would be happy to exchange Carices, on most liberal terms, with any Botanist for C. *ovata*, Rudge, credited to Canada, C. *Fraseri*, credited to N. Carolina, C. *scirpoidea* Mx. C. *subulata*, Mx. and C. *miliaris*, Mx.

near-lanceolate, shorter than the culm, abbreviated below, generally pubescent, sheathing; sheaths striate, pubescent; spikes three, from half an inch to an inch in length, oblong, rather slender, somewhat three-sided,—highest spike staminate below,—lower ones entirely pistillate, nearly sessile, supported by linear-lanceolate, pubescent bracts; staminate scale ovate, acute; fruit ovate, generally obtuse, costate, pubescent, rather close; pistillate scale ovate, mucronate, pubescent, carinate, green, varying from about half the length to the length of the fruit. Colour of the plant a dull green.

Flowers in May. Grows on the borders of woods, on hills and in wet upland meadows. West base of Mt. Holyoke—common in Berkshire county.

β. costata. C. *costata.* Schw.

Has its fruit more strongly costate, and its outer sheaths purplish-brown. Its leaves more numerous and larger.

The difference seems not sufficient to constitute it a distinct species. The fruit of C. *virescens* differs considerably in the distinctness of the nerves or ribs. On examining specimens from Pennsylvania, I can find no essential difference from the real C. *virescens*. Both C. *virescens* and C. *costata* are referred, in the "Analytical Table of Carices," to those species which have more than four spikes and two stigmas, neither of which is correct.

44. C. *hirsuta.* Willd.
Muh., Pursh, Eaton, Pers. no. 95. & Ell.
Schk. tab. Www. fig. 172.

Spicis tristigmaticis ternis brevi-oblongis alternis erectis, suprema brevi-pedunculata et infra stamenifera, cæteris subsessilibus foliaceo-bracteatis, omnibus approximatis densifloris; fructibus ovato-triquetris nervosis obtusis ore integris glabris, squamæ ovatæ acuminatæ glabræ subæqualibus.

Culm 12—18 inches high, triangular, scabrous above, glabrous below, dark brown at base, leafy; leaves linear-lanceolate, long as the culm, sheathing, and, like the sheaths, retrorsely pubescent and striate; spikes three, sometimes four, about half an inch long, rather close-fruited, oblong, approximate highest spike staminate below—lower ones wholly pistillate, nearly sessile, with long linear-lanceolate, subpubescent bracts—lower bract much surpassing the culm; staminate scale oblong, obtuse, white on the margin; stigmas three; fruit ovate, triangular, nerved, *glabrous in maturity*, *but pubescent in its younger state,* obtuse; pistillate scale ovate, acuminate, white on the margin, green on the keel, nearly as long as the fruit, colour of the plant rather a light green.

Flowers in May. Grows on moist upland meadows and hills. Phillipstown, N. Y.—Dr. Barratt. In the meadows south of Newburgh, N. Y with C. *squarrosa*, C. *granulari-oides*, C. *pubescens*—common, like the preceding species, but not abundant in Berkshire county.

Schk. has given two figs. of this plant, and also of the capsules, but the varieties of this species are not likely to lead to mistakes. Though it is a very distinct species, it may before maturity be confounded with C. *virescens*, because its *young fruit is pubescent.* Its shorter, thicker spikes, and its longer, retrorsely pubescent leaves, easily distinguish it, even before its fruit becomes glabrous, from that species.

45. C. *vestita.* Willd.
Muh., Pursh, Eaton, Pers. 106, & Ell.
Schk. tab. Bbbb fig. 182.

Spica stamenifera solitaria, vel binis, cylindracea oblonga, suprema elongata pedunculata; spicis fructiferis tristigmaticis binis ovato-oblongis sessilibus subapproximatis bracteatis, sæpe superne stameniferis; fructibus ovatis oblongis subtriquetris nervosis brevi-rostratis bifidis pubescentibus, squama ovato-oblonga acutiuscula submucronata paulo longioribus.

Culm 18—30 inches high, acutely triangular, scabrous above, striate; leaves linear-lanceolate, striate, rough, shorter than the culm, abbreviated below; staminate spike one, sometimes two, oblong, cylindric—the highest long, large, and pedunculate—the lowest sessile and short; staminate scale oblong, tawny, white and membranaceous on the margin; stigmas three, sometimes two according to Muh., pistillate spikes 2—3, sessile, oblong, cylindric, about half an inch long, often with a few staminate florets at the apex, supported by long, leafy bracts shorter than the culm; fruit ovate-oblong, shortly beaked, bifid, nerved, somewhat three-sided, pubescent; pistillate scale ovate-oblong, submucronate, tawny, green on the keel, and a little shorter than the fruit.

Flowers in May. Inhabits wet and marshy situations. It has not been found in Berkshire county—common on Connecticut river, in Massachusetts and Connecticut—Deerfield, Mr. Hitchcock—Pennsylvania.

This is a finely characterized species, and is excellently drawn by Schk.

46. C. *granularioides*. Schw.
Tab. A. fig. 4.

Spicis distinctis; spica stamenifera solitaria oblonga pedunculata; spicis fructiferis tristigmaticis binis vel ternis oblongis remotis exserte pedunculatis erectis subdensifloris bracteatis, suprema subsessili; fructibus oblongis obtusiusculis glabris nervosis ore integro subdivergentibus, squama ovato-subulata paulo longioribus

Culm 8—12 inches high, triangular, rather slender, scabrous above, leafy towards the base; leaves linear-lanceolate, flat, rather smooth, shorter than the culm, striate, about two lines broad; bracts leafy, as long or longer than the culm with short, distinct sheaths; staminate spike single, from the same bract with the highest pistillate, pedunculate, sometimes with a small bract at the base; staminate scale oblong, subobovate, obtuse, tawny; pistillate spikes 2 – 3, remote, often quite distant, the highest nearly sessile, the others supported on peduncles projecting more than the length of the sheaths, about half an inch long, cylindric, oblong, rather densely flowered; stigmas three; fruit oblong, obtuse, sometimes a little attenuated at the base, nerved, glabrous, entire at the mouth, sometimes with a very short beak; pistillate scale, variable in length, ovate and subulate, tawny on the edge, and green on the keel, generally a little shorter than the fruit. Colour of the plant is a bright green.

Flowers in May. Grows in moist soil, upland meadows at Newburgh, N. Y.; on the Housatonnuc in Sheffield; Phillipstown, N. Y. Dr. Barratt.—Bethlehem, Pennsylvania, Mr. Schweinitz.

This plant is related to C. *conoidea*, C. *tetanica*, and C. *pallescens*, but it differs much from either of them. Mr. Schweinitz made it a new species with great propriety.

Plates of several of the new species of Carex described in this work, accompany this paper. The figures have been drawn by a hand distinguished for its accuracy in delineating plants. The figures are of the size of the originals. The dissections are on the *right* of the species to which they belong. The *first*, in passing towards the right hand, represents the *scale*; the *second*, the *fruit*; and the *third*, when given, the *seed*.

Table A. fig. 1.	C. *aristata.*	Vol. VII.	p. 277.
" ditto 2.	*lenticularis.*	Vol. VII.	p. 273.
" ditto 3.	*disperma.*	Vol. VIII.	p. 266.
" ditto 4.	*granularioides.*	Vol. IX.	p. 262.
Table B. fig. 5.	C. *setacea.*	Vol. IX.	p. 61.
" ditto 6.	*formosa.*	Vol. VIII.	p. 98.
" ditto 7.	*novæ-angliæ.*	Vol. IX.	p. 64.
" ditto 8.	*Schweinitzii.*	Vol. IX.	p. 68.
Table C. fig. 9.	C. *tenera.*	Vol. VIII.	p. 97.
" ditto 10.	*longirostris.*	Vol. IX.	p. 257.
" ditto 11.	*Deweyana.*	Vol. IX.	p. 62.
" ditto 12.	*trisperma.*	Vol. IX.	p. 63.

Art. IX.—*On the Botany of America.* By William Jackson Hooker, LL.D. F.R.S.E.*

In noticing, as we propose to do, the progress of botany, and the present state of that science in various parts of Europe, it is by no means our intention to pass by in silence what has been effected by our brethren in North America, a country which, for extent and interest, has scarcely any parallel in the world. If we were to estimate it from its southern extremity, we should commence our calculations at the tenth degree of north latitude; but as we shall confine our observations to those districts which have submitted to the sway of the United States, or to those which may, with more propriety, be termed the British possessions in North America, we shall omit the Mexican dominions altogether; and beginning with the thirtieth degree of latitude, we have a space extending northward beyond the arctic circle; and if we include the island of Newfoundland, through eighty degrees of longitude in its utmost breadth. The vegetation is as various as are the climate and the soil, throughout this vast extent of continent. In the Floridas grows a majestic species of *Palm*, (*Chamærops Palmetto*,) and the *Orange*, the *Cotton*, the *Indigo*, and even the *Sugar cane* may be cultivated there to great perfection and advantage. In the Carolinas and the Floridas the eye of the traveller is charmed with the beauty and grandeur of the forest trees, the various species of *Evergreen oak*, the numerous kinds of *Pine*, *Walnut*, and

* From Dr. Brewster's Edinburgh Journal of Science, No. III. p. 108.

Plane; the majestic *Tulip tree* (*Liriodendron tulipifera,*) reaching to the height of 140 feet, and loaded with large and brilliant flowers, the curious *deciduous Cypress*, and the superb *Magnolias*.

A different vegetation occurs in the more northerly of the United States; and what renders the botany of North America peculiarly interesting to the British naturalist is, that a very large proportion of its vegetable productions may be assimilated to our own climate. This is especially the case with that extensive portion of it under our immediate consideration. The *Oaks* and *Firs* of this district of North America now decorate many of our plantations and pleasure grounds, and as the quality of their timber comes to be better known and appreciated, they will doubtless occupy a conspicuous place in our woods and forests. Our shrubberies owe their greatest beauty to the various species of *Kalmia, Azalea, Rhododendron, Robinia, Cornus, Sambucus, Ceanothus*, and *Lonicera*, to the *Syringa*, the *flowering Raspberry*, and a hundred others, which flourish as if they were the aboriginal natives of our soil; whilst the gardens of the curious are indebted for many of their choicest productions to the herbaceous plants of North America, the greater number being remarkable for the brilliancy of their blossoms, and not a few, such as the *Dionæa* and *Sarracenia*, striking us as amongst the most singular of all vegetable productions in their structure. Nay, such is the superiority of the climate, and the fertility of the soil, that our European fruits, which were taken over by the early settlers, have improved prodigiously in quality; to that degree, even that we now procure grafts of them for our orchards and wall-trees; and the most highly flavoured apples that we (north of the Tweed at least) can obtain for our desserts, are actually imported themselves from America.

In the arctic regions of the New World, there is a striking similitude in the botanical productions with those of the summits of our highest Scotch mountains.

The earliest accounts of the plants of North America consist of detached memoirs, principally published by foreigners, the Americans being themselves, for a long time, too much occupied in commerce and agriculture to devote their time and attention to science; nor is it till a country has arrived at that degree of political and mental improvement to which we find the United States now to have attained, that we can expect any branch of science to be estimated as it deserves.

A small history of the *Plants of Canada* by Cornuti appeared in Paris in 1635. About the year 1740 was published Catesby's *Natural History of Carolina*, &c. in 2 vols. large folio, illustrated with a great number of highly coloured figures of plants, &c. Gronovius edited the *Flora Virginica* of Clayton, at Leyden, in 1739. In the Memoirs of the American Academy, Dr. Cutler printed his Account of the *Vegetable Productions of the New England States;* and, in 1788, *Walter's Flora Caroliniana* appeared in London.

The elder Bartram, during his extensive and interesting travels, discovered many curious plants, and was the means of making them known to the botanists of Europe, especially of Britain. His friend and patron, Mr. Peter Collinson, who kept up a constant correspondence with him, Colden, and other naturalists of America, was one of the first to cultivate the plants of that country in England, which he did with much success, at his charming garden at Mill Hill, near London. Dr. Garden was another eminent promoter of American botany, and in his communications to Linnæus, he sent many new and interesting plants. His botanical enthusiasm seems to have been very great; and we have some striking proofs of it lately published by Sir J. E. Smith, in the Linnæan correspondence. In one of those letters, addressed to the illustrious Swede from South Carolina, Dr. Garden thus expresses himself on the occasion of his being disappointed of an intended journey to the Apalachee mountains, by an order for the expedition to return. "In my letters," he says, "to you at that time, I gave you an account of my intended journey, and in what manner the arrival of our new governor put a stop to us. Good God! is it possible to imagine the shock I received when the unhappy express overtook us, just two day's march on this side of the mountains? My prospect of glutting my very soul with the view of the southern parts of the Great Apalachees was instantaneously blasted. How often did I think of the many happy hours that I should have enjoyed in giving you a detail of their productions! How often did I think of the secret pleasure which I should have, in being instrumental, though in the least degree, to the advancement of our knowledge of the amazing works of the Supreme Architect! How happy should I have been to have thrown in my mite, by adding one new genus or species to the vegetable or mineral kingdom! With what pleasure did I bear the sun's scorching beams, the fatigue of travelling, the cold ground for my pillow, and the uncomfortable dreariness of rain, when I had in view the wished-for examination of the productions of the mountains! We had advanced about 260 miles of our journey through the woods, when our hour was come that all our promised Elysium vanished, and left nothing but a blank, a doleful blank to ne, and I may say to every one of the company; for we were happily collected, and unanimity reigned amongst us. What will you think when I tell you that one of our company was a very accurate drawer, and he had promised me to do every thing for me, and according to my direction, that I should desire; so that, in this one circumstance, my loss was irreparable. Bui why do I dwell ou the most disagreeable of all the incidents that ever Providence mingled in my lot?"

Kalm, the celebrated pupil of Linnæus, who was also Professor of Natural History at Abo, in Finland, visited America at the expense of the king of Sweden, in the years 1747—51. His researches extended as far as Canada, and the plants which he collected served materially to enrich the *Species Plantarum* of his great master; while the Linnæan herbarium, as Sir J. E. Smith assures us, abounds in specimens brought home by Kalm, and distinguished by the letter K. The name of this botanist is commemorated in the beautiful genus *Kalmia.*

Until the year 1803, however, nothing had been published containing a thoroughly scientific arrangement of any extensive portion of the northern part of the New World. The providing of materials for such a work was reserved for Andre Michaux, a Frenchman, every way qualified for the task, and who, after returning from a most successful botanizing expedition to Persia, and bringing with him, amongst other treasures, the curious *Rosa simplicifolia* and *Michauxia companulata,* was appointed to visit North America at the charges of the French government, with a view to enrich France with its various vegetable productions, particularly its forest trees; for which, it must be confessed, that the climate of that country is even better qualified than that of England.

New-York Michaux constituted the depôt for the collections which he made through New-Jersey, Pennsylvania, and Maryland; and he there established a garden, from whence he despatched numerous packages to France. Another depôt was formed at Charleston, for the reception of the productions of the Carolinas and the Alleghany mountains, which he explored with great difficulty and danger, travelling no less than 900 miles across the wilds of Carolina and Georgia alone. Thence he visited Spanish Florida, making his way up the rivers for considerable distances, in a canoe hollowed out from a single trunk of the deciduous *Cypress (Cupressus disticha)*. In May 1789, he investigated the mountains of Carolina, and, assisted by some Indian guides, without whom it would have been impossible to have made any progress; he penetrated the vast woods of the intervening plains, through thickets of *Rhododendron*, *Kalmia*, and *Azalea;* but was prevented from going so far as he had intended, in consequence of a dispute between the Indians and the white people, which rendered it unsafe for Europeans to venture among the former. He therefore returned to Charleston by New York and Philadelphia. He now recommended and instructed the Americans to collect and prepare the root of the *Ginseng (Panax quinquefolia,)* in the same manner as the Chinese do for sale; and, for a long time, a trade was actually carried on with China in that article.

Michaux had still another object in view, which was that of tracing the botanical topography of America; and, having effected so much in the southern States, he resolved to extend his researches as far north as Hudson's Bay. In short, he arrived at a country, where, as he says himself, "nought but a dreary vegetation was found, consisting of black and stunted pines, which bore their cones at four feet only from the ground; dwarf *Birch* and *Service Trees*, a creeping *Juniper*, the *Black Currant*, the *Linnæa borealis*, *Ledum*, and some species of *Vaccinium*."

Michaux did not return to Europe till 1796, when he was shipwrecked on the coast of Holland. The circumstance is thus related by his biographer in the third volume of the *Annales du Museum d'Histoire Naturelle*. "The passage had not been unpropitious; but on the 18th of September, when in sight of the shores of Holland, a dreadful tempest arose; the sails were rent, the masts broken, and the vessel struck and split against the rocks. Such was the state of exhaustion and fatigue to which all the sailors and passengers were reduced, that the greater number would have been lost, but for the assistance that was rendered by the inhabitants of Egmond, a little neighbouring village. Michaux was lashed to one of the yards, and he was senseless when carried on shore; he did not recover till some hours after, when he found himself extended before a fire, with more than fifty persons standing around him. His first idea, when his recollection returned, was to inquire for his collections. He was informed that the packages which contained his own effects had been lying on deck, whence they were washed by the violence of the waves; but that those chests which had been lodged in the hold had been taken out safely. This intelligence consoled him. Notwithstanding the wretched state of his health, Michaux was compelled to remain six weeks at Egmond, and to work day and night. His plants having got wetted by the salt water, he was obliged to immerse them all in fresh water, and one after another, to dry them between new papers."

On his return to his native country, Michaux employed himself in preparing his *History of Oaks*, a work which reflects the highest credit upon its author; not only because of the number of new species which are there made known to us, but also on account of the important uses to which the timber of the different kinds may be applied. An appointment to explore other countries* prevented him from publishing himself any of his various new and important discoveries. His *History of the Oaks* was indeed printed, but the plates were not all ready for the press before his departure from Europe. It was edited in 1801. But that work which more immediately concerns our present subject, and which was compiled from the materials that he collected during his travels in North America, is his *Flora Borealis Americana, sistens Characteres Plantarum quas in America Septentrionali collegit et detexit Andreas Michaux*. This appeared in 1803, (the very year of Michaux's death,) in two volumes octavo, with fifty-one neat plates in outlines. The anonymous editor, and indeed he may justly be considered the author, was the eminent Claude Louis Richard, late professor of botany at the School of Medicine in Paris, and unquestionably one

* He embarked in the ill-conducted expedition under Captain Baudin; but like many others of the officers, when the vessel arrived at the Isle of France, he refused to proceed further, and thinking that Madagascar presented a glorious field to the naturalist, he quitted the expedition; keeping his motives a secret till the moment of the ship's departure. Landing on the east coast of that island, he resolved to prepare a garden for the reception of his plants in the vicinity of Tamatada; but here he was seized with a fever, the consequence of the climate, aided by over-exertion, and of which he died in 1803.

of the most profound botanists that Europe has ever known. The whole is in Latin, and, as may be supposed, the proportional number of new species is extremely large ; and certainly, considered as the first Flora of so entensive a country as North America, it confers the highest credit on the industry and acuteness of Michaux

Long before the publication of this work, another naturalist, Frederick Pursh, a Pole*, we believe, by birth, but educated in Dresden, instigated by the richness of the vegetation, and the hope of making numerous discoveries, resolved to visit North America, and carried his plan into execution in 1799, when he embarked for Baltimore, in Maryland, with the resolution not to return to Europe till he had examined

* This celebrated Botanist, we believe, has been commonly, though erroneously, considered a native of Poland. While Professor Silliman was in Canada, in the autumn of 1819, he had a personal interview with Mr. Pursh, in the course of which the latter stated expressly, that he was a *Tartar*, *born and educated in Siberia*, *near Toboltski*. "Indeed," says Professor Silliman, "he possessed a physiognomy and manner different from that of Europeans, and highly characteristic of his native country."

"Mr. Pursh expressed himself very warmly on the subject of the liberal aid which he received in Europe from scientific men, in the use of their libraries and their herbariums, and in the tender of their private advice and information ; he mentioned, particularly, his obligations to Sir Joseph Banks, and President Smith. He informed me, that he contemplated another tour to Europe for the purpose of publishing his *Flora of Canada*, upon which he had been already several years occupied, and expected to be still occupied for several years more. These researches led him much among the savage nations of the North-west, and around the great lakes. He went first among them in company with the exploring and trading parties of the North-West Company, but fearing to be involved in the consequences of their quarrels, he abandoned their protection, and threw himself, alone and unprotected, upon the generosity of the aborigines. He pursued his toilsome researches, month after month, travelling on foot, relying often on the Indians for support, and of course experiencing frequently the hunger, exposure, and perils of savage life. But such was the *enthusiasm* of his mind, and his complete devotion to the *ruling passion*, that he thought little of marching day after day, often with a pack weighing sixty pounds on his shoulders, through forests and swamps, and over rocks and mountains, provided he could discover a *new plant ;* great numbers of such he assured me he had found, and that he intended to publish the drawings and descriptions of them in his Canadian Flora." (See "*Remarks made on a Tour between Hartford and Quebec*," p. 351.)

Mr. Pursh died, after a very lingering illness, at Montreal, July 11th, 1820. It is to be hoped that inquiry has been, or will be, instituted concerning the papers of this learned man. His *Flora of Canada*, though probably not sufficiently mature for publication, would almost undoubtedly afford many valuable items. C. H.

the country, and collected materials to the utmost extent of his means and abilities; and it is certain that he did this under many and great disadvantages. His travels were extensive; for he remained nearly twelve years in America, and in two summers only he went over an extent of country, equal to 6000 miles, principally on foot, and with no companion save a dog and his gun. From the first four or five years of his residence in America, Pursh seems to have been chiefly employed in collecting plants about Philadelphia, and in receiving them from his correspondents for cultivation in his gardens there. In 1805, he explored the western territories of the southern states, including the high mountains of Virginia and Carolina; and in 1806, he went through many of the northern States, commencing with the mountains of Pennsylvania, and extending his investigations to those of New Hampshire, embracing the country of the lesser and great lakes.

But the most important of the advantages to which I allude, were derived by Pursh's personal acquaintance with, and communications from, various botanists, who about this time were to be found in different parts of the United States.

Among these, the first undoubtedly in point of rank and character, will stand the amiable Dr. Muhlenberg, minister of the German church at Lancaster, in Pennsylvania. He was thoroughly conversant with the vegetable productions of his own district, and in a measure with those of America generally: for he published, in 1813, a *Catalogue of the Plants of North America,* which contains a great number of new species; and what redounds still more to his credit, though it was a posthumous work, he was the author of an excellent treatise on the *Grasses and Sedges of North America,* which was edited in 1817 by his son, assisted, as he tells us in the preface, by Mr. Elliott, Mr. Baldwin, and Mr. Collins. This work is entirely in Latin. Dr. Muhlenberg carried on a most extensive correspondence with the botanists of Europe, by whom he was greatly esteemed. He supplied the celebrated Hedwig with many of the rare American mosses, which were published either in the *Stirpes Cryptogamicæ* of that author, or in the *Species Muscorum.* To Sir J. E. Smith, and Mr. Dawson Turner, he likewise sent many plants, and one of his new mosses was published by the latter gentleman in the *Annals of Botany,* under the name of *Funaria Muhlen-*

bergii. It is well known that Dr. Muhlenberg possessed very extensive materials for a general description of the plants of the New World; but what has become of these we have been unable to ascertain. His herbarium is in the possession of the American Philosophical Society.

Another of the friends of Pursh was Dr. B. Smith Barton, a physician and a naturalist, and unquestionably a great promoter of Science, and especially of Botany, in America. He was appointed Professor of Natural History in the university of Philadelphia in 1789. We recollect, in our early youth, reading with great delight some of his *Fragments of Natural History*, as they were appropriately termed, which first brought to our notice many highly curious objects of that country, and reminded us of the writings of our own Stillingfleet and White. He has the credit of publishing an elementary work on Botany, which, though rather diffuse in style, is full of entertaining anecdotes; and the references and terms being all made applicable to American plants, it must have done much towards recommending the study of botany in that country.

Mr. Marshall, author of a work on the forest trees of America, was then living, and he imparted to Pursh some useful materials, principally afforded by his garden, rich in trees and shrubs.

The sons of the celebrated John Bartram, before mentioned, possessed an old established garden, founded indeed by the elder Bartram, at Philadelphia, on the banks of the Delaware. Mr. William Bartram, the well-known author of the travels through North and South Carolina, was then, and we believe is still living; a man who merits the gratitude of every naturalist, for the cordial reception which he gave to Wilson, the ornithologist, at the period when that highly-gifted individual had scarcely a friend in the world. It was the advice and encouragement that Mr. Bartram gave him, that was mainly the cause of the appearance of one of the most valuable works on science that was ever published in any country, the *American Ornithology* * Mr. Pursh appears to

* We cannot help here, though but little connected with the subject of this paper, making an extract from the interesting life of Wilson, published by Mr. Ord, in the 9th volume of the *American Ornithology*. "His residence being at but a short distance from the botanical garden of Messrs. Bartram, situated on the western bank of the Schuylkill, (a sequestered spot, possessing attractions of no ordinary kind,) an acquaintance was soon contracted with that venerable naturalist, Mr. William

have received an equally kind reception and much valuable information from Bartram.

In 1802, Mr. Pursh had the charge of the extensive gardens of W. Hamilton, Esq. called the Woodlands, which having, immediately previous, been under the charge of Mr. Lyon, an Englishman, and an eminent collector, were found to be enriched with a number of new and valuable plants; and Mr. Pursh affirms, that through Mr. Lyon's means, more rare and novel plants have been introduced from thence to Europe than through any other channel whatever. The herbarium, as well as the living collection of Lyon, was of great use to Mr. Pursh; and the plants described by him, from specimens seen only in that herbarium, are numerous.

The interesting expedition of Messrs. Lewis and Clarke across the vast continent of America to the Pacific Ocean, by the way of the Missouri and Great Columbia rivers, was productive of a small collection, of about 150 species of plants, (but of which not a dozen were previously known to the natives of America,) which Mr. Pursh had the opportunity of describing. These were gathered during the rapid return of the expedition from the Pacific Ocean towards the United States. A far more extensive herbarium had been formed by the same expedition on the ascent towards the Rocky Mountains, and among the chains of the Northern Andes; but this was lost, in consequence of the inability to carry it beyond a certain point.

Another set of specimens to which Mr. Pursh had free access, was that belonging to Mr. Ensley, a German naturalist, who had been sent out to America by Prince Lichtenstein. It was particularly rich in the vegetable productions of Lower Louisiana and Georgia.

Bartram, which ripened into an uncommon friendship, and continued without the least abatement until severed by the hand of death. Here it was that Wilson found himself translated, if we may so speak, into a new existence. He had long been a lover of the works of nature, and had derived more happiness from the contemplation of her simple beauties, than from any other source of gratification. But he had hitherto been a mere novice: he was now about to receive instructions from one whom the experience of a long life, spent in travel and rural retirement, had rendered qualified to teach. Mr. Bartram soon perceived the bent of his friend's mind, and its congeniality to his own, and took every pains to encourage him in a study, which, while it expands the faculties and purifies the heart, insensibly leads to the contemplation of the glorious Author of nature himself."

Thus, by Mr. Pursh's personal exertions and industry, and by the aid of other botanists, he found himself, about the year 1807, in possession of materials for a Flora of North America, amounting to nearly double the number of species enumerated by Michaux. He began seriously to think of publishing them, and applied to some bookseller in Philadelphia for that purpose; but his intention was deferred in consequence of his being called upon to take the management of the public Botanic Garden at New-York, originally established by Dr. David Hosack, and his private property. Here, again, keeping his favourite object respecting the publication of a Flora in view, he had the opportunity of adding farther to his knowledge of the plants of the United States, and of obtaining still greater assistance, particularly from M. Le Conte of Georgia, and from the estimable Professor Peck* of New Cambridge University.

Fortunately for the cause of science, there existed at the time of which we are speaking, so many obstacles to the publication of scientific works in America, that Mr. Pursh was led to visit England, where the reception he met with from Sir Joseph Banks, and A. B. Lambert, Esq. made him resolve upon printing his book in this country. The access which was granted him to the Libraries and collections of these two eminent men, were alone a source of much advantage to him. He had also the opportunity of examining, amongst others, the select Herbaria of *Clayton*, in the Banksian collection, from which the *Flora Virginica* was formed; of *Walter*, from which the *Flora Caroliniana* was compiled, in the possession of Messrs. Frasers of Sloan-square; of Catesby, part of which is in the British Museum, whilst another part, together with numerous additions from Walter,

* We recollect when, many years ago, this gentleman did us the honour of a visit in England. He mentioned that his taste for natural history was induced by the perusal of an *imperfect* copy of Linnæus's *Systema Naturæ*, a work then scarcely known in America, and which he obtained from the wreck of a ship which was lost near the spot where he resided. Professor Peck afterwards became eminent, particularly for his knowledge of insects; and his communications to our great entomologist, the Rev. Mr. Kirby, are highly valuable. Many of these were published by Mr. Kirby, in the Transactions of the Linnæan Society, and amongst them the curious *Xenos Peckii*, an insect which inhabits the joints in the abdomen of the *Wasp*. Another insect nearly allied to this is the *Stylops Melitta* of Mr. Kirby's *Monographia Apum Angliæ*, and which inhabits the same situation in the body of the *Honey bee*.

Michaux, J. Bartram, and a Mr. Tilden, from Hudson's Bay, is in the Sherardian Herbarium at Oxford; that of Plukenet, in the British Museum; of Pallas, (in the possession of Mr. Lambert,) rich in the vegetable productions of northern Asia, which, as is well known, bear a great affinity to those of the northern parts of America; of Mr. Bradbury, which was formed in Upper Louisiana, in the possession, we believe, of the Botanic Garden at Liverpool; and of A. Menzies, Esq. which was selected, during that gentleman's voyage with captain Vancouver, upon the N. W. coast of America. Nor should the various collections be omitted which are found in the gardens of England, especially in the vicinity of London.

Thus prepared, the *Flora Americæ Septentrionalis,* or a *Systematic Arrangement and Description of the Plants of North America, by Fk. Pursh,* appeared in London in the year 1813, with 24 well-executed plates of new species, in 2 vols. 8vo. The specific characters are in Latin, the observations in English.

The arrangement is that of the sexual system; but the author has made considerable deviations from the generally received arrangement of the Linnæan school. The classes *Dodecandria* and *Polyadelphia* are omitted, as well as *Monœcia, Diœcia,* and *Polygamia;* and their genera are referred to other classes, some according to the number of stamens, others to his 19th class, which is called *Diclinia,* and which contains *Euphorbiaceæ, Amentaceæ,* and *Coniferæ;* thus bringing into his arrangement a union of a natural and artificial system, which has not been adopted by others.

Michaux's work included the whole of the class *Cryptogamia;* but this, though all perhaps that was then known, contained so scanty a list as scarcely to deserve notice. Mr. Pursh professes to go no farther than the order Filices of the class Cryptogamia.

Sometime after the publication of his Flora, the author again visited America, but with a view of confining his researches to a part which had been very little explored, namely Canada. There he died in 1820. His herbarium of that country, which was considerable, has been purchased by Mr. Lambert, who, we believe, is also the possessor of that far more extensive and valuable one which Pursh had made in his former travels in the United States.

In the year 1814, there appeared in America, printed at Boston, the *Florula Bostoniensis*, or a Collection of Plants of Boston and its environs, by Jacob Bigelow, M.D. in 1 vol. 8vo. It is in English, and strictly arranged according to the Linnæan system. It was destined principally for the use of the students in Botany; and the plants described therein were all collected during two seasons, in the immediate vicinity of Boston, or within a circuit of from five to ten miles; and although very few new species are added, the number of individuals is very considerable for so limited a space.* During the year 1816, accompanied by our valued friend Dr. Francis Boott, Dr. Bigelow examined the botany of the White Mountains in New-Hampshire, and published an account of it in the *New-England Journal of Medicine and Surgery* for that year. This was one among many other journeys made by these gentlemen in the New-England States, with a view to the publication of a Flora of that district. The design, however, has been relinquished, and the principal cause, since it has arisen from Dr. Boott's naturalization among us, we ought not to regret. Science, however, has been a sufferer; for, from our personal knowledge of this gentleman, we are satisfied that he would have been a most able and zealous coadjutor in such an undertaking. A very extensive collection of the plants of that country has been liberally presented to us by Dr. Boott, which has satisfied us, that in the art of preserving specimens, no one has ever exceeded, or perhaps ever equalled him; and the names are very frequently accompanied by valuable notes.

It is delightful to see a man, of the talents and rank in life of Mr. Elliott of Charleston, the excellent President of the Literary and Philosophical Society of South Carolina, deeply engaged in important public affairs, yet cheerfully devoting his leisure hours to the promotion of the arts and of science, and actually engaged in publishing a Flora, under the unassuming title of a *Sketch of the Flora of South Carolina and*

* At the moment of our sending these notices to the press, we have received from its esteemed author, who is a Professor in Harvard College, New Cambridge, a second edition of the *Florula Bostoniensis*, containing about twice the number of plants enumerated in the first edition, and also many valuable remarks, particularly on the useful natures and qualities of the species. Dr. Bigelow is also the author of a valuable work, entitled, *American Medical Botany*, begun in 1817, of which three parts have reached us.

Georgia, which he commenced in 1816. This is arranged according to the Linnæan system, having specific characters both in Latin and in English, and very copious notes and descriptions. A work thus conducted cannot fail to be of great importance to the student of American botany; the more so, since the author has written from his own personal observation, depending little upon the assistance of others, and in a capital where science has not been so much cultivated as in the northern States. In a letter now before us, the author says, "no one in Europe can, probably, appreciate correctly the difficulty of the task in which I have engaged. The want of books, the want of opportunities for examining living collections or good herbaria, the want of coadjutors, have all served to render my task arduous, and to multiply its imperfections." Nevertheless, there are many new species, described with great care and fidelity, and the grasses, which are accompanied with some neat plates, have particularly attracted the author's attention. There are several beautiful novel species, and some newly established genera. We have received of this work to the 6th No. of the 2d volume, which includes so far as the class *Monœcia;* and we are informed by Mr. Elliott, that another number will complete the *Sketch*. This we regret, as the work cannot thus take in the *Cryptogamia;* and we consider Mr. Elliott's talent for minute description admirably calculated for such plants as that class embraces. No man seems to be more strongly impressed with the value of the study of natural history than Mr. Elliott. "It has been, for many years," says he, "the occupation of my leisure moments; it is a merited tribute to say, that it has lightened for me many a heavy, and smoothed many a rugged hour, that beguiled by its charms, I have found no road rough or difficult, no journey tedious, no country desolate or barren—in solitude never solitary, in a desert never without employment. I have found it a relief from the languor of idleness, the pressure of business, and from the unavoidable calamities of life."*

We come now to the agreeable employment of mentioning a very important work, both on account of the extended nature of the publication, and of the manner in which it has been executed; we allude to the "*Genera of North American*

* See Elliott's address to the Literary and Philosophical Society of South Carolina, delivered at Charleston, and published there in 1814.

Plants, and a Catalogue of its Species to the year 1817, *by Thomas Nuttall*," in 2 vols. 12mo. printed at Philadelphia. Mr. Nuttall is an Englishman by birth, and a native of Yorkshire; but he visited North America at an early age, and is now domiciliated in that country. His love of botany and mineralogy is exceedingly great, and a personal asquaintance, which his late visit to this country has enabled us to have the pleasure of forming, has only served to increase the esteem and respect which his writings had already taught us to entertain towards him. For many years previous to the publication of his Flora, the author was engaged in visiting very extensively the territories of the United States, particularly the southern and western ones. "For nearly ten years," he says in his preface to his *Journal of Travels into the Arkansas territory*, "I have travelled throughout America, principally with a view to becoming acquainted with some favourite branches of natural history. I have had no other end in view but personal gratification; and in this I have not been deceived; for innocent amusement can never leave room for regret. To converse, as it were with nature, to admire the wisdom and beauty of creation, has ever been, and I hope ever will be, to me a favourite pursuit; and to communicate to others a portion of the same amusement and gratification has been the only object of my botanical publications."

The "*Genera of North American Plants*" is entirely in English; and it appears that it was the design of the writer to have arranged it according to the natural orders. But out of deference to public opinion, in a country where the artificial system of Linnæus had almost exclusively been studied, Mr. Nuttall adopted that method. He has, however, made a great many valuable remarks upon the natural orders, following several of the genera, and has recommended the adoption of some new ones. He has well defined the characters of the order *Monotropeæ*, to which he has properly referred the highly curious *Pterospora*. As, however, the well-known genus *Pyrola* belongs unquestionably to the same family, the term *Pyroleæ* might perhaps have been considered as more appropriate. The characters of the genera (which he here extends to 807, exclusive of any cryptogamia,) have, as may be inferred from the title, occupied a greater share of attention from Mr Nuttall. He has added to the essential characters, those taken from the habit of the plant, and he has noticed their geographical distribution. In the enumeration of species, he has included all that have been described by other authors, sometimes made observations upon them, and added a very considerable number of new individuals, which have been discovered by himself or his friends. This book may therefore be well said to form an era in the history of American botany; and we rejoice that the execution of it has fallen into such able hands.

Mr. Nuttall has added still more to his credit as a naturalist and a man of most acute observation, by the publication of his *Travels in the Arkansas territory.* This was a journey accompanied with great difficulty, and not a little danger. The plants which he collected were numerous and interesting, very different from the vegetation of the rest of the U. States, and many of them perfectly new. Some detached accounts of the botany of this singular district have already appeared, particularly in the *Journal of the Academy of Natural Sciences at Philadelphia,* and not a few of the plants themselves are now cultivated in our botanic gardens, from seeds gathered by Mr. Nuttall.

This gentleman now occupies the chair of Natural History in the University of New Cambridge.

We regret not to be able to give any account of *Eaton's Manual of Botany,* nor yet of *Barton's* more extended *Flora of North America,* (which is, we believe, in the course of publication,) never having had the opportunity of seeing these works.

The various scientific journals which are published in America, contain many memoirs upon the indigenous plants. Among the first of these in point of value, and we think also the first with regard to time, we must name *Silliman's American Journal of Science,* in which we find Botanical Tracts by Professor Ives of Yale College, and by Mr. Rafinesque ; by Dr. Torrey, a physician at New-York, "on the plants collected by D. B. Douglass of West Point, in the expedition around the great lakes, and the upper waters of the Mississippi, under Governor Cass, during the summers of 1818—20;" and also "on a new species of *Usnea** from New

* Dr. Torrey did not possess the fructification of this plant. We were so fortunate as to obtain a specimen of it through the kindness of Mr. Edwards, late surgeon of the Hecla, which came from the same country, and has fine shields. It is one of the handsomest species of *Usnea* that we are acquainted with; but it certainly approaches very near the *U. sphacelata* of Brown, from the Arctic regions. Dr. Mitchill, who com-

South Shetland," *(U. fasciata* of Torrey); by Mr. Lewis de Schweinitz, in a valuable "Monograph of the genus *Viola*;" by Mr. Nuttall, on a "collection of plants made in East Florida by Mr. Ware;" by Mr. M. C. Leavenworth, on "four new species of plants from Alabama;" by Professor C. Dewey of William's College. upon "*Carices*."

In the *Journal of the Academy of Sciences*, the Botanical Memoirs are entirely from the pen of Mr. Nuttall.

The *Annals of the Lyceum of Natural History of New-York* were only commenced last year; but the numbers, (of which we have received five from that excellent institution,) contain several communications on the subject of botany. In No. I. is a "Synopsis of the Lichens of the state of New-York," by Mr. A. Halsey; and a description by Dr. Torrey of "some new and rare plants collected in the rocky mountains, during the expedition thither, commanded by Major Long, by Dr. Edwin James;" in No. II. a "Synopsis of the *Carices*," by Dr. Schweinitz. No III. contains an article "on the American *Utriculariæ*," by M. Le Conte, who enumerates 11 species. No. IV. "on the genus *Gratiola*," by the same author. No. V. "on the genus *Ruellia*," by M. Le Conte; and on "some new grasses found by Dr. James, on the rocky mountains," by Dr. Torrey.

Mr. Schweinitz, whom we have already more than once alluded to, is a native of Germany, where, as well as throughout Europe, he is advantageously known, in conjunction with M. Albertini, as the author of a Latin work on the *Fungi of Upper Lusatia*. Since his residence in America, he has continued to dedicate most of his attention to the fungi; and his manuscript, containing an account of 1373 fungi found in Upper Carolina alone, was edited by Dr. Schwaegrichen in 1823, under the title of "*Synopsis Fungorum Carolinæ Superioris*," in a thin volume, 4to; and it is not a little singular to observe how many of these are common to Europe as well as America.

We shall close our notice of American botanical publications by the mention of that, which, if we may judge from the first number, (which is all that we have yet received from the

municated the plant to Dr. Torrey, seems inclined to believe this lichen to be the only vegetable production of New South Shetland. We have received half a-dozen different ones, and will venture to predict that many more will yet be discovered.

author,) bids fair to rank among the most valuable that has appeared in that country; the *Flora of the Middle and Northern Sections of the United States, by Dr. Torrey.* A frequent correspondence, and a mutual interchange of botanical specimens, have made us acquainted with the zeal and acquirements of this gentleman; both of which are now assiduously engaged in the preparation of his work, the continuation of which we anxiously expect. No. I. extends as far as, but not to the conclusion of, the *Class Triandria,* and *Order Digynia;* for here likewise the arrangement is that of Linnæus. The whole is in English. The synonyms are sufficiently copious, and the descriptive part contains much useful criticism and observation. We know, too, that Dr. Torrey has made a most ample collection of the cryptogamic plants of the United States; that he is well acquainted with the species and their characters; and we may therefore confidently hope that this department of botany will now find a place in the Floras of North America.

Our attention has hitherto been almost exclusively turned to the progress of botany in the United States. There is still a vast extent of highly interesting country to the northward, from the 45th parallel of lat. to 74, including 29 degrees, and to the westward, which, as being for the most part either in the acknowledged possession of the British government, or of the Hudson's Bay Company, or what has been explored by British enterprise, we shall denominate the *British possessions in North America.*

Small, indeed, compared to the extent of the country, is the amount of what has been published *exclusively* on the plants of these regions. We may, we believe, sum up the whole in the mention of the Botanical Appendix to Captain Franklin's Narrative, and those to the various recent Arctic Voyages of Discovery, among which the observations of our countryman, Brown, have given an additional interest to the subject, besides a small paper upon some new and rare Canadian plants, gathered by Mr. Goldie during an excursion of some extent in that country, which was printed in the *Edinburgh Philosophical Journal.* Unless we indeed extend our remarks to Greenland, of which country a list of the plants has been printed by Sir Charles Giesecké, in the *Edinburgh Encyclopædia,* art. Greenland, and other species are included in the *Flora Danica* of Professor Hornemann.

Brief and scanty as is this catalogue, we anticipate, from the mostly unpublished collections that have been formed, and from the various expeditions that are now sent out, or that are about to be so, that, in a very few years Great Britain will be in a condition to fill up the void which exists in her Flora of her portion of North America.

The herbaria at present existing, as connected with the plants of those countries, over and above those to which we have already alluded, are perhaps not very extensive. Sir Joseph Banks made collections on the Labrador coast, and we believe that the missionaries of that territory have sent home many plants to the Museum of their Society. Lady Hamilton possesses numerous well-dried plants of Newfoundland, and we have ourselves opened a correspondence with some gentlemen of that island, from whom much may be expected. In Canada, besides what has been effected by Mr. Pursh, we know of several individuals who are industriously engaged in furthering the Flora of that country, and of Hudson's Bay. In the first rank of these, we are proud to be able to mention the Right Honourable the Countess of Dalhousie, the lady of his Excellency the Governor, whose rank and influence, no less than her superior acquirements and great love of science, entitle us to hope for much from her in the promotion of our wishes. On the sea-coast of Hudson's Bay, collections made as far north as Chesterfield Inlet, during Duncan's voyage of discovery, exist, we believe, in the Banksian Herbarium. Mr. Graham, in Foster's time, sent plants as well as animals home from Churchill. Tilden's plants, in the Sherardian Herbarium, are from Moosefactory, near the bottom of Hudson's Bay. In the interior, to the eastward of the rocky mountains, no one has botanized but Dr. Richardson, during Franklin's journey. With the fate of a large portion of that collection, and with the affecting and afflicting cause of it, the public are well acquainted. On the north-west coast, Mr. Menzies* has been the principal investigator; but a Mr. Nelson, who perhaps accompanied some of the voyagers, who succeeded Captain Cook in the survey of that coast, has communicated many specimens, which are in the Banksian or Lambertian Herbarium. Pallas' Herbarium, in

* Many of these plants have been ably described by our valued friend Sir J. E. Smith, President of the Linnæan Society, in the botanical part of Rees's Cyclopædia.

the hands of Mr Lambert, contains plants gathered by the Russians in the Aleutian isles; and De Candolle has published, in his Prodromus, some interesting individuals, communicated by Dr. Fischer from the same neighbourhood.

More ample materials may confidently be looked for from the following sources:—The great attention already bestowed during former voyages by Captain Parry and his officers, to the vegetable productions of the Arctic regions, would alone warrant us in expecting that the same desire will be felt during the present expedition, to contribute all in their power to the natural history of the countries which they explore. But we have further the assurance of the distinguished commander of the expedition himself, in the last letter which we received from him, dated Whale Fish Islands, July 1, that no exertion should be wanting on his part to secure every species of plant that may be met with in the course of the voyage.

The Horticultural Society of London have despatched one of their most able collectors to the mouth of the Columbia, David Douglas, who was formerly one of the head gardeners at the Glasgow botanical garden. He had, immediately previous to his being sent on the present expedition, done himself great credit, and given his employers the highest satisfaction, during his mission to the United States, for the purpose of procuring plants and fruits for the society. His undertaking is now a far more arduous one, and one in which we know that no exertions on his part will be wanted to bring it to a successful issue. After spending the ensuing season in collecting on the north-west coast, through nearly ten degrees of latitude, he will cross the Rocky Mountains in lat. 55°, and fall in with Captain Franklin's line of route at Isle de la Crosse, and return overland with that enterprising officer to Hudson's Bay.

The Hudson's Bay Company, with a liberality that reflects the highest credit upon them, made application and provision for a surgeon to one of their ships, who, to his medical knowledge should have added the acquirement of natural history, particularly of botany. It was our good fortune to have in view, at the period when the application was made to us, a young man every way qualified for such a situation, Mr. Scouler, unquestionably one of our ablest botanical students. He embarked for the north-west coast of America in the month of July of this year (1824,) and will be absent altogether two years.

The greater portion of the interior of this extended country, and its northern coast, remains to be explored and investigated by Captain Franklin and our inestimable friend Dr. Richardson, together with the officers and men who will be appointed to accompany them. Of the botanical acquirements of the last-named gentleman we have the highest opinion. For zeal in collecting he cannot be surpassed; still, in order that his collections may be more complete, and that a greater extent of country may be embraced, he has, partly at his own expense, and partly by the aid of government, resolved upon taking with him Mr. Drummond of Forfar, whom we have already mentioned in this Journal most favourably, as the author of a valuable work on the mosses of Scotland, and whom we have no hesitation in pronouncing to be one of the most acute and ardent followers of botany that this country possesses.

The expedition, as is well known, will embark early in February, and it will land at New-York. Captain Franklin, Dr. Richardson, and Mr. Drummond will proceed together as far as Red River on Lake Winipeg, or Carlton House on the Saskatchawan, which will be Drummond's head-quarters for two summers, from whence he will make excursions in company with the fur traders, at the head of that vast valley which forms the extensive plain across the Missouri, and opens towards Mexico. Here, therefore, he may be expected to meet with a highly curious vegetation and plants, similar to those which Nuttall, James, and Bradbury, discovered on the banks of the Missouri itself. He will likewise have the opportunity of botanizing on the declivities of the Rocky Mountains, in lat. 52°.

Captain Franklin and Dr. Richardson will proceed together as far as the mouth of the Mackenzie river, which will probably be the extreme northern point attained by the latter; for his great object is to examine, with the utmost care, the region which lies between Mackenzie and Coppermine rivers; and here he will unquestionably more than supply the place of those collections which were lost during the former journey. Captain Franklin again, and the officer that accompanies him, will proceed from the mouth of the Mackenzie in boats, to Behring's Straits; they will doubtless devote as much time as their other important avocations will permit, in gathering plants and other objects of natural history; and Dr. Richardson will take care to instruct one or more of the party in the mode of preserving vegetable productions. The prayers and the wishes of their friends, and of every friend to science, will accompany these able and intrepid investigators.

Some idea may now be formed of the extent and value of the collections which will be obtained, and we are confident that such arrangements will be made as will secure to every botanist the credit of his respective discoveries. We think then, that these should be destined for the foundation of a ***Flora of the British Possessions in North America;*** which, if no individual more competent to the task presents himself, the writer of the present article will not shrink from undertaking; and this he offers to do the more readily, since some of the most effectual aid has already, and unsolicited, been offered to him.

ENTOMOLOGY.

ART. IX.—*On the Emigration of a Colony of Caterpillars,* observed in Provence.* From the MS. Tour of JAMES SKENE, Esq. of Rubieslaw.†

IN scrambling over one of the arid coteaux above Tolonai, the beautiful summer residence of our worthy old friend, Marshal Comté Gallifet, I was attracted by the manœuvres of a troop of emigrating insects, which amused me very much. It is very easy to attribute the singular economy in the actions of the insect world to the mere influence of instinct, as the governing principle of every living thing below the scale of reason; but we must either extend the meaning of that word beyond the mere actions of an involuntary impulse, or find it fall short of explaining much of what may be observed in the operations even of that lowest tribe of creatures. We readily lavish our admiration on the wonderful arrangements of some tribes, whose operations may be more particularly exposed to our scrutiny, but this may arise fully more from our deficiency of observation or opportunity, than from the

* This is probably the Phalæna processionea of Linnæus.
† From Dr. Brewster's Edinburgh Journal of Science, No. III. p. 93.

inferiority of one class to another in the marvellous nature of their operations. Wherever our observation penetrates in the wide field of nature, we shall not want cause for wonder, or motives for diffidence in the limited extent of our own faculties. It is admitted that instinct may account for their proceedings so long as they remain uninterrupted by opposition, but what must we call that species of intelligence that instantly proceeds to remedy, if practicable, any unforeseen accident that may interrupt their proceedings?

I observed, what appeared to me, a very slender snake, writhing across my path, which, but for the unusual season for these reptiles to appear, I should, no doubt, have passed unheeded. See plate IV. Fig. 8 Upon examination, however, it turned out to be the orderly emigration of a colony of large caterpillars. They were proceeding assiduously along the rocky path, in a line of march by single files, and so close that they appeared to have a hold each of his neighbour's tail, and the continued wave formed by their motion had a very singular effect. The stony surface of the path rendered their progress exceedingly tortuous, and interrupted by much climbing over stones, as they seemed in general more disposed to go over the top of a stone than round its base. When such obstacles occurred, the march, notwithstanding, did not sustain the slightest derangement, as no troops could mark time with greater precision and patience than the rear of the line, while the front was engaged in climbing over any obstacle, or the leader had stopped to examine the difficulty; the front, in their turn, tarrying until the rear had succeeded in surmounting the obstruction which the front had just passed. They were twenty-two in number, and nearly of the same size, except one, considerably larger than the rest, whose place was exactly in the centre of the line. The leader, on the contrary, was rather smaller than any of the rest. A large precipitous stone was in their way; the leader reared up, moving his head from side to side, as if gazing at it, or willing to reach some corner; and leading his troop round, he frequently performed the same examination, until they reached the small bush, round the stem of which he ascended, the long line following with perfect confidence, and by means of a branch of the bush, they attained footing on the stone.

Traversing the stone, the opposite side of which was quite precipitous and pretty high, it became uncommonly interesting to see how this intelligent general would proceed. He examined with accuracy, trying every possible break, during which time the main body remained patiently waiting, and without making the slightest attempt to assist in the examination, which their leader conducted with much activity and solicitude. At length, having ascertained the pass to be quite impracticable, he resolved upon a counter march, which was instantly performed with the most surprising regularity. For the whole line in succession advanced to the wheeling point on the brink before they turned, performing the evolution with as perfect precision as the best trained troops, the advancing and retreating lines passing close alongside of each other, and even climbing the same twig, while the front line descended without confusion, passing even over each other's bodies without interruption or hesitation.

Having completed their descent in the same manner as they had mounted, a new line of direction was taken, which however was very soon most alarmingly interrupted by the arrival of a woman leading an ass loaded with brush-wood, of which some branches trailed along the path. After the passage of this formidable assailant, I returned with some anxiety to examine the state of my colony, and found that they had suffered materially from the disaster, and were thrown into the greatest confusion. The line of march had been broken; a considerable body still followed the leader with a quickened pace; others, united in parties of three and four, regularly keeping their position in the rear of each other, while their temporary conductor sought, with evident anxiety, to find out the main body, hastening first to the one side and then to the other. A good many were scattered singly, and much distressed, seemingly uncertain how to proceed. I took each of them up in their turn, and with a view to ascertain the range of their vision, placed them at different distances from the main body, with their heads turned towards it, and I found that they uniformly remained quite unconscious of its presence, until placed within half an inch of each other. They then approached with evident eagerness, and were readily admitted into the line, by the rear halting until they had taken their places.

I put one of these stragglers in front, with his tail to the leader's head, but he pertinaceously refused the honour of conducting the line; a considerable sensation seemed to be communicated through the whole body at this attempt at usurpation, of which they seemed to become aware, but by what means I could not discern. As soon as this forced usurper was at liberty, he turned round to the leader, who repulsed him with vigour, and bit at him; upon which he retreated hurriedly along the line, constantly trying to get into his place, but was bit at by every one as he run the gauntlet, till at last a good natured friend permitted him to join the line. I then took out the large one, who was obviously a stupid fellow, when the rear immediately closed up the breach. I placed him at the head, and used every inducement to make him take the lead, but in vain. He seemed much confused by the hearty buffets given to him by the active little Bonaparte whom I wished him to supplant, so that he probably would have failed in regaining his place, had I not given him some assistance out of sympathy, for the distress my experiment had occasioned him. He seemed delighted to get into his place again; but was so much confused by the adventure, that he mistook the first sharp turn the line came to, and threw the whole rear into confusion. They broke their line, and much consternation and bustle ensued, until each had replaced his head close to his neighbour's tail.

I now took up the leader, obviously less, though more active and intelligent than the rest, when the alarm instantly spread over the whole line. I expected the second to take the command, but he seemed the most distressed of any, and eagerly sought about from side to side, and in his perplexity he turned quite around, as if consulting with his follower. The hesitation and confusion was now universal. Various parties broke off as the impression reached the rear, and sought anxiously about, returning again to the line. Having replaced the leader at the head, he instantly took the command, advancing with confidence, and conducting the whole line in perfect order. When I now interrupted their march, the main body no longer exhibited their former anxiety and impatience when the leader was removed, but seemed to wait with perfect composure and confidence, until the obstruction was overcome, which the leader used every means and ingenuity to accomplish. It did not occur to me till I had left these amusing travellers, to try the experiment of placing the leader in the rear, in order to observe how he would bear the degradation, and to ascertain if the head of the column would have been thereby changed.

Art. X.—*Account of an Insect of the Genus Urocerus, which came out of the Wood of a Table.* By Mr. John Foggo, Leith.*

The insect I am about to describe is a species of *Urocerus*, and is quite distinct from the *U. gigas*, the only British species which has any resemblance to it. It protruded from a folding table of fir, veneered with mahogany. When the insect was discovered, the table had been folded for some days; and what first excited observation, was a large quantity of very fine dust which covered the whole of the under leaf. On examination, it was found to have proceeded from a hole in the upper leaf, and to have been occasioned by the insect, in attempting to escape from its confinement. It had penetrated the under leaf to the depth of $\frac{1}{8}$ of an inch. Fortunately, the table was in the possession of Mr. Robert Strong, junior, a gentleman who could well appreciate the value of the incident. Mr. Strong carefully removed the insect from its cell, and found it dead, no doubt suffocated, the circulation of air in the room recoiling upon it the dust which its own exertions had made. Having taken proper precautions, he has so far succeeded, as now to have it in a tolerable state of preservation, with the exception of the antennae and palpi, which gave way in the process. See Plate IV. Fig. 9. It is in length rather more than an inch, exclusive of the horn-like process which gives the generic name, and is two lines long. When the animal was discovered, the antennae were reflected, lying close to the back, and reached to the anterior of the last segment of the abdomen. One of the palpi is still attached to the head; it is of a yellow colour, increasing in thickness towards the tip. The head is rather compressed than globular, with a large yellow protuberance behind each eye. The throat, trunk, and part of the head are covered with short stiff brown hairs. The scutellum is ovato-acuminated, of a dark brown colour; the thighs and anterior segments of the abdomen are also of a brown colour, the rest yellow. The vagina extends about three lines beyond the extremity of the horn.

Within these few years, several instances exactly similar to the above have been published, but as yet no satisfactory explanation has been given. By some naturalists, they have

* From Dr. Brewster's Edinburgh Journal of Science, No. III. p. 85.

been considered quite analogous to the well-known facts of reptiles being found alive in solid rocks, and have been referred to the same cause, a temporary suspension of the vital functions. The circumstances, however, are essentially different. We have reason to believe, that the reptiles were enclosed in the same state as when they were discovered. But with respect to the insects, in whatever state they entered the tree, they must have undergone some of the different processes of transformation. It becomes, therefore, interesting to ascertain in what state the animal has existed during its confinement, and what are the causes which have retarded its advancement to maturity. A late author had conjectured, that the ovum from which the insect was produced, having been prevented from undergoing the necessary evolution, had retained its animating principles till summoned into action by some change in its relation to external objects; and further, that it might have lain dormant for an indefinite space of time. The same author has likewise endeavoured to explain in this manner the periodical visitation of the locust, palmer worm, Hessian fly, &c. with the additional hypothesis that certain modifications of the atmosphere may be peculiarly favourable for their production. This explanation, however, is liable to several objections. It is difficult to conceive any cause that could operate year after year in preventing the animal from arriving at maturity, and that too, apparently in the very situation selected by the instinct of the mother. Moreover, on examining the cavity in which this animal was lodged, it is evident that, while within the tree, it must have passed its life in an inert state. This is a fact which is scarcely consistent with our knowledge of the economy of insects, for they are, I believe, always most voracious in the larva state. It is, therefore, most probable, that the larva penetrated the tree in order to prepare for becoming a chrysalis, and having at last assumed its perfect form, emerged into light in the usual time. That the insect made its appearance in the ordinary period peculiar to the species, is rendered probable from several collateral facts. It is well known that several species of insects remain in the chrysalis for many years; that the locust appears in numbers, once only in 17 years, and the palmer worm in 30 years, yet these are cycles not recognised by meteorologists. The tribe Urocerata is also subject to periodical swarming, "et paraissent certaines années en telle abondance quils ont été pour le peuple un sujet d'effroi." Mr. Marsham mentions, that several individuals of the Urocerus Gigas issued from the planks forming the floor of a bed-room. A solitary individual of the *U. psyllius* was taken in the neighbourhood of Edinburgh, which very likely found its way into this country by a similar means.

ICHTHYOLOGY.

Art. XII.—*The Hedgehog-Ray—a species of Fish taken occasionally near New-York, in the Atlantic Ocean, and now, as is believed, for the first time described;* By Samuel L. Mitchill, M. and LL. D., &c. (Read before the New-York Literary and Philosophical Society, June 10, 1824.)

The fish brought me this morning by Capt. Enos Woodruff, was taken by him with a hook and line, in the sea, off Barnegat, where the water was seven fathoms deep. It had been wounded so slightly that he kept it alive for several days, and he supposed it might have been living yet, had it not perished in consequence of the highly electrical state of the atmosphere during the late shower, accompanied by remarkably bright lightning and loud thunder. His belief is, according to the opinion prevailing among fishermen, that the thunder killed the fish.

The animal undoubtedly belongs to the great family of Raja, which comprehends the Rays, Skates, Torpedoes, and most of the other horizontally flat fishes not appertaining to the *Pleuronectes*, or flounder tribe.

When drawn from its element, it had the appearance, for some minutes, while its vital energy remained, and it was yet pendant from the hook, of a hedgehog: that is to say, a contraction of the muscles had taken place, by which the approximated margin, or circumference, from the several parts, resembled a bowl, or basket, of which the belly was the inner, and the back the outer side. The tail, at the time, was incurvated so much as to enter the mouth, or project beyond it. When in this posture, the fish seemed capable of presenting the globular or spherical form of the back, with its armature and prickles, to its enemies or pursuers. For, even when held in the air, its rotundity remained until the muscles were relaxed by death; and, even then, after animation was extinct, there was a curvature of the rim, or periphery, showing its tendency to a concave figure. The only other individual of the species I ever saw, was one that was catched, in my presence, on board the boat that went to the fishing banks, south-east of Sandy-Hook, on the 23d July, 1822. I examined it while alive, and immediately on being raised from the depth of five fathoms. I then named it

RAJA ERINACEUS,

with this specific character: "having a tail bearing two dorsal fins, with the vestige of a third at the extremity; thickly aculated on the sides, though destitute of the spines called stings; having a pale-brown prickly skin, over which dark-brown spots are distributed; and having also a patch of about twenty spines on each wing, or flap, which, while the wings or flaps are extended, and lie flat, are concealed or covered by the skin; but, when the wings or flaps are contracted, come forth and are erected like the claws of a cat, when they are capable of arresting or tearing soft objects presented to them."

The length of the specimen now before me is seventeen inches, and the breadth nine inches and a half. The head is roundish, though ending in something like a pointed snout. The cheeks (if they may be so called) are parting projections, of a curved form, on the sides of the snout, and are laterally anterior to the eyes. The pectoral fins (wings or flaps) are circular or roundish, and, viewed in connexion, present a sort of elliptical figure. The ventral fins have three little elevations or protuberances backward, that might almost be called digitations, as there are traces, within the common integuments, of concealed fingers. The anal fins have no striking peculiarities. Near the base of these, and under the tail, the two appendages, peculiar to these creatures, proceed obliquely to the length of five inches.

The whole body is so semi-diaphanous that the bones can be discerned on holding it up between the eye and the light. This quality distinguishes the marginal parts of the flaps particularly, and yet more distinctly characterizes the snout.

Tail thick and stout, like that of the skate ; and, measured from the base to the ventrals, nine inches long Toward the extremity it supports two fins, which are faintly radiated. The foremost of these is jagged b hind with several slits or notches: the hindmost has no such divisions. There is a trace of a third fin, near the very end of the tail, in the form of a neat film.

Skin slimy and scaleless. It is beset with prickles in spots or patches. There is a patch in front of each eye, reaching along the inner orbit, and likewise occupying the space between the eyes. Two lines of spines proceed, one from each ocular patch, to the tip of the snout, where they join, in the form of the letter V inverted. The cheeks, or lateral pouches, are covered with prickles, so as to bear some resemblance to whiskers.

Behind the eyes, and on the back part of the head, there is a patch of prickles, in the shape of an equilateral triangle, with one of its sides backwards, and an angle forward.

On each wing, or flap, is a patch of catspaw prickles, of the retractile quality, mentioned in the definition. From the moustaches, the skin of the flaps, along the edge, and for a small distance beyond, is roughened by a set of more minute prickles.

Along each side of the back is a row of stiff and short spines. proceeding towards the tail ; and smaller ones near them, with a rather irregular distribution. On the tail they are much more numerous, distinct, and strong ; distinguishable in two main rows, or lines, with a smooth scaleless and spineless stripe between them, reaching to the dorsals. The lower side of the tail, and the whole belly, are quite smooth. There is a trifling roughness on a patch of each caudal appendage.

Eyes half covered and elegantly curtained. Behind them open and ample orifices, or ears Nostrils distinct, and connected with the mouth, through fissures, to the upper lip. Teeth, in both jaws, associated, compact, and sharp-pointed.

The lower or belly side of this fish exhibits a bending, or inflexion of the margin, all the way round to the ventral fins, of such a kind that when, even after death, it lies upon its back, there is a rising, or rim, like that of a cup or basin, capable of preventing the escape of water.

A delineation from nature, by the hand of my friend, Samuel Akerly, M. D. already well known for his researches in ichthyology, as well as by his labours in various other departments of natural science, accompanies this description.

The fish itself, after having been well preserved in muriate of soda, by dry salting, was forwarded, through the minister of the marine and colonies, by the way of Havre-de-Grace, to the administration of the royal garden and museum at Paris.

New-York, June 6, 1824.

MATHEMATICS, MECHANICS, PHYSICS, AND CHEMISTRY.

Art. XIII.—*Remarks on Professor Wallace's Reply to B.*

In Vol. VII. page 278, of this Journal, a paper was published, under the title of "New Algebraical Series, by Professor Wallace, Columbia, S. C." containing a demonstration of the properties of a series of a peculiar form, and showing its uses in several cases. In some remarks on this, by B. in Vol. VIII. page 131, it was stated that this series was nothing more than the usual development of the Binomial Theorem, and that the same method of demonstration had been published by Euler, about fifty years since, in the Petersburgh Transactions.

There was nothing uncourteous in the manner or language used by B. in mentioning this *historical fact.* It has however excited the displeasure of Professor Wallace, who, in his reply, in Vol. IX. pages 98—103, besides making several improper insinuations, which will be passed over without comment, has also asserted, in page 100, "that Euler presupposes the knowledge of the expansion of a binomial function, and the results which he has given do not include a single case of a transcendent function, and were only given as examples of *the simplest case of the binomial theorem*, viz. $(1+z)^m=1+\frac{m}{1}\cdot z+\frac{m}{1}\cdot\frac{m-1}{2}\cdot z^2$ +, &c.$=f(m)$, *where m is supposed a whole positive number,*" which case, as is well known, can be demonstrated in an extremely short and simple manner by the common operations of multiplication.

Now it is a fact, *notwithstanding the positive declaration of Professor Wallace to the contrary*, that Euler's demonstration is not restricted to this very simple and easy to be demonstrated case; but is general for all values of the exponent, whether integer, fractional, positive, negative, or surd, and it is characterized by La Croix as being elegant and rigorous.* Moreover, every thing that can be obtained from the multiplication of these new series can be easily deduced from Euler's method by a perfectly rigorous process.

Professor Wallace complains that a wrong title was given to his paper. *This could not have been known to* B.; and if it had been known, it would in nowise have affected the justice of his remarks. The fact would still have been that Professor Wallace had republished as a late discovery what had been known by mathematicians for half a century. The only difference, as it now appears, is, that Mr. Stainville gave it as new for the *first* time in 1818, and Professor Wallace for the second time in 1824—Euler's having been published in 1775. When B. read the first communication of Professor Wallace, the thought never occurred that the method was not claimed as a new process, particularly as the words "*New Algebraic Series*" occur at the top of every page,† and the very guarded acknowledgment of his obligation to Mr. Stainville in vol. vii. p. 285, is so connected with the account of numerical faculties, integrations, derivations, and the notices of other series besides those denoted by *fa*, that it did not attract particular attention as referring exclusively to this last series. The whole notice of Mr. Stainville is comprised in this brief sentence, "M. de Stainville of the Polytechnic School has given the *series* in this communication in Volume IX. of Gergonne's Annals; and from the extensive *application* of which they are susceptible, the subject is deserving of farther investigation." This is not very definite because there are several series in that paper. Admitting it, however, to refer particularly to the series denoted by *fa*, the question will then occur—who discovered all its properties and made all the deductions from it? was it Mr. Stainville,

* La démonstration précédente ne laisse rien à désirer du côté de la rigueur et de l'élégance.—*Comp. des. Elémens.* p. 163.

† In justice to Professor Wallace it should be remarked, that no part of this title can be attributed to him, as there was none accompanying his manuscript. The title mentioned was inserted at the time of publication.—Ed.

or Professor Wallace? This is nowhere distinctly stated, and it is believed that most persons, after reading what Professor Wallace has written, would suppose he claimed some, if not a very large portion, for his own. But the real fact is that *none* of it is *his*. The whole of the first seven pages, Vol. VII. pp. 278—284, and a large portion of the two remaining pages of Professor Wallace's first communication are *merely literal translations* from Stainville and Gergonne, and what is not copied from them is quite unimportant. From this statement the reader can judge whether Professor Wallace's acknowledgment of his obligation to Mr. Stainville was sufficiently explicit to make himself understood, and to avoid the suspicion of appropriating to himself the labours of others.

It ought to be observed, as a *point which has an important bearing on the question under discussion*, that Mr. Stainville and Professor Wallace have nowhere intimated that the general expression of their new series can be reduced to a *finite* form, represented by the binomial $(1-kz)^{-\frac{a}{k}}$, as B. first showed; and it would seem from some circumstances that they supposed the proposed series to be of a more *general* nature than the binomial series, and to include it as a *particular* case.

At first it was a matter of surprise to find Professor Wallace had made the assertion that Euler's demonstration of the binomial theorem was restricted to the very simple case of an integer positive exponent; but upon reflecting on some of the circumstances, it appeared probable that he had never seen the memoir of Euler, in vol. XIX. of the *Nov. Comm.*, or thoroughly examined the account of it by La Croix. The volume of the *Novi Comm.* in which it was originally published, is now out of print and difficult to be procured, so that it is not to be found in some of our best libraries, even in those which contain most of the other volumes of that collection; probably there are not six copies of it in the United States. When B. wrote his former remarks, he had never seen Euler's publication, but referred to the account of it given by La Croix in one of the volumes of his complete *Cours de Mathématiques*. This volume of La Croix's work is enriched with numerous theorems, invented by Newton, Euler, La Grange, etc.; yet Professor Wallace seems to be offended because B. referred him to it, and observes that he calls the attention of the American reader to *more important works*, particularly to the third volume of La Croix's Calcul Différentiel et Intégral, 2d edition, to which he says, "I would refer for general information on these subjects, and not to the Complément des Elémens d'Algèbre, however useful as a *school book.*" Now upon looking over this volume of the Calcul Différentiel, and several other works mentioned by Professor Wallace, nothing is to be found relative to the point in question between him and B., which is simply to ascertain the fact whether Euler did give, about fifty years since, a demonstration of the binomial theorem, upon principles exactly like those published by Professor Wallace in his formulas i. ii. iii. iv. This was what B. asserted, and no more; he said nothing about the application of these formulas, of *Definite Integrals*, of La Grange's *Fonctions Génératrices*, of La Place's *Théorie analytique des probabilités*, of Wallis's *Arithmetica Infinitorum*, of Woodhouse's *Analytical Calculations*, or Bishop Berkeley's *Analyst*, with which Professor Wallace fills up the greater part of his reply, though these works have no relation to the subject, and the mention of them can serve no other purpose than to divert the attention and keep the main question out of sight. Moreover it does not follow, though these important works are thus quoted so readily, that they have all been *seen* by Prof. Wallace. His reply furnishes an instance to the contrary in his reference to the Petersburgh Transactions: for in page 101, when speaking of Euler's labours on the Integral Calculus, he refers to Vols. "XV. and XVI. of the *Nov. Comm. Petrop.*—S. 28," and to "*Tom.* V. *des anciens mémoires de Petersbourg, p.* 44." Now there is *nothing* said about these integrals in the first mentioned volume, and the other with the *French* title is wrongly quoted. The title is in *Latin*, being *Commentarii Academiæ Scientiarum Imperialis Petropolitanæ*, sometimes in familiar discourse and writing called the ancient memoirs or commentaries, to distinguish them from the new series of the same work. The same peculiarity of quotation occurs in page 301, vol. I. of Le Gendre's *Exercices de Calcul Intégral*, where, in speaking of this last volume, he uses the familiar reference of "*Tom. V. des anciens mémoires de Pétersbourg*," which is *literally copied in French*, by Professor Wallace. Le Gendre also refers to the *article* 28 of vol. XVI. and to the *page* 44 of vol. V., instead of using in both places the *page* or the *article*. This reference is also made in exactly the same manner by Professor Wallace. These circumstances render it highly probable that in this part of his reply he had before him Le Gendre's work, and not the original paper of Euler.

It is not necessary for B. to notice the many irrelevant subjects which Professor Wallace has brought into notice in his reply. The remarks hereafter to be made will therefore be confined chiefly to the proof of the identity of Euler's method with that republished by Professor Wallace. For this purpose the detail of Euler's demonstration will be given and compared with that of Professor Wallace. This will also serve to bring into more general notice one of the best demonstrations ever given of that important theorem.

The manner in which Euler first proposes the Binomial Theorem in page 103, vol. XIX., *Nov. Comm.*, is

$$(a+b)^n = a^n + \frac{n}{1} \cdot a^{n-1} b + \frac{n}{1} \cdot \frac{n-1}{2} \cdot a^{n-2} b^2 +, \&c.$$

and by putting $x = \frac{b}{a}$, he reduces it to the form $a^n (1 + \frac{b}{a})^n = a^n (1+x)^n$, and the question is thus reduced to the more simple case of $(1+x)^n$. But it may be observed that this form, though more simple, is equally extensive with the former, and the one may be deduced from the other. Euler then observes that the development of this, when n is a positive integer, is well known to be of the following form:

$$(1+x)^n = 1 + \frac{n}{1} \cdot x + \frac{n}{1} \cdot \frac{n-1}{2} \cdot x^2 + \frac{n}{1} \cdot \frac{n-1}{2} \cdot \frac{n-2}{3} \cdot x^3 +, \text{etc.}^* \quad \text{(A)}$$

He also remarks, that if n is *not a positive integer*, the value of this series may be considered as an unknown quantity which may be expressed by the symbol $[n]$, or as La Croix more simply denotes it by fn, so that generally for all values of n,† positive, negative, integer, fractional, or surd,

* The demonstration of the binomial theorem when n is a positive integer, is easily obtained by several methods. For the convenience of reference, a demonstration is given at the end of this paper.

† The words of Euler, in vol xix. p. 107, *Nov. Comm.*, are "verum si *n non fuerit numerus integer positivus* valorem hujus seriei tanquam incognitum spectemus, ejus loco hoc signo $[n]$ utamur." La Croix uses

$$fn = 1 + \frac{n}{1} \cdot x + \frac{n}{1} \cdot \frac{n-1}{2} \cdot x^2 + \frac{n}{1} \cdot \frac{n-1}{2} \cdot \frac{n-2}{3} \cdot x^3 +, \&c. \qquad (B)$$

Euler also says that when n is a positive integer number, the value of this series is known and is expressed by $fn = (1+x)^n$. Its value in *other cases* he investigates in the following manner :

Changing in (B) the quantity n into m, he gets

$$fm = 1 + \frac{m}{1} \cdot x + \frac{m}{1} \cdot \frac{m-1}{2} \cdot x^2 + \frac{m}{1} \cdot \frac{m-1}{2} \cdot \frac{m-2}{3} \cdot x^3 +, \&c.$$

Multiplying these values of fn, fm, their product $fn . fm$ will evidently be a series ascending according to the integer positive powers of x of the following form :

$$fm.fn = 1 + Ax + Bx^2 + Cx^3 + Dx^4 + Ex^5 +, \&c. \qquad (C)$$

in which it is plain that the co-efficients A, B, C, &c., depend wholly on m and n, and are independent of x.

This multiplication is precisely like that in Professor Wallace's paper at the top of page 279, vol. VII. Euler performs it in the following manner, in vol. XIX, page 108, *Nov. Comm.*

$$fm = 1 + \frac{m}{1} . x + \frac{m}{1} \cdot \frac{m-1}{2} \cdot x^2 +, \text{ etc.}$$

$$fn = 1 + \frac{n}{1} \cdot x + \frac{n}{1} \cdot \frac{n-1}{2} \cdot x^2 +, \text{ etc.}$$

$$fm . fn = \begin{cases} 1 + \frac{m}{1} \cdot x + \frac{m}{1} \cdot \frac{m-1}{2} \cdot x^2 +, \text{ etc.} \\ \qquad \frac{n}{1} \cdot x + \frac{m}{1} \cdot \frac{n}{1} \cdot x^2 +, \text{ etc.} \\ \qquad\qquad + \frac{n}{1} \cdot \frac{n-1}{2} \cdot x^2 +, \text{ etc.} \end{cases} \qquad (D)$$

the more simple expression fn, which is adopted in this paper, putting $[n] = fn$, $[m] = fm$, $[m+n] = f(m+n)$, etc., which is the only alteration made in the symbols used by Euler. It may not be amiss to recall to mind that by putting in (B), $x = -kz$, $n = -\frac{a}{k}$, we obtain the same series which Mr. Stainville calls fa.

Putting this product equal to the assumed value (C) and comparing the co-efficients of the powers of x, Euler finds

$$A=m+n$$

$$B=\frac{m}{1}\cdot\frac{m-1}{2}+\frac{m}{1}\cdot\frac{n}{1}+\frac{n}{1}\cdot\frac{n-1}{2}\text{, or by reduction}$$

$$B=\frac{m+n}{1}\cdot\frac{m+n-1}{2}.$$

The values A, B are thus deduced in exactly the same manner as Professor Wallace obtains the co-efficients of z, z^2, in Vol VII. page 279; and he also obtains the co-efficient of z^3 and the general value of the co-efficient of z^p, by a similar, but long and complicated operation, in pages 279, 280, 281, of the same volume. On the contrary, Euler takes a much shorter and easier path. For, after remarking that the co-efficients C, D, E, &c. may be found in m and n, *by continuing the multiplication, in the same manner as A, B were found*,* he observes that the calculation of these co-efficients by this method is laborious and troublesome, and the truth of this remark is abundantly proved by the long operation of Professor Wallace. Euler then says, that the process of multiplication by which the series (D) is obtained renders it very evident that the co-efficients of x, x^2, x^3, &c or the quantities A, B, C, D, &c. are definite functions of m, n, which retain the same form, whatever be the values of m, n,† and it is therefore only necessary to find the values of A, B, C, &c. in terms of m, n, in some simple case, as for example when m and n are integer positive numbers, and the same values *of A, B, C, &c may be immediately adopted for any fractional or surd values* because the pro-

*It is stated by La Croix, page 163, Comp. Elém. d'Algèbre that Segner found the general term of the series A, B, C, &c. by this method of continued multiplication in the Berlin Memoirs for 1777. This must have been substantially the same as Mr. Stainville's.

† A slight attention to the manner in which the series (D) is obtained by the multiplication of the series fm, fn, will render it evident that the co-efficient of any term x , is an *integer* function of the powers and products of m, n, containing a definite number of terms of the form $c.\,m\,.\,n^f$, e, f being integer positive numbers not exceeding p, c being a numerical factor, and c, e, f, being independent of m, n, will be the same whether m, n, be integers or fractions, consequently the form to which the sum of these co-efficients $c.\,m^e.\,n^f$ is reduced must be the same for all values of m, n, whether integers, fractions, or surds.

cess of multiplication of the functions fm, fn, to obtain the series (D) is the same whatever m and n may be, whether integral or fractional. Now in the case of m and n being *integer* positive numbers, the formula (A) gives $fm=(1+x)^m$, $fn=(1+x)^n$, therefore their product $fm, fn=(1+x)^{m+n}$. Developing this quantity $(1+x)^{m+n}$, $m+n$, being an integer, by the same formula (A) we shall have when m, n, are integer positive numbers,

$$fm, fn=1+\frac{m+n}{1}x+\frac{m+n}{1}.\frac{m+n-1}{2}.x^2+\frac{m+n}{1}.\frac{m+n-1}{2}.\frac{m+n-2}{3}.x^3+\&c. \qquad (D')$$

Comparing the second member of this expression with the formula (C) we get the values

$$A=\frac{m+n}{1};\ B=\frac{m+n}{1}.\frac{m+n-1}{2};\ C=\frac{m+n}{1}.\frac{m+n-1}{2}.\frac{m+n-2}{3},$$

etc. and by the principle above explained these may be adopted for *all* values of m and n, so that the formula (D′) may be applied to all such values. Now if in the formula (B) we write $m+n$ for n we shall get for $f(m+n)$ an expression equal to the second member of (D′) therefore we shall have for all values of m, n, positive, negative, integer, fractional. or surd,

$$fm.\ fn=f(m+n) \qquad (E)$$

and this is equivalent to Professor Wallace's formula I. page 282, Vol. VII. putting $m=a$, $n=b$.

Having obtained the formula (E) Euler easily deduces from it the expressions $fm, fn, fp=f(m+n+p)$; $fm, fn, fp, fq=f(m+n+p+q)$ similar to Professor Wallace's fa, fb, $fc=f(a+b+c)$; $fa, fb. fc, fd=f(a+b+c+d)$

also, $(fm)^a=f(ma)$ similar to his formula II. Vol. VII. page 282,

$$f(\frac{i}{a})=(1+x)^{\frac{i}{a}} \text{ similar to his formula IV.}$$

and $f(-m)=(1+x)^{-m}$ for negative exponents, as in page 282.

This comparison of the two methods, shows that Euler's demonstration is identical in principle with that published by Professor Wallace, as B. asserted in his first communication. With respect to the application of the method to the investigation of logarithms and exponential quantities, no objection had been made by B. and of course it is not necessary to discuss the subject. It may not however be inexpedient to state that every result given by Professor Wallace can easily be obtained from the binomial theorem; and mathematicians have usually developed such quantities by means of that theorem.

Thus having the identical equation

$$\left\{(1+nz)^{\frac{m}{n}}\right\}^{Ax}=(1+nz)^{\frac{mAx}{n}}$$

by substituting the developments of

$$(1+nz)^{\frac{m}{n}} \text{ and } (1+nz)^{mAx}$$

given by the binomial theorem, we obtain the equation

$$\left(1+\frac{m}{1}.z+\frac{m}{1}.\frac{m-n}{2}.z^2+\frac{m}{1}.\frac{m-n}{2}.\frac{m-2n}{3}.z^3+\&c.\right)^{Ax}=1+\frac{mAx}{1}.z+\frac{mAx}{1}.\frac{mAx-n}{2}.z^2+\&c.$$

putting now $m=1$, $z=1$, $n=0$, it becomes like Professor Wallace's formula, Vol. VII. page 283,

$$\left(1+\frac{1}{1}+\frac{1}{1.2}+\frac{1}{1.2.3}+\&c.\right)^{Ax}=1+\frac{Ax}{1}+\frac{A^2x^2}{1.2}+\frac{A^3x^3}{1.2.3}+\&c.$$

By putting the series in the first member $1+\frac{1}{1}+\frac{1}{1.2}+\&c.$ $=e$, it becomes $e^{Ax}=1+\frac{Ax}{1}+\frac{A^2x^2}{1.2}+\&c.$

and by making $e^{A}=a$, or $A=l.a$, we get

$$a^x=1+\frac{xl.a}{1}+\frac{x^2l.a^2}{1.2}+\&c.$$

being the same as Professor Wallace has given in Vol. VII. page 284. In like manner, his expression of log. $(1+x)$ &c. may be found, but it is unnecessary here to repeat these calculations. It may however, be proper to observe, that Professor Wallace is not correct in his assertion that the multiplication of the proposed series fa, fb, &c. *leads to results* which have not been logically established, "either by Newton or Leibnitz or any of their followers down to La Grange. The whole of their methods, notwithstanding the application of the principle of exhaustions, of indivisibles, of the theory of limits, of prime and ultimate ratios, the expansion of binomials, multinomials, &c.—are still liable to the objections of Berkeley, their reasoning being more or less infected with the *fallacia suppositionis*, or, as he calls it, the *shifting of the hypothesis*.—The results deduced from the single multiplication of Stainville's series are not liable to the objections of the *fallacia suppositionis*."

Upon the preceding extract, it may be remarked, that having shown that Euler's demonstration is *identical* with that published by Professor Wallace, it follows that no objection can be made to the one that does not apply with equal force to the other, therefore the assertion of Professor Wallace, of the superior excellency and logical precision of his method over that of every other one known, is wholly destitute of foundation. It is somewhat amusing to observe that while Professor Wallace is boasting of the great logical accuracy of his *deductions* from this method, he stumbles upon as complete a *fallacia suppositionis* as ever Dr. Berkeley found fault with. This occurs in Vol. VII, page 284, in finding the series which expresses the log. $(1+x)$. This series, though correct, being investigated by a process in which the hypothesis is completely shifted. It is done by putting the two developments of $(1+x)^m$ page 284 Vol. VII. equal to each other, and neglecting the first term 1 of each series, which mutually destroy each other, by which he obtains

$$\frac{m.l(1+x)}{1}+\frac{m^2.l^2(1+x)}{1.2}+\text{\&c.}=m.\frac{x}{1}+m(m-1)\frac{x^2}{1.2}+\text{\&c.}$$

This is true for all values of m. But if we put $m=0$, it becomes simply $0=0$, and in the present form determines nothing. Professor Wallace, however, divides the whole expression by m, which Berkeley contends ought not to be done except when m is a *real quantity;* after the division is performed m is put$=0$, and the value of $l(1+x)$ is deduced. Now though the true value is obtained, it is done by completely shifting the hypothesis, according to Berkeley's idea, from m finite, in which the development is possible, to $m=0$, in which case there is in fact nothing produced but the identical equation $1=1$ or $0=0$.

This introduction of $m=0$, in its *vanishing* state, is what Berkeley particularly objects to; calling such an expression the "*Ghost of a departed quantity*." From this example it is evident that there is no peculiar excellence, in a logical point of view, in this *application* of the method in the paper Vol. VII. page 284. Other similar objections might be made, but it is unnecessary to extend these remarks any farther.

B.

Demonstration of the Binomial Theorem for integer positive values of the exponent, referred to in the former part of this paper.

If we multiply $1+x$ by itself and that product by $1+x$ and so on, we shall successively obtain $(1+x)^2=1+2x+x^2$, $(1+x)^3=1+3x+3x^2+x^3$, $(1+x)^4=1+4x+6x^2+4x^3+x^4$, all of which are contained under this general expression,

$$(1+x)^n=1+\frac{n}{1}\cdot x+\frac{n}{1}\cdot\frac{n-1}{2}\cdot x^2+\frac{n}{1}\cdot\frac{n-1}{2}\cdot\frac{n-2}{3}\cdot x^3+\text{\&c.} \quad \text{(A)}$$

which by the above multiplications is true when $n=1$, $n=2$, $n=3$, $n=4$. To prove it to be true for all integer positive values of n it is only necessary to show that the multiplication of the formula (A) by $(1+x)$ will produce a similar expression composed in $n+1$ as that formula is in n, or that

$$(1+x)^{n+1}=1+\frac{n+1}{1}\cdot x+\frac{n+1}{1}\cdot\frac{n}{2}x^2+\frac{n+1}{1}\cdot\frac{n}{2}\cdot\frac{n-1}{3}\cdot x^3+\text{\&c.} \quad \text{(A}'\text{)}$$

for from thence it would follow that being true for $n=4$, it must be true for $n+1=5$; being thus true for $n=5$, it must be true for $n+1=6$, and so on *ad infinitum*. Now by performing the multiplication of the series (A) by $1+x$, and placing the products by 1 and by x beneath each other according to the powers of x, it becomes, by introducing into the lower line the factors $\frac{1}{1}$, $\frac{2}{2}$, $\frac{3}{3}$, $\frac{4}{4}$, &c. instead of 1, for the sake of symmetry, and including in parentheses the equal factors of the two products;

$$(A);\quad 1+\frac{n}{1}\cdot x+\left(\frac{n}{1}\right)\cdot\frac{n-1}{2}\cdot x^2+\left(\frac{n}{1}\,\frac{n-1}{2}\right)\frac{n-2}{3}\cdot x^3+\left(\frac{n}{1}\,\frac{n-1}{2}\cdot\frac{n-2}{3}\right)\frac{n-3}{4}\cdot x^4+\ \&c.$$

$$x\times(A);\quad \frac{1}{1}\cdot x+\left(\frac{n}{1}\right)\quad \frac{2}{2}\cdot x^2+\left(\frac{n}{1}\cdot\frac{n-1}{2}\right)\quad \frac{3}{3}\cdot x^3+\left(\frac{n}{1}\cdot\frac{n-1}{2}\cdot\frac{n-2}{3}\right)\frac{4}{4}\cdot x^4+\ \&c.$$

$$1+\frac{n+1}{1}\cdot x+\left(\frac{n}{1}\right)\cdot\frac{n+1}{2}\cdot x\quad+\left(\frac{n}{1}\cdot\frac{n-1}{2}\right)\frac{n+1}{3}\,x^3+\left(\frac{n}{1}\,\frac{n-1}{2}\cdot\frac{n-2}{3}\right)\frac{n+1}{4}\cdot x^4+\&c.(A'')$$

and by placing the factor $n+1$, at the beginning instead of at the end of the terms it becomes exactly like the formula (A′) whence the proportion assumed by Euler for integer positive values of the exponent is true.

Art. XIV.—*New demonstrations on the theory of the Overshot Water-wheel.* By Mr. A. B. Quinby.*

Theorem I. Any quantity of water, acting through any fall, upon an overshot water-wheel, will raise an equal quantity of water through the same vertical height.

First, Let the wheel be the whole height of the fall: and describe the circle ADBE, Fig. 1, to represent the wheel. Draw the vertical diameter AB; and at right angles to it, the diameter ED. Say, now, as the quadrantal arc AD : CD : : CD : to a fourth term. Make CG=this fourth term; and suppose a wheel G*tvw*, whose radius is equal to CG, to be fitted permanently (in any way) upon the shaft that carries the water-wheel. Suppose, also, two racks, G*b* and *vd*, to rest upon the teeth of the wheel G*tvw*, and to stand parallel with the vertical diameter AB. If, now, a particle of water P, be applied upon the end of the rack G*b*, it is obvious that it will cause this rack to descend, and turn the wheel G*tvw*, and raise the rack *vd* on the opposite side; and if a particle of water W=to P, be attached to the lower end of the rack *vd*, it is plain that the two particles, P and W, will reciprocally balance each other; and, if the particle P be supposed to descend through any space whatever, its effect, during the time

* For this description see Plates IV. and V.

of its descent, will be sufficient to raise the particle W through an *equal space.*

Let it next be considered, what *effect* the particle P would have, during its descent, through some particular or assumed space.

Take $Py = AB$, and it will be manifest that the *effect* of the particle P, during its descent to the point y, will be properly expressed by the product $P \times Py$, or $P \times AB = W \times BA$. Let it also be considered, that during the descent of the particle P, from P to y, the wheel will be made to turn through half a revolution; for, since by cons. AD : CD : : CD : CG; and by the property of circles AD : CD : : tG : CG, it follows that $tG = CD$; and, consequently, $Gtv = 2CD = AB = Py$: and, therefore, if we suppose a particle of water to be at A when the particle P shall begin to descend, it will have described the arc ADB, and have arrived at the point B, at the time that the particle P shall have arrived at y.

It is now proposed to estimate the *effect* which a particle of water P′,=to P, would have in descending from A, through the arc ADB; in comparison with the *effect* that would be produced, during the same time, by the particle P, acting upon the teeth of the wheel, at the point G.

From P′ let fall the perpendicular P′n; and it is manifest that the tendency which the particle P′ has to produce rotation, is to that which the particle P has to produce rotation, in the ratio of Cn to CG. If, therefore, CG be taken to express the tendency of the particle P to produce rotation; then that of the particle P′ to produce rotation, will be properly expressed by the line Cn; the perpendicular distance of the particle P′ from the line ACB. And, in general, the tendency of the particle P′ to produce rotation, at any point whatever of the semicircle ADB, will be expressed by the perpendicular distance of that point from the line ACB.

Hence, to determine the *mean* tendency of the particle P′ to produce rotation, (*in terms of CG,*) during its descent from A to B, in the arc ABD, we must find the *mean* distance of the semicircular arc ADB from the line ACB; which, by Vince's Flux. p. 97, is $=\frac{CD^2}{AD}$; but, CG was *made* $=\frac{CD^2}{AD}$; and, therefore, the *mean* tendency of the particle P′ to produce rotation, during its descent, (from A to B, through the arc ADB,) is equal to that of the particle P, estimated for the same time.

And as the *effects* produced by the two equal particles, (or powers,) P and P′, during any given time, will obviously be to each other, as the *mean* tendencies of those particles, (during the same time,) to produce rotation; it follows that the *effect* produced by the particle P′, in descending from A to B, in the arc ADB, will be equal to that produced by the particle P, in the same time; or $= W \times Py$.

Hence, if a particle of water descend upon an overshot water-wheel, which is the whole height of the fall, it will raise an equal particle through the same vertical height:—and, as this will be the case with every particle, it follows that any quantity whatever of water, descending upon an overshot water-wheel, which is the whole height of the fall, will raise an equal quantity through the same vertical height.

The same can be demonstrated in a different manner.

Let the circle ABE, Fig. 2, represent an overshot wheel; and let P, P′, P″, &c. be different situations of the same particle of water P: and suppose each of the arcs PP′, P′P″, &c. to be an indefinitely small element:—then, each element and its chord, (and also its sine and tangent,) may be considered as coinciding. Wherefore, for the value of P, in the respective elements, we have, (by mechanics,)

$$\frac{P \times Pl}{PP'}, \quad \frac{P \times lm}{P'P''}, \quad \frac{P \times mn}{P''P'''}, \quad \frac{P \times no}{P'''P''''};$$

and, for the *effect* of P in the respective elements, (or, for the tendency which P has in the respective elements to raise the equal particle W,) we have $\frac{P \times Pl}{PP'} \cdot PP'$, $\frac{P \times lm}{P'P''} \cdot P'P''$,

$\frac{P \times mn}{P''P'''} \cdot P''P'''$, $\frac{P \times no}{P'''P''''} \cdot P'''P''''$, $= P \times Pl$, $P \times lm$,

$P \times mn$, $P \times no$; whence it is plain that the *effect* of P, in the respective elements, is, always, as the perpendicular space passed through; and, also, that the *effect* of P, in descending through any number of elements; or through any portion whatever of the arc P, P′, P″, &c. is, always, as the perpendicular distance passed through; or, as the vertical space intercepted between the point A and a perpendicular drawn from the lower extremity of the last element, to the line AB. Hence, if it can be proved that the *effect* of P, in any *one* element, is sufficient to raise the equal particle W through an equal vertical space, the thing proposed will be demonstrated.

Let us take the element P‴ P⁗: and, then, since this element is indefinitely small, we may consider it as coinciding with the perpendicular P‴ P⁗; which is equal to the sine sP⁗; and, therefore, the *effect* of P, in descending through the element P‴ P⁗, will be the same as the *effect* of P, in descending through the perpendicular P‴ P⁗;* but, if P descend through the perpendicular P‴ P⁗, it is obvious that its *effect* (during the time of its descent) will be sufficient to raise the equal particle W through the same vertical space. Hence, by this, as by the preceding demonstration, any quantity of water, acting through any fall upon an overshot water-wheel, which is the whole height of the fall, will raise an equal quantity of water through the same vertical height.

Cor. From the foregoing demonstrations we are able to correct the general error given by so many writers on the overshot water-wheel, that "The *effect* produced by a given quantity of water acting upon an overshot wheel, depends (in theory) upon the number of buckets." This error is conspicuous in Dr. Gregory's valuable work on mechanics, and in the Edinburgh Encyclopædia.

Next, let the wheel *not* be the whole height of the fall:—the same result will obtain. Suppose a particle of water P, to descend from F, Fig. 1, through the vertical height FA, and to act, at A, upon the wheel, in the tangential direction A*l*:—let us consider the *effect* that this particle will have from its momentum at A; or, which is the same, (P being a unit,) from its velocity at A, in giving angular motion to the wheel; or, in raising the equal particle W, suspended at the extremity E, of the horizontal radius. By the known law of falling bodies, the particle P, when it shall have arrived at the point A, will have acquired a velocity sufficient, if its direction were reversed, to project it back through the altitude AF, to its original height F. Whence it is manifest that the momentum of the particle P, in the direction A*l*, will be sufficient to raise the equal particle W, suspended at E, through a vertical height=AF. Wherefore, as the *effect* of

*The author is aware that this part of this demonstration is not strictly scientific. The result, however, is true.

P, after it shall have issued upon the wheel at A, and during its descent in the arc ADB, will, by the foregoing case, be equal to $W \times BA$; we have, for the whole *effect* of the particle P, during its descent from F to B, $W \times AF + W \times BA = W \times BF$:*—and as this result will obtain for any value whatever of AF, it follows, that if a particle of water descend through any fall, and act upon an overshot water-wheel, which is *not* the whole height of the fall, it will raise an equal particle through the same vertical height. And, as the same will be the case for any number of particles, it is demonstrated that any quantity of water, acting through any fall, upon an overshot water-wheel which is *not* the whole height of the fall, will raise an equal quantity of water through the same vertical height.

There is another method by which this second case can be demonstrated by referring to the first. By mechanics the *effect* of any body in motion varies as the square of its momentum. Wherefore, putting $h = FB$, Fig 1, and $x = FA$; and supposing a particle of water P, to descend from F to A, we shall have, for its *effect* at A, (estimated in the direction A*l*,) $(P\sqrt{2gx})^2$; and for its *effect* in descending from A, through ADB, we shall have $(P\sqrt{2g \times \overline{h-x}})^2$. Hence, for the whole *effect* of P, in descending from F to B, we have $(P\sqrt{2gx})^2 + (P\sqrt{2g \times \overline{h-x}})^2 = P^2 2gx + P^2 2g \times \overline{h-x} = 2P^2 gh$—a constant quantity; and which shows that the *effect* of an overshot water-wheel does not depend, at all, upon the wheel's diameter:—and, consequently, the same result obtains in the second case as in the first.

There is still another method by which this second case can be demonstrated.

Let *amb*E, Fig. 3, represent an overshot wheel; and AF the height of the fall above the wheel: and suppose a tight canal, or conduit, F*ambtc*, to be filled with water, and to be supplied from the trough GF; then, by a known law in hydraulics, any quantity of water which shall descend from F, will cause an equal quantity to be discharged at *c*; and with a velocity that will project it through the vertical space *cd*, to the original summit level FG*d*.

* In this, and in some other of the demonstrations here given, the wheel is supposed to move indefinitely slow.

Let us now suppose the wheel *amb*E, to be entirely free to turn—the circumference sliding closely against the shoulder at *a*, of the conduit, and closely, also, against the shoulder at *b*, of the branch *vtb*. And, further, suppose the part *ambtc*, of the conduit, to be extremely small, so that the water contained in it shall be only a succession of single particles; and, lastly, suppose the circumference *amb* &c. to have about it an immense number of very small buckets, so that each particle of water that shall strike the wheel, at *a*, shall be received into a separate bucket; or, which will be equivalent, suppose each particle of water that shall strike the wheel at *a*, to adhere to the circumference until it arrive at the lower point *b*.

These conditions being all granted, and the conduit being now supposed full of water, let us consider the *effect* which a given quantity of water, descending from F, and acting through the part *amb* of the conduit, upon the circumference of the wheel, will have in giving motion to the series of particles in the branch *btc* of the conduit.

From the conditions that have been stated, and from known principles in mechanics, and a known law in hydraulics, it is obvious that the water in the part F*amb*, of the conduit, will communicate to the circumference of the wheel a velocity equal to that which is due to the height *a*F; and, consequently, as the same velocity that shall be communicated to the circumference of the wheel, will (from the conditions stated) also, necessarily, be communicated to the series of particles in the branch *btc*, it follows that the velocity communicated by the water in the part F*amb*, of the conduit, to the series of particles in the branch *btc*, will be equal to that which is due to the height *a*F. Wherefore it is plain that each particle of water that shall pass through the conduit, or down upon the wheel, will be ejected at *c*, with a velocity that will raise it to the point *a*, in the original summit level FG*d* And, as this will be true for any number of particles, or for any capacity whatever of the conduit *ambtc*,* it follows, as by the preceding demonstration, that any quantity of water, acting through any fall upon an overshot water-wheel which is *not* the whole height of the fall, will raise an equal quantity of water through the same vertical height.

* The capacity of this conduit may be increased at pleasure, by increasing the length of the buckets, or the width of the wheel.

The foregoing general result now being established, it is proposed next to examine, *not* the *effect* which a given quantity of water *will produce*, or *is capable of producing;* but the *effect* which *in practice can be derived* from a given quantity of water, acting through a given fall upon an overshot water-wheel, under *given circumstances.*

To do this, let it be given that the velocity of the circumference of the wheel shall be equal to that which is due to the height of the fall above the wheel: then,

Theorem 2. The *effect* which, in practice, *can be derived* from any quantity of water, acting through any fall upon an an overshot water-wheel, will vary as the diameter of the wheel.

Let *amb*E, Fig. 4, represent an overshot wheel; and suppose a conduit F*ambg*, as represented in the figure; and suppose, also, a vertical column of water *zy*, equal in size to the conduit *ambg*, and equal in height to the vertical line *nc*, or to the diameter *ba*, to be suspended to the cord *se*, which passes over the pulley M, and under the pulley N, and thence (through a hole at *m*,) to the plug *bi*, (at the point *b*,) to which it is fastened

These conditions being granted, it is plain, that if the part F*amb*, of the conduit, be filled with water, and the proper supply be delivered at F, the plug *bi* will be driven from *b*, towards the extremity *g*, and with a velocity equal to that which is due to the height *a*F. And it is also plain, that while the plug *bi* shall be driven through any space whatever, towards the part *g*, the column *zy* will be raised through an equal space. Hence, taking *bg*=*b*F, and supposing the water to descend from F until the plug *bi* be driven to *g*, the column *zy* will be raised through a vertical space=*b*F. Whence it is obvious that *zy* expresses the *effect* which, *in practice, can be derived* from a given quantity of water (viz. that contained in the part *bg* of the conduit) acting through the given fall F*b* upon the wheel *amb*E; the whole *effect* being expressed by *bg*, or *b*F. But *zy* is=*ba*, the diameter of the wheel; and *b*F is = the whole height of the fall—hence it is determined, that if the circumference of an overshot wheel move with a velocity equal to that which is due to the height of the fall above the wheel, the *effect* which, *in practice, can be derived* from any quantity of water, acting through any fall upon an overshot water-wheel, will vary as the diameter of the wheel.*

This result being obtained, it is proper, in the next place, to notice, that *in practice* the water does not descend in the buckets entirely down to the lowest point b, but is always discharged when at an angular distance of about 30° (on the wheel's circumference,) from the point b. Let this be granted; and, then,

Theorem 3. If the circumference of the wheel move with the velocity due to the height of the fall above the wheel; the *effect* which, *in practice, can be derived* from any quantity of water, acting through any fall upon an overshot water-wheel, will vary as $\frac{43}{50}$ of the wheel's diameter (very nearly.)

Let t, Fig 5, be the point at which the water is discharged, and tn a perpendicular drawn from t to the vertical diameter ba; then, by what was proved in Theorem 1, Fig. 2, the *effect* of any quantity of water in descending upon the wheel from a to t, will be to the *effect* of the same quantity in descending from a to b, as an to ab; but, as an to ab, so is 43 to 50 (very nearly). Consequently, by what has been already shown, the *effect* which *in practice can be derived* from any quantity of water acting through any fall upon an overshot water-wheel, will vary as $\frac{43}{50}$ of the wheel's diameter.

It now remains to determine the velocity which the circumference of an overshot water-wheel must have, in order that the *effect* which *in practice can be derived* from a given quantity of water, shall be a maximum.

Theorem 4. The greatest *effect* which *in practice can be derived* from a given quantity of water, acting through a given fall upon an overshot water-wheel, is when the velocity of the circumference of the wheel is the *least possible.*

Put $h=b$F, Fig. 5, and $x=a$F; and put V=the velocity due to the height aF, and v=the velocity of the circumference of the wheel: then, by mechanics, and from what has been demonstrated, the *effect* which *in practice can be derived* from a given quantity of water, acting through the given fall Fb, upon the wheel ambE, will vary as the quan-

* From this demonstration, and the others here given, it will be perceived that the whole standing theory, given in books, on the subject of the overshot water-wheel, is false.

tity $(V-v)^2+\frac{4}{5}\frac{3}{0}(h-x)$; which will manifestly be a maximum when v is the *least possible.**

Theorem 5. If the circumference of an overshot wheel move with the velocity due to the height of the fall above the wheel, the product of the velocity and circumference of the wheel will be the greatest when the diameter of the wheel is $\frac{2}{3}$ the height of the whole fall.

Put h=BF, Fig. 1. and x^2=AF: then the circumference will be 3.14159, &c. $(h-x^2)$; and the product of the velocity and circumference will be $\sqrt{2gx^2}\times 3.14159,\&c.(h-x^2)$; which is to be a maximum; or, by rejecting constant factors $x(h-x^2)=hx-x^3=$max. Wherefore, $h\dot{x}-3x^2\dot{x}=0$; or, $x^2=\frac{1}{3}h$; and $h-x^2=\frac{2}{3}h$.†

Theorem 6. If the circumference of an overshot wheel move with the velocity due to the height of the fall above the wheel, the wheel will have its greatest angular motion, or will perform the most revolutions in a given time, when its diameter is the *least possible.*

Retaining the same notation, we have for the angular motion of the wheel $\frac{\sqrt{2gx^2}}{3.14159,\&c.(h-x^2)}=\frac{\sqrt{2g}}{3.14159\&c.}\times\frac{x}{h-x^2}$; which will obviously be greatest when the quantity $h-x^2$, (the diameter of the wheel,) is the *least possible.*

Note. The author deems it proper to state, that all the preceding demonstrations were made out in January last; but for certain causes were not arranged and offered for publication until the present time.

New-York, Dec. 28, 1824.

Remark by the Editor.—Mr. Quinby, in a letter to the Editor, dated Feb. 12, 1825, promises to communicate a paper, for a subsequent number of this Journal, applying the above theory to the "Pitch-back" and "Breast Wheels."

* Dr. Gregory, in his Mechanics, states that, "In an overshot wheel, the machine will have its greatest perfection," or, as he expresses it in a subsequent edition, "will have its greatest rotary velocity, when the diameter of the wheel is $\frac{2}{3}$ of the height of the water above the lowest point of the wheel." Both these enunciations are obviously false.

† This demonstration exhibits what, in Dr. Gregory's Mechanics, is given to express the greatest perfection of the machine; or, as it is in the last edition of his work, the greatest rotary velocity (meaning, it is presumed, angular velocity) of the wheel. But it is plain that the quantity exhibited in this demonstration does *not* express the greatest perfection of the machine; nor the greatest rotary velocity of the wheel.

Art. XIV.—*On high and low pressure Boilers.* By A. B. Quinby.

The following is the substance of a paper communicated by the author to the committee appointed by the Literary and Philosophical Society of the City of New-York, to investigate the causes which gave rise to the explosion of the boiler on board the Steam-Boat Ætna.*

To determine the comparative eligibility of the *high* and the *low* pressure steam-engine, the two following things appear to me necessary to be considered. *First*, the liability of each engine to explode; and *secondly*, the danger, or injury, which each engine is capable of producing in case an explosion takes place.

To determine the comparative liability of the two engines to explode, it will be necessary to consider the four following things:—the diameters of the boilers used in the two engines; the elastic force of the steam in each boiler; the tenacity of the metal of which the boilers are composed; and the thickness of each boiler.

The diameter of the boiler on board the Ætna was thirty inches; and the diameter of a boiler for a *low* pressure engine of equal power would be about ninety inches; or *three times* as great.

The elastic force of steam in the boiler of the Ætna was usually 150 lbs. per square inch; and the elastic force of steam in a *low* pressure boiler is usually 10 lbs. per square inch.

The tenacity of the metal of which boilers are composed is about 60,000 lbs.; or six-sevenths that of good wrought iron.†

As, however, the cylinder which constitutes the boiler is not *solid* metal, but is composed of plates *riveted together*, it will be necessary to diminish the number which expresses the tenacity.

Let, therefore, the tenacity be put at 30,000 lbs. in place of 60,000.

* The communication was made at the request of Dr. Dekay, chairman of the committee.

† The tenacity of any metal is usually expressed the by greatest weight in lbs. which a bar one inch square, of that metal, is capable of sustaining when pulled endwise.

The thickness of the boiler in the Ætna, was $\frac{3}{8}$ of an inch; and the thickness of a *low* pressure boiler for an engine of equal power would be about $\frac{1}{4}$ of an inch.

From these data it is easy to calculate the comparative liability of the two engines to explode; for, by mechanics, the force of steam which a *high* pressure boiler 30 inches in diameter, and $\frac{3}{8}$ of an inch thick is capable of resisting, is equal to the thickness multiplied by the tenacity of the metal, divided by half the diameter;* $=\frac{3}{8}\times\frac{30,000}{15}=750$ lbs.; which is 600 lbs. more than the usual working pressure; or 5 times the usual working pressure.

And, next, the force of steam which a *low* pressure boiler 90 inches in diameter, and $\frac{1}{4}$ of an inch thick, is capable of resisting is $=\frac{1}{4}\times\frac{30,000}{45}=166\frac{1}{2}$ lbs.; which is $156\frac{1}{2}$ lbs. more than the usual working pressure; or $16\frac{1}{2}$ times the usual working pressure.

Hence, if the excesses, merely, be considered, laying aside the ratio of the elastic force of the steam in the two boilers, it appears that the *high* pressure engine is safer by $443\frac{1}{2}$ lbs. per square inch, than one of the *low* pressure kind. But, on the contrary, if the ratio of the elastic force of the steam in the two boilers be considered, and the excesses be laid aside,

* The formulæ for the elastic force of steam which a given boiler will sustain may be derived in the following manner:

Let the circle ADB, Fig. 6, represent an end projection of a boiler one inch in length. And put (te) for the tenacity of the metal; e for the elastic force of the steam employed; r for the radius of the boiler; and (th) for the thickness.

Then $r : \frac{2r}{3.14159\ \&c.}$, (the *mean* dis. of the semicircle ADB, from the line ACB,) $:: e : \frac{2e}{3.14159\ \&c.}$, the *mean* elastic force of the steam employed, (acting upon the surface ADB,) inflected into directions perpendicular to the line ACB.

Hence, for the whole force of the steam employed, estimated in a direction perpendicular to the line ACB, we have

$$\frac{2e}{3.14159\ \&c.}\times\overline{r\times 3.14159\ \&c.}=2re.$$

And for the strain at A, or B, we have $2re\div 2=re$.

And, now, $(te) : re :: \overset{in.}{1} : \overset{in.}{(th)}$. Whence $re=(th)\times(te)$; and $e=\frac{(th)\times(te)}{r}$: also, $(th)=\frac{re}{(te)}$.

it will appear from the above results, that the *low* pressure engine is more than *three times* as safe as one of the *high* pressure kind ; or, that the safety of the *low* pressure boiler is to that of the *high* pressure boiler in the proportion of $16\frac{1}{2}$ to 5.

But it can be shown that either engine can be made entirely safe ; and that one kind is not, *in fact*, any more liable to explode than the other.

To prove this we have, (by mechanics,) the thickness of a *low* pressure boiler 90 inches in diameter, capable of resisting 10 lbs. per square inch, $=\frac{45 \times 10}{30,000}=.015$ in. ; and, that of a *high* pressure boiler 30 inches in diameter, capable of resisting 150 lbs. per square inch $=\frac{15 \times 150}{30,000}=.075$ inches.

And, now, if we multiply the first of these results by 10, we shall have .15 in. for the thickness of a *low* pressure boiler capable of resisting 10 times the usual working pressure ; which is 90 lbs. above the usual working pressure.

And the thickness of a *high* pressure boiler capable of resisting 10 times the usual working pressure is $=\frac{15 \times 150 \times 10}{30,000}=.75$ in. ; and, lastly, the thickness of a *high* pressure boiler capable of resisting 90 lbs. per square inch above the usual working pressure is $=\frac{15 \times \overline{150+90}}{30,000}=$ .12 in.

Hence, as it is fully practicable to make a boiler of a thickness equal to any of the foregoing results, it is plain that one kind of engine may be made just as safe as the other.

I shall merely add, that as the tenacity of metals is diminished by an increase of temperature, the tenacity in the case of the *high* pressure boiler should have been taken some less than in the case of the *low* pressure boiler.*

* As no experiments have ever, to my knowledge, been made for determining the decrease of the tenacity of metals corresponding with a given increase of temperature, and as this, in my estimation, is a subject of considerable philosophical interest, I will respectfully suggest to the gentlemen who compose the present committee, that they have such experiments instituted, as may, if possible, detect the *law*, by which the tenacity *decreases*, during a given *increase* of temperature.

On the subject of the injury which each engine is capable of producing, in case an explosion takes place, the committee are amply prepared to decide.

Respectfully,
A. B. QUINBY.

New-York, June 28, 1824.

Art XV.—*On the Spiral of Archimedes;* by A. B. Quinby.

Prof. Silliman,

Dear Sir,

The subject of describing the spiral of Archimedes, by means of an instrument, was proposed at a meeting of the Mathematical Club in June 1822. A few days after the problem was given, I invented the instrument which the drawing you will receive with this letter represents.

At the time the subject was suggested, the Club were not aware that an instrument for describing this curve had been invented by Clairaut. After my discovery, I learned from my scientific friend, Dr. Adrain, that the Memoirs of the Academy of Sciences contains an account of an instrument invented by Clairaut, which describes many curves, and among them the spiral of Archimedes.

Reference to the Plate.

The upper drawing, Fig. 1, Plate V. represents a horizontal view of the instrument, standing on a table. The lower drawing represents a vertical view of the instrument, in the same position. The part *cc′* is a cylinder, about which the thread *th* is wound. This cylinder is held permanent by the scew S*w*, which passes through its centre. The braces *bb′* (of which there are four) enter, by small shoulders, into the bars AL and DG, and support, at their upper extremity, the inner ring *rr′*. This ring, and the braces and cylinder, always remain at rest. The outer ring RR′, which carries the bars BB′, rests upon a shoulder of the inner one *rr′*, and may be made to revolve to the right, or the left, at pleasure. A section of these two rings is seen at the point *v*. The part *f* is a small block of brass, which has grooves in its sides, and which slides freely along between the two bars BB′.— Through this block the brass pin P*p* is let fall, which carries on its lower end a pen or pencil. The thread *th* (which passes through a hole at *h*) is carried over the pulley *m*, and down under the pulley *n*, and then along between the parallel bars BB′, and fastened to the block *f*.

To those who have a knowledge of the properties of the curve in question, it is plain, that if the extremity B′ of the parallel bars be pushed from us, the pin P*p* will describe (upon the table) the spiral of Archimedes.

The curve, Fig. 7, Plate IV. is a spiral of Archimedes, as described by this instrument.

It will be perceived that both branches of the curve are here given; and that the instrument, in its present state, describes the two branches successively; and likewise that the two branches described are, *necessarily*, the two *opposite* branches. By a small modification, the instrument would describe the two branches simultaneously.

Respectfully, your ob't servant,

A. B. QUINBY.

New-York, Nov. 4, 1824.

Art. XVI.—*On Crank Motion, in reply to the remarks of the author of a Review in the North American.*

TO THE EDITOR.

Sir,

I notice in the last number of your Journal of Science and Arts a reply from the writer of the article in the North American Review to the Note I added to my solution of the *Crank Problem.*

In answering this reply, I shall endeavour to be perspicuous; and as I have now "hunted up some information on the subject," I hope to be able to convince the ingenious writer of that article, not that he *now* believes that the *crank* occasions a loss of *three-fourths* of the whole power, but merely that when he wrote the article in the North American

Review, he *did believe* that the *crank* occasions a loss of *three-fourths* of the whole power employed!!

"There is," says this writer, "in the steam-engine, a loss of power *in changing the direction of its action* from rectilinear to rotary, *by the mtehods in common practice*," &c.; which on an average amounts to about *three-fourths* of the whole power, as appears from the reports on the performance of the engines used at the mines in Cornwall."

Now it is certainly not difficult, for any person who can comprehend plain language, to understand what is expressed in the above quoted sentence. "There is, in the steam-engine, a loss of power, *in changing the direction of its action* from rectilinear to rotary, *by the methods in common practice*." Can any words convey a clearer or more definite meaning than these here used:—for does not every individual, who has the least knowledge on the subject of the construction of the steam-engine, know that "the method in common practice," for changing the direction of the power from rectilinear to rotary, is the *crank?* And yet the writer of the article in question boldly asks, "Can any one pretend, for one moment, that there is any thing in this paragraph which warrants Mr. Quinby's assertion that the loss of power is supposed to result from the *crank?*"

But there is something more conclusive to be said on this subject. In Rees' Cyclopædia, article steam-engine, we have the following words: "Before quitting the subject of double engines,* [double cylinder engines,] employed to give a rotative motion to machinery by a *crank*, we must notice the remarkable difference, shown by Messrs. Leans' reports, between the performance of the small engines employed in drawing the matter out of the mines, and those used in pumping water."

"We should think the loss of power from friction, in drawing up buckets by a rope, could not be greater than the friction of pump-buckets, and of the water moving in the pipes; therefore, all the difference must be attributed to the application of the rotative motion, [by the *crank*,] and to the smallness of the engines; these are usually 14, 16, and 24 inches

* Those who are familiar with the construction of different kinds of engines, will perceive, by reading the article steam-engine, in Rees' Cyclopædia, that the engine here meant is Woolf's double cylinder engine, and not the double engine invented by Watt.

in diameter; but their performance, with respect to coal, is only 3, $3\frac{3}{4}$, 4, and 5 millions. The best engine they have, draws only from $9\frac{1}{2}$ to 11 million pounds, one foot high, with each bushel of coal, which is only one-third of the performance of the best large engine employed in pumping."

"One of Woolf's double [cylinder] engines, at Wheal Fortune mine, in May 1816, drew only *three* million pounds, one foot high, with each bushel; but another, at Wheal Var mine, drew *six* millions."

Now it is deemed proper here to notice, *first*, that in the case just quoted, the author (the writer of the article Steam Engine, Rees' Cyclopædia) attributes *all* the difference between the performance of the two engines employed, to *two* causes, viz. the application of the rotative motion by the *crank*, and to the smallness of the engines; and, *secondly*, that the writer of the article in the North American Review offers this very case as the basis on which he founds his assertion, that "There is, in the steam-engine, a loss of power *in changing the direction of its action*, from rectilinear to rotary, *by the methods in common practice*."*

With respect to the first of these opinions, it is to be remarked, that however respectable the writer of the article Steam Engine, Rees' Cyclopædia, may be, as a man of science, his knowledge was inadequate to the subject on which he wrote:—for, certainly, no individual, who is competently acquainted with the steam-engine, and with the application of the rotative motion by the *crank*, would ever conclude that "therefore, all the difference must be attributed to the application of the rotative motion by the *crank*, and to the smallness of the engines,† since there are other causes to

* It will be noticed by the reader, that the writer of the article in the North American Review, lays aside the smallness of the engines, and attributes *all* the difference to the *single* cause of *changing the direction of the power*, from rectilinear to rotary, *by the methods in common practice.*

† In the article Steam Engine, Rees' Cyclopædia, the author states, that "There is, in the Philosophical Journal, a description of a contrivance by Mr. Samuel Clegg, for producing a rotative motion from a reciprocating one, which not only simplifies the machine very much, but exceeds the power of the common *crank* one-third."

From this we learn what part of the supposed loss of power in the steam-engine this writer would attribute to the application of the rotative motion by the *crank*; for, since he believed that Mr. Clegg's contrivance exceeds the power of the common *crank* one-third, it is plain which this difference (if indeed it exists,) may be much more obviously and properly referred.

On the subject of the application of the rotative motion by the *crank*, it is now known, and mathematically established, that it occasions "no loss whatever of the acting power;" and with respect to the smallness of the engines, it is obviously a circumstance insufficient to produce the difference stated. There must therefore be other causes on which this difference depends. But what other causes, it will be asked, can be sufficient to produce the prodigious difference of *three-fourths*, in the performance of two similar engines? The answer is plain. It is, *first*, the injudicious or wasteful application of the coal consumed; and, *secondly*, the want of a constant and sufficient load in the buckets, during the time the engine is in action. The latter, it is believed, is the chief cause on which the difference depends.

There is now one other thing to be noticed before I proceed further in my examination of this reply from the writer of the article in the North American Review.

In Rees' Cyclopædia, and likewise in the North American Review, each writer makes the quantity of coal consumed to be the measure of the power of the respective engines. But does not every person know, who is in the least degree acquainted with the steam-engine, and with the science of Mechanics, that the quantity of coal consumed is *not* the measure of the power of a steam-engine?

I now proceed in examining the reply from the writer in the North American Review. "Before Mr. Quinby concluded," says this writer, "that a very great blunder was made in these estimates, it would have been well for him to have hunted up some information on the subject."

In answer to this remark, it is now stated, that the more information Mr. Quinby has hunted up on the subject, the more he is confirmed in his original belief that "a very great blunder was committed by those who made the estimates."

It has already been shown that one of the causes to which the difference is attributed does not exist; and the other, it is

that he must also have believed that the application of the rotative motion by the *crank* occasions a loss of *at least* one-third of the whole power. And this opinion had, no doubt, its full weight with the writer of the article in the North American Review.

known, has no connexion with a loss of power in the steam-engine.

With a view to clearness, and for the information of the writer of the article in the North American Review, I shall here give a definition of the power of a steam-engine. The power of a steam-engine is the product of the elastic force of the steam employed and the surface of the piston upon which it acts.

This definition being admitted, it is easy to perceive that both the writers who have made the estimates, have committed not only "a very great," but a very *egregious*, blunder, since they both have taken, not the elastic force of the steam employed, and the surface of the piston upon which it acts, but the quantity of coal consumed, for the measure of the power of the respective engines.

Besides this blunder, it is further to be noticed, that both the writers in question have founded their inference on the presumption that the engines employed in drawing the matter out of the mines, are always uniformly and sufficiently loaded. But on this subject they have stated no evidence, or have referred to no authority; and it is more than probable that, in raising the matter out of the mines, the load applied in the buckets was neither uniform nor sufficient; and consequently "a blunder" has, on this score, been committed, as well as in making the quantity of coal consumed to be the measure of the power of the respective engines.

I shall now notice the words, "As appears from the reports on the performance of the engines used at the mines in Cornwall."

On the subject of this assertion, I shall take the liberty to state that there is not in the Messrs. Leans' reports one word that justifies, or even makes admissible, the assertion that, "there is in the steam-engine a loss of power *in changing the direction of its action* from rectilinear to rotary *by the methods in common practice.*"

In Tilloch's Philosophical Magazine we have the whole series of reports on the performance of the engines used at the mines in Cornwall, by Messrs. T. & J. Lean, commencing Aug. 1811, and ending Nov. 1818; and in these reports the case noticed by the writer of the article Steam Engine, Rees' Cyclopædia, is not mentioned; and if it was mentioned it would never lead a scientific writer, who is competently acquainted with the steam-engine and with the science of mechanics, to conclude that *all* the difference must be attributed to the application of the rotative motion by the *crank*, and to the smallness of the engines; nor, that "there is in the steam-engine a loss of power *in changing the direction of its action* from rectilinear to rotary *by the methods in common practice*," since, as before observed, there are other causes to which this difference may be much more obviously and properly referred.

But we will suppose for a moment that *all* the difference does result from the application of the rotative motion by the *crank*, and from the smallness of the engines; or, as the writer of the article in the N. A. Review expresses it, from "*the changing of the direction of the power* from rectilinear to rotary *by the methods in common practice*;" and let us examine what will be the result:—then, since one of Woolf's double cylinder engines at Wheal Abraham mine, in May 1816, in which the direction of the power *was not changed* from rectilinear to rotary *by the method in common practice*, gave a product of 56 millions of lbs. raised one foot high with each bushel of coal, and another of the *very same kind of engines*, at Wheal Var mine, in the same month, in which the direction of the power *was changed* from rectilinear to rotary *by the method in common practice*, gave a product of only 3 millions of lbs. raised one foot high with each bushel, it follows, on the principle adopted and contended for by the writer of the article in the N. A. Review, that there is in this case, *in changing the direction of the power* from rectilinear to rotary *by the method in common practice*, a loss of $\frac{53}{56}$, ($=94\frac{1}{2}$ hundredths,) of the whole power employed!!!

And now it is asked, Does the writer of the article in the N. A. Review presume that any person possessing an unperverted mind, will believe that the prodigious difference above exhibited is attributable to *the changing of the direction of the power* from rectilinear to rotary, *by the method in common practice*; or, which is precisely the same thing, to the *crank?*

But the writer of the article in question asserts, that he did not connect his idea or statement of a loss of power *in changing the direction of its action* from rectilinear to rotary *by the methods in common practice*, with any mechanical agent whatever; and that no such connexion can be inferred without violence to the whole statement. On the subject of this assertion I shall only put one question. Does the writer of the article in the North American Review mean in his sentence that contains the words, "no mechanical agent whatever," that the loss of power which he imagines, depends upon no part whatever of the machine? If he means that it depends upon no part whatever of the machine, it is frankly confessed by the writer of the present reply, that the utmost stretch of his *mechanic* and conceptive powers does not enable him to comprehend in what way any loss of power can take place.

I shall now notice the charge made upon me for offering my opinion, that "the very frequent attempts to make a rotary engine are unnecessary and idle."

It will be remembered by the scientific reader, that in my solution of the *crank problem* I demonstrated, that all the power applied at the upper extremity of the shackle-bar* is transmitted by the *crank* to the appending machinery; or which is the same, that the *crank* occasions no loss whatever of the acting power. Now this fact having been established, and it being known that no machine can impart *more* power than is applied; and it being also known at the same time, that all the attempts that have been made "to apply the action of the steam directly to a wheel," or to construct rotary engines, have been instituted with the hope, and for the single purpose of obviating the very great loss of power which different individuals have *supposed to result* from the application of the *crank*, it was certainly a fair, and tenable, and necessary conclusion, that all the attempts to construct rotary engines are both *unnecessary* and *idle*; and I have now no hesitation in offering it as my deliberate and decided opinion, that every attempt that shall ever be made to construct a rotary steam-engine will prove not only *unnecessary* and *idle*, but *unscientific* and *silly*.

It now remains to take some notice of the last paragraph of the reply from the writer of the article in the North American Review. "It may be observed, however," says this writer, "that it is not for Mr. Quinby to set bounds to the efforts of invention. It is the business of genius to conquer difficulties which, to ordinary men like us, appear insurmountable; and it may even happen that some of these very efforts, which, on the authority of Mr. Quinby's opinion, are to be considered as unnecessary and idle, will, by being

* In Europe this is called connecting-rod; but on this continent, as far as the writer is informed, it is universally called by the name he uses.

very long and patiently continued, end in inventions of considerable public utility."

In reference to the sentiments expressed in this paragraph, I am willing to state, that I do claim the right (in common with others) to set bounds to the efforts of invention. Can the writer of the article in the North American Review invent a right angled plane triangle, whose three angles shall not be equal to two right angles? Can he invent a steam-engine that shall be able to impart to the appending machinery more power than is applied? It is now established that all double stroke engines do impart to the appending machinery all the power that is applied, and consequently a *saving* of power can only be effected by the invention of a machine that shall impart more power than is applied to it; and this, in the judgment of the writer of this reply, is not possible.

A. B. QUINBY.

New-York, Nov. 1, 1824.

Note. In my note to my demonstration of the *Crank Problem*, I wrote the words, "reciprocating motion produced by the *crank*." This is an error. It should be, rotary motion produced by the *crank*.

A. B. Q.

Art. XVI.—*On the action of Iron in motion on Tempered Steel.* By MM Darier and Colladon.*

The manner in which steel is cut by soft iron, as ascertained by Mr. Barnes, has been pointed out, p. 155 of our last volume; and since then the effect has been attributed to the softening of the steel at the point of contact by the heat resulting from the friction. The following experiments and results, in relation to this subject, are extracted from a mémoire published in the *Bib. Univ.* xxv. p. 283

The authors of the paper were led to doubt the sufficiency of the reason above given, by finding, on an examination of the iron plate made use of to cut some steel, that its edge

* From the London Quarterly Journal for October 1824.

was set with small particles of steel, which, seen through a lens, did not appear as if untempered, and which, when tried with a file, were found as hard as the best tempered steel. Suspecting, therefore, some other cause for the effect, they first endeavoured to ascertain what degree of motion was sufficient, simply to compensate for the power which in ordinary circumstances steel has of cutting iron, and above which iron, on the contrary, becomes possessed of the power of cutting steel.

The steel employed consisted of gravers, very carefully tempered. The soft iron plate used was 7 inches 5 lines in diameter, and very carefully centred and mounted, so that any required degree of velocity could be given to it. The time was measured by a temporary pendulum. Whilst the velocity of the iron wheel, measured at its circumference, was less than 34 feet in a second, the graver cut it with the greatest facility, and without any appearance of re-action. At 34 feet 5 inches, the graver did not cut the iron so well, but was itself unaffected. At 34 feet 9 inches, it was slightly attacked, and the iron turnings cut by it were less abundant. At 35 feet 1 inch, the effect of the iron on the steel was very decided. Above this point the difference increased continually with the velocity; and at 70 feet per second, only imperceptible portions of iron could be detached, whilst the gravers were attacked with the greatest violence.

Having ascertained the point at which the change in the reciprocal action of iron and steel took place, the next thing was to ascertain whether the softening of the steel was the necessary cause. The wheel was therefore cleared of the particles of steel at its edge, and put it into motion with velocities from 40 to 200 feet per second; the gravers were then applied to it for an instant only at a time, and though sensibly attacked by the iron, yet not the slightest softening could be observed.* When preserved wet, the effect was the same. When the pressure was strong and continued, then the gravers became hot and were softened; but the fracture of the steel was then very different from the fracture of the tempered portion, and the steel, when applied to the wheel, would give way before it, forming a bur: the action

*This reasoning is hardly conclusive, since the particle removed might have been heated, though the neighbouring particles were not.—*Ed. Lond. Jour.*

of the iron also on it seemed rather diminished than otherwise.

Hence MM. Darier and Colladon conclude that the effect was not due to the softening of the steel; nor, as the wheel was clean, could it be due to the particles of steel adhering to its surface; and they feel inclined to attribute it to the blow only, thinking it easy to conceive that the fragile steel may be broken by the action of the iron before it can have time to introduce itself between its molecules.

Rock crystal and agate were held to a wheel of soft iron, moving at velocities from 130 to 200 feet per second: the first was acted upon, but the surface produced was unequal and rough; the agate was also acted upon though less powerfully: but it is supposed that this means, even when much greater velocities are used, cannot be applied to the cutting of these or similar substances with advantage; at the same time the effects, though small, confirm the authors in their view of the cause of the phenomenon.

They then quote similar effects known to be due to the force of percussion, as the piercing of a plank by a ball of tallow, the force of liquids, even when moving with great velocity: when, therefore, to an edge of soft iron, moving with the velocity described, hard elastic bodies are applied, as steel, agate, &c., their particles are displaced and torn off, for they cannot move by each other without division; but when a soft body is applied to the wheel, as copper, brass, tin, and even soft steel, then the substance is pressed before the iron, and being ductile rises up in burs.

The iron wheel was replaced by one composed of 4 copper, 1 tin; but this hard and elastic alloy slipped over the bodies presented to it without producing any effect except violent vibrations. A wheel of copper was then used; steel gravers constantly cut this wheel without being touched by it: but when gravers were made of alloys, all harder than copper but softer than steel, the copper wheel immediately attacked them. Hence it appears that a small difference in the hardness of bodies requires for its compensation a much greater one in the velocities. It is remarkable, that though files and springs of steel were applied forcibly, for a long time, to the copper wheel, moving with extreme rapidity, scarcely any heat was produced; and the same was the case with the substances that were attacked by the wheel. The authors conclude by stating their opinion, that the experiments are sufficient to prove the dependence of the effect upon mere percussion, and that the softening of the steel is an accidental circumstance.

Professor Silliman, on the same subject, remarks, that the effect in question was first described by the Rev. H. Daggett, and was discovered by some mechanists belonging to the sect of shakers. The thinner the pieces of steel, the more rapid the effect: when not thicker than a common joiner's saw, they were cut almost as rapidly as wood is cut by the saw itself. It is remarked, also, that none of the ordinary operations, commenced upon cold and hard steel, will divide it with so much rapidity as this mode of applying soft iron.

M. Silliman then explains the effect, as many others have done, by considering the steel as previously heated, and softened, and then cut; but he observes that it is not "perfectly clear why even ignited steel should be so easily cut by the impinging of soft iron. No smith probably ever thought of attempting to divide steel by applying an iron tool;" so that, whether the steel be considered as hot or cold, the effect may be referred, as MM. Darier and Colladon have referred it, to percussion.

Art. XVII.—Mr. Patten's *Air Pump.*

To the Editor of the American Journal of Science, &c.

Sir,

I deeply regret that the remarks which were offered on Mr. Patten's Air Pump, in a preceding number of your Journal, should have excited any jealousy, or have produced that degree of feeling, which appears to be evinced in Mr. P.'s animadversions upon those remarks, and which differ so much from the spirit in which they were offered. I can truly state, what was before *explicitly stated* in the remarks, that I referred to the subject, "not as claiming credit" for the invention, but to propose an improvement. There are few men whose inventions, like those of Wollaston, are *perfect* at the moment of their production; and I ventured to suggest what I conceived to be an improvement of Mr P.'s invention, by which I hoped to dispense with valves, and by which the air pump can be immediately converted into a condenser; the construction of the stop-cock is, I apprehend, not perfectly understood by Mr. P.; and although he considers the suggestion of it as "a substitution altogether useless," and "an awkward alteration" of his own contrivance, yet there are *other gentlemen* who perhaps may differ from Mr. P. in opinion on this subject; but after all, the merits or demerits of the proposed improvement must rest, not on opinion, but on its *practical utility*, and on that I am entirely willing that it should stand or fall. Perhaps something similar to this may have been suggested before; there have been numerous inventions to dispense with valves; and the contrivance may have been thrown aside as useless, thus sharing the fate of many mercurial air pumps.

As to the "insinuated charge of borrowing," I am not conscious of having made that insinuation myself, but I am conscious that none was ever intended by *me*, as I am determined that my remarks shall ever be governed by *courtesy* and *candour*.

It does not diminish the credit of Scheele that, without any knowledge of what had been done, he should have discovered oxygen gas after its discovery by Priestley; and, "parvis componere magna," it is not, perhaps, disreputable to me, without any communication, directly or indirectly, with Mr. P., to have entertained notions about an air pump similar to his own, even "several months," or "several years," after he had conceived them; nor does it, I conceive, diminish aught of the praise to which Mr. P. is entitled, that another individual should have had similar notions to those he possessed.

As soon as the *practicability* of Mr. Patten's air pump is established, I shall endeavour to avail myself of its use, and, whether furnished or not with the "awkward alteration," shall cheerfully give him the whole credit to which he is entitled.

There is certainly nothing remarkable in the fact that two persons, "at no inconsiderable distance from each other," having the *same object in view*, should adopt similar means for attaining it. There are not wanting instances of persons, living in different countries, and at different periods of time, attaining the same object by similar methods, and that too *without any concert*, or *any knowledge of a prior invention*: this last remark is probably applicable to the "*balance* *beam*," and with all due deference, I would inquire, what is the difference between this *new* apparatus, either in principle or in application, and the *old* fashioned contrivance for distinguishing between a true and a counterfeit guinea? I confess that I now see none, except that the former is a more improved instrument, and the latter was limited to weighing guineas and half guineas only, in air and in water; but the fact that a similar machine was in use years ago, does not in my estimation diminish the credit due to Mr. Patten for his invention.

With great regard,
Your obt. servant,
S. F. DANA.

Hanover, N. H., March 18th 1825.

ART. XVIII.—*Analyses of several minerals, by* Prof. GMELIN, *of the University of Tubingen.* Communicated by Jeremiah Van Rensselaer, M. D.

PROF. SILLIMAN,

DEAR SIR,

I HAVE much pleasure in offering you an extract of a letter just received from my friend Prof. Gmelin, dated, "University of Tubingen in Wurtemberg, Jan. 6th, 1825."

Yours truly,
JER. VAN RENSSELAER.

New-York, Apil 21st, 1825.

"Since my last to you I have been much occupied with analyses, and shall give you some of the results obtained.

"I have discovered a beautiful mica in large laminæ to be a crystallized *Lepidolite*—that is to say, to contain lithion. It is composed of

Silica, - - - -	52.254
Alumina, - - - -	28.345
Ox. of Manganese, - -	3.602
Potash, - - - -	6.903
Lithion, - - - -	4.792
Fluoric Acid, - - -	3.609
	99.505

"This mica has a beautiful rose red colour, and occurs near Penig, in Saxony, together with amblygonite, topaz, albite, schorl, &c.

"Most of the minerals that occur in this place contain lithion; as for instance, a fine variety of quartz, lithomarge, andalusite, &c. I shall publish the analyses of all these minerals in the Edinburgh Philosophical Journal, and it will give me much pleasure to send you specimens of each.

"While on this subject, allow me to say that I have discovered a very useful test for lithion, before the blowpipe: viz. the flame assumes a very fine purple colour—but the flame of an oil lamp should be used, and not that of a tallow candle. By means of the latter the colour of the flame is not so decided.

"By an analysis of *Helvin*, a very scarce mineral, I have discovered glucine to be a constituent of it. It consists of

Silica, - - - -	33.258
Glucine, - - - -	12.089
Oxydule of manganese, -	31.817
Protoxide of iron, - -	5.564
Sulphuret of manganese, -	14.000
	96.728
Loss by ignition,	1.555

"The *Latrobite* of Mr. Brooke (Diploite of Bresthaupt) is composed, according to my analyses, of

Silica, - - - -	44.653
Alumina, - - - -	36.814
Lime, - - - -	8.291
Ox. of manganese, - -	3.160
Manganese with ox. of manganese,	0.628
Potash, - - - -	6.575
	100.000
Gain,	.121

Art. XIX.—*On Lightning-Rods.* By Jeremiah Van Rensselaer, M. D.

Read before the Lyceum of Natural History, New-York.

We hear so frequently of the destruction of lives and property by the effect of lightning, that it is surprising more effectual measures are not taken to guard against its power. In a country where the discovery was made, we should naturally expect to find it in extensive use; and yet England and France are both more zealous than the government of the United States in bringing to perfection the science of Franklin, of whom it was well said,

Eripuit cœlo fulmen, sceptrumque tyrannis.

The valuable report of M. Gay-Lussac on Parratonnerres, or lightning-rods, has been published in the Annals de Chimie, and may be advantageously consulted by translation in the Annals of Philosophy. It was drawn up at the instance of the French Academy of Sciences, and offers many very interesting observations.

The means proposed in the 3d Vol. of the American Journal of Science p. 347, for the greater security of buildings, are fully adequate to that purpose, and should be extensively adopted. With a view to draw public attention to this important subject, perhaps the following observations may be serviceable; premising that the papers of MM. Gay-Lussac, de Romas, and Charles, contain a collection of valuable and interesting observations so very generally found in the able and lucid reports made to the French Academy.

It is estimated that the velocity of electric matter, or of lightning is at the rate of about 1950 feet per second:—that it penetrates bodies, and traverses their substance with unequal degrees of velocity: that the resistance of a conductor increases with its length, and may exceed that offered by a worse but shorter conductor:—and that conductors of small diameter are worse conductors than those of larger.

The electric matter too tends to spread itself over conductors, and to assume a state of equilibrium in them, becoming divided among them in proportion to their form, and principally to their extent of surface; hence a body that is charged with the fluid, being in communication with the immense surface of the earth, will retain no sensible portion of it.

A lightning-rod is defined to be a conductor which the electric matter prefers to the surrounding bodies, in its descent to the ground for the purpose of expanding itself, and commonly consists of a bar of iron elevated on the buildings it is intended to protect, and descends, without any divisions or breaks in its length, into water or moist ground. When the rod is not perfect in its communication with a moist soil, or has breaks in it, the lightning, in its course, leaves it at that spot, for some other near body, or divides itself between the two to pass more rapidly into the earth.

It is proved by the experiments of MM. de Romas and Charles, that the higher the rod is elevated in the air, other circumstances being equal, the more its efficacy will be increased. It is announced that the most advantageous form for the extremity is that of a very sharp cone. In this country it is usual to have three points diverging—in Europe, on the continent particularly, only one is used, placed perpendicularly.

How far the sphere of action of the rod extends has not been accurately determined; but it is known that some buildings have been struck even when they had rods attached to them. This however has always taken place at a certain distance from the conductor—say 3 or 4 times its length.* It is the opinion of M. Charles, that a rod will effectually protect from lightning a circular space, whose radius is twice that of the height of the conductor. By increasing the height of the conductor, therefore, the space protected will be enlarged in proportion.

A current of electric matter, whether luminous or not, is always accompanied by heat, the intensity of which depends upon the velocity of the current. This heat is sufficient to make a metallic wire red hot, or to fuse or disperse it, if sufficiently small, so that thin slips of copper nailed to the masts of vessels afford no security. The heat of the electric fluid scarcely alters the temperature of a bar of metal, on account of its mass; and no instance has yet occurred of a bar, of rather more than half an inch square, or of a cylinder of the same diameter, having been fused, or even heated red hot

* The length of the stem, and not of the whole rod, is undoubtedly here intended. C. H.

by lightning. A lightning-rod, therefore, need not be of a greater size ; but as its stem should rise from 15 to 30 feet above the building, it would not be of sufficient strength at the base to resist the action of the wind, unless it were thicker at that end. An iron bar, about $\frac{3}{4}$ of an inch, is sufficient for the conductor of a lightning-rod.

A lightning-rod consists of two parts, the *stem* which projects above the roof into the air, and the *conductor* which descends from the stem to the ground. The stem is proposed by M. Gay-Lussac, to be a small bar of iron, tapering from base to summit in form of a pyramid, and for a height of 30 feet, which is the mean length of stems placed on buildings, the base should be about $2\frac{1}{2}$ inches square. Iron being liable to rust by action of air and moisture, the point of the stem would soon become blunt; and, therefore, to prevent it, a portion of the top, about 20 inches in length, should be a conical stem of brass or copper, gilded at its extremity, or terminated by a small platina needle, two inches long. Instead of the platina needle, one of standard silver may be substituted. The platina needle should be united by a silver solder to the copper stem ; and as it might separate, notwithstanding the solder, it should be further secured by a small collar of copper. The copper stem is united to the iron one by means of a gudgeon, which screws into each : the gudgeon, being first united to the copper stem by two steady pins at right angles, is then to be screwed into the iron stem, and secured by a pin.

The conductor should be $\frac{3}{4}$ of an inch square, and, as already mentioned, should reach from the stem to the ground. It should be firmly united to the stem, by being jammed between the two ears of a collar, by means of a bolt. The conductor should be supported parallel to the roof, about 6 inches from it, by forked stanchions, and after turning over the cornice, without touching it, should be brought down the wall, to which it should be fastened by means of cramps. At the bottom of the wall, it should be bent at right angles, and carried in that direction 12 or 15 feet.

Iron, in immediate contact with moist earth, soon becomes covered with rust, and in time is destroyed : to prevent this, the conductor should be placed in a trough filled with charcoal, in the following manner. Having made a trench in the ground about two feet deep, a row of bricks is laid on the broad side, and covered by another row placed on the edge :

a stratum of charcoal is then strewed over the bottom of the bricks, about two inches thick, on which the conductor is laid, and the trough is then filled with more charcoal, and closed by a row of bricks laid on the top. Iron, thus buried in charcoal, will suffer no change in thirty years. After leaving the trough, it is best to lead the conductor into a well, at least two feet below the lowest water mark. The extremity of the conductor should terminate in two or three branches, to afford a more ready and divided passage to the lightning into the water. If there is no well convenient, then a hole, at least six inches in diameter, should be made, ten or fifteen feet deep, and the conductor passed to the bottom of it, in the centre, and the hole then carefully filled up with charcoal, and beat down as hard as possible around the conductor. In a dry soil or rock, the trench for the conductor should be at least twice as long as in a common soil, or even longer, if then it can reach moist ground. Should it be impossible to extend the trench, others, in a transverse direction, should be made, in which are to be placed small bars of iron, surrounded with charcoal, and connected with the conductor. In general, the trench should be made in the dampest, and consequently lowest spot near the building, and the water gutters made to discharge the water over it so as always to keep it moist. Too great precaution cannot be taken to give the lightning a *ready passage to the ground*, for it is *chiefly on this that the efficacy of the lightning-rod depends.*

Iron bars being difficult to bend according to the projections of a building, it has been proposed to substitute *metallic ropes.* Fifteen iron wires are twisted together to form one strand, and four of these form a rope, about an inch in diameter. To prevent its rusting, each strand is well tarred separately, and after they are twisted together, the whole rope is tarred over again with great care. Copper, or brass wire is, however, a better material for their construction than iron. If a building contain any large masses of metal, as sheets of copper or lead on the roof, metal pipes and gutters, iron braces, &c. they must all be connected with the lightning rod, by bars of something less than half an inch square. Without this precaution, the lightning might strike from the conductor to the metal, especially if there should be any accidental break in the former, to the very serious injury of the building, and danger of the inhabitants.

Lightning-Rods for Churches.

For a tower, the stem of the rod should rise 15 or 25 feet, according to the area: the domes and steeples of churches being usually much higher than surrounding objects, do not require so high a conductor as buildings with extensive flat roofs. For the former, therefore, their stems, rising six feet above the cross, or weathercock, will be sufficient; and being light, may be easily fixed to them, without altering their appearance, or interfering with the motions of the vane.

Lightning-Rods for Powder-Magazines.

These require to be constructed with the greatest care. They should not be placed on the buildings, but on poles, at six or ten feet distance. The stems should be about seven feet long, and the poles of such a height, that the stem may rise fifteen or twenty feet above the building. It is also adviseable to have several lightning-rods about each magazine. If the magazine be in a tower, or other very lofty building, it may be sufficient to defend it by a double copper conductor, without any stem. This is done on the European continent. As the influence of this conductor will not extend beyond the building, it cannot attract the lightning from a distance, and will yet protect the magazine should it be struck.

Lightning-Rods for Ships.

The stem of a lightning-rod for a ship consists merely of a copper point, screwed into a round iron rod, entering the extremity of the top-gallant mast. An iron bar, connected with the foot of the round rod, descends down the pole, and is terminated by a crook, or ring, to which the conductor of the lightning-rod is attached, which in this case is formed of a metallic rope, connected at its lower extremity with a bar or plate of metal, and which latter is connected to the copper sheathing on the bottom of the vessel. Small vessels require but one ; large ships should have one on the main-mast, and another on the mizen-mast.

It has been proposed to have conductors fixed to the surfaces of the masts, and the electric fluid conveyed by means of strips of metal over the deck and sides of the vessel. But this mode is highly objectionable; and perhaps the best method yet devised, is to convey the electric fluid from the mast-head to the surface of the water, in a direct line, by me ns of a series of long copper links. It has come to my knowledge within a few months, that a vessel in the gulf-stream wi h powder on board, was struck by lightning and blown up, in consequence of the conductor not reaching the water, having been *loose*, and drawn on deck.

It is allowed from experiment, that the stem f a lightning rod effectually defends a circle of which it is the centre, and whose radius is twice its own height. According to this rule, a building sixty feet square requires a stem only fifteen or eighteen feet, raised in the centre of the roof. A building of one hundred and twenty feet, by the same rule, would require a stem of thirty feet, and such is often used; but i is better, instead of one stem of t at length, to have two of fifteen or eighteen feet, one being erected thirty feet from one end of the building, the other at the same distance from the other end, and consequently sixty feet from each other. The same rule should be followed for any larger or smaller building.

MISCELLANEOUS.

Art. XX.—*Description of Minerals from Palestine.* By Professor Hall.

A few months since, I had the pleasure to receive a box of minerals, and with them, a number of other objects of curiosity from the Rev. Pliny Fisk, American missionary to Jerusalem They were collected by this gentleman himself, in Egypt, Greece, and Palestine. The following is a catalogue of some of the most important of those from the Holy Land. The laoel accompanying each mineral, in Mr. Fisk's handwriting, is accurately copied, and placed immediately after each number. The name of the article is then given, and such remarks and quotations are subjoined, as are thought to be illustrative of the mineralogy and geology of that most interesting of all countries.

1. "Taken out of the river Jordan 'right against Jericho,' June 4, 1823." This is a rolled pebble of white carbonate of lime, containing thin veins of quartz.

2. "From the walls of a ruined convent on the plains of Jericho." It is an artificial composition of siliceous and calcareous pebbles, varying in magnitude from a pin's head to a small bean, and cemented together by lime. Among the pebbles I noticed one of chalcedony, which was white and semi-transparent.

3. "From the banks of the Jordan, where it issues from the lake of Tiberias." This is a dark green hornblende, partially crystallized, through which are sparingly scattered small particles of decomposing limestone. "On the shores of the lake of Tiberias, we found pieces of a porous rock resembling the toadstone of England: its cavities were filled with zeolite." Clarke's Travels. Vol. II. p. 258.

The soil, as you descend towards Tiberias, a village situate on the south-western shore of the lake of the same name, is black, and seems to have resulted from the decomposition of rocks, which have a volcanic appearance. The stony fragments, scattered over the surface, were amygdaloidal and porous, their cavities being occasionally occupied by mesotype, or by plumose carbonate of lime. (Clarke.)

5. "Taken out of the brook, where it is said, David picked up the stones, with one of which he slew Goliath." Five smooth stones, all water-worn masses of grayish white limestone

"And the Philistines stood on a mountain on the one side, and Israel stood on a mountain on the other side: and there was a valley between them." This was the valley of Elah. "As the country was then," says Dr. Clarke, "so it is now. The very brook, whence 'David chose him five smooth stones,' has been noticed by many a thirsty pilgrim, journeying from Jaffa to Jerusalem; all of whom must pass it in their way." This writer, who was an able geologist, informs us, that the country, between Jerusalem and Jaffa, is excessively rough, and broken, and the road intolerable Rich valleys there are, where he saw "plentiful crops of tobacco, wheat, barley, Indian millet, melons, vines, pumpkins, and cucumbers;" among craggy "mountains of naked limestone."

6. "From the precipice, on the brow of which Nazareth is built." It is a coarse, gray, compact limestone. This place is mentioned by St. Luke. "And they rose up, and thrust him (Christ) out of the city, and led him unto the brow of the hill whereon their city was built, that they might cast him down headlong." Nazareth, where the angel announced to Mary, that she should be the joyful mother of the Redeemer of the world, is situated, says Clarke, "on a barren, rocky elevation, facing the east," and the country around it bids defiance to agriculture It is about two leagues north from mount Tabor (Calmet): from which you have one of the finest views in Syria. (Volney.) This is an isolated mountain, of a conical form, and "appears to be a full mile in height;" paths are made on the south side, by which travellers may ascend it on horseback. At the bottom of the mountain, it looks as if it terminated in a point; but on ascending, you find, at the top, a level plain, three thousand paces in circumference, and covered with noble oaks; (D'Arvieux.) From this alpine plain, Barak, accompanied by Deborah, descended, with his little band of soldiers, to attack and annihilate the legions of the host of Sisera. Here, it is believed, the transfiguration of our Saviour took place; when Peter said to his master, "it is good for us to be here:

and let us make three tabernacles; one for thee, and one for Moses. and one for Elias." This lofty mountain, together with all the hills, in this part of Palestine, is. if the testimony of travellers may be credited, composed almost entirely of limestone.

7. "From Aceldama." St. Matthew asserts, that the chief priests, on receiving again the thirty pieces of silver, which they had given Judas Iscariot, as a reward, for betraying his Lord to them, "took counsel, and bought with them the potter's field to bury strangers in:" it was therefore called the "Field of Blood" From this "field," which is south-east from the city, in the valley of Hinnom, the specimen was taken, it is a white friable carbonate of lime. "Aceldama," or "Field of Blood," says Dr. Clarke, "belongs to the Armenians, and is still *a place of burial* It has ever been famous, on account of the sarcophogous virtue, possessed by the earth about it, hastening the decay of dead bodies"

8. "From David's cave. See 1 Samuel xxiv." It is a calcareous concretion, formerly embracing small limbs, or stocks, of vegetables, which are now decomposed and gone, leaving the mass full of little cavities Similar specimens I have broken off from the sides of a cave in Bennington, Vermont.

"Then Saul took three thousand chosen men out of all Israel, and went to seek David and his men, upon the rocks of the wild goats, and he came to the sheep-cotes by the way, where was a CAVE, and Saul went in to cover his feet; and David and his men remained in the sides of the cave." The cave was in the wilderness of En-gedi, thirty-seven miles south of Jerusalem; (Dr. Parish) and was, probably, a natural production. But what were its dimensions? We are not informed, whether Saul's army of three thousand men entered this subterranean apartment with him or not. It is likely they encamped without. But Saul himself went in "to cover his feet," and to take refreshment by sleep. The youngest son of Jesse, and his six hundred men were now lodged in the *sides* of the cavern, and, probably, at a considerable distance from their royal master. A conversation was held, between David and his soldiers, who urged him to take the life of his enemy, whom the Lord had now placed in his power, and who had so often barbarously attempted *his* destruction. But David, shuddering at the suggestion of effecting kingly homicide, and, wishing to set a better example before those who would surround the throne, when he should wield the royal sceptre, boldly refused to imbrue his hands in the blood of the "Lord's anointed." He, however, ventured, while the king was sleeping, to "cut off the skirt of his robe." Saul arose, and departed, without discovering David, or any of his attendants. Although we have no data for determining the exact dimensions of the cave, it may, from the above remarks, safely be inferred, that it was *capacious;* such a one, as is rarely met with, except in limestone regions. Indeed the structure of the specimen before us, plainly shows, that it must have been formed from the oozing of water, charged with calcareous matter, through the roof of the cavern.

Travellers assert, that immense caverns, both natural and artificial, exist in other parts of Palestine, which now serve as temporary retreats for the plundering Arabs. To these caves the Israelites often fled for safety, when their country was invaded by foreign enemies

9. "From a hill west of Jerusalem, which overlooks the city." A reddish gray, siliceous carbonate of lime, capable of being wrought into a coarse kind of marble.

10. "From the tomb of Huldah, the prophetess, on mount Olivet." This is a handsome white marble, having a smooth and conchoidal fracture. The mount of Olives, is a steep hill, on the east of Jerusalem, the valley of Jehoshaphat lying between it and the city; (Calmet.) "Towards the south," says Dr. Clarke, who witnessed what he describes, "appears the lake Asphaltites. Lofty mountains enclose it with prodigious grandeur. To the north of the lake are seen the verdant and fertile pastures of the 'Plain of Jericho,' watered by the Jordan, whose course we distinctly discerned. Nothing else appears in the surrounding country, but hills, whose undulating surfaces resemble the waves of a perturbated sea. We found a grove," he adds, "of aged olive-trees, of immense size, covered with fruit, almost in a mature state." On this mount, many touching scenes have been exhibited. David, fleeing from the destruction threatened by his wicked and unnatural son, "went up by the ascent of mount Olivet, and wept as he went up." When arrived at the summit, an ancient author beautifully remarks, "flens et nudis pedibus, Deum adoravit." On this eminence stood the Saviour, in full view of the city, when he wept over Jerusalem, and, in the most melting language, foretold its tremendous overthrow.

11. "From Tiberias." This is unquestionably one of the fragments, which Dr. Clarke, in the sentence, quoted under No. 4. calls "amygdaloidal." It is of a dark brown colour, is very compact, and heavy,—is not operated on by the acids;—is feebly magnetic, and contains a few pores, which are filled with a friable carbonate of lime. It is evidently a variety of amygdaloid.

12. "From the valley of Jehoshaphat." This valley is on the east of Jerusalem, and the brook Kidron, where there is no water, except during part of the year, runs through the middle of it. The specimen is a pale white granular limestone.

13. "Broken off from the rock over the pool of Siloah."

14. From the pool of Siloah, where the water makes its appearance the second time. The spring issues from a rock, and runs into a silent stream. It has a kind of ebb and flow. Both these specimens are limestone; the former of a light gray colour, and the latter white, and might be wrought into a very beautiful marble. "Regaining the road, which conducts towards the east, into the valley of Jehoshaphat, we passed the *Fountain of Siloa*, and a white mulberry-tree, which is supposed to mark the spot where the Oak Rogel stood." Clarke.) This mulberry-tree is mentioned by Pococke, who remarks, "near this pool, at a *white mulberry-tree*, they say, Isaiah was sawn asunder, by order of Manasseh, and here, it is believed, he was buried, under the Oak Rogel." The Fonntain of Siloam, according to Josephus, is situate in the valley of Hinnom, which is on the south-east of Jerusalen, and was not included within the walls of the ancient city.

15. "From the grave of Lazarus." It belongs to that variety of Limestone, which Brongniart denominates *Chaux Carbonatée Saccaroide*. It has a granular texture, bearing a considerable resemblance to that of loaf sugar, and yet its structure is distinctly lamellar.

16. "From mount Zion." Three specimens of reddish gray siliceous limestone, having a smooth fracture, a little conchoidal. On application of the acids, a moderate effervescence is produced. A part of mount Zion, which was anciently comprehended by the walls of the city, is now excluded. Jerusalem. according to Dr. Clarke, occupies at present only one eminence—that of mount Moriah. on which Solomon's temple once stood; and on which now stands a

superb mosque. The views of the edifice, (into which no Christian is allowed to enter,) struck this gentleman so forcibly, that he, unhesitatingly, pronounced it to be "the most magnificent piece of architecture in the Turkish empire, and far superior to the mosque of St Sophia in Constantinople." Mount Zion is situate on the south side of the city. "On quitting the city by 'Zion Gate,' and descending," says Dr. Clarke, "into a narrow dale, sloping towards the valley of Jehoshaphat, we observed upon the sides of the opposite mountain facing Mount Zion, a number of excavations in the rock. We rode towards them, their situation being very little elevated above the bottom of the dale, upon its southern side. When we arrived, we instantly recognised the sort of sepulchres, which had so much interested us in Asia Minor. They were all of the same kind of workmanship, exhibiting a series of subterranean chambers, hewn with marvellous art, each containing one, or many, repositories for the dead, like cisterns, carved in the rock, upon the sides of those chambers. The doors were so low, that to look into any one of them, it was necessary *to stoop*, and in some instances, to creep upon our hands and knees; these doors were grooved, for the reception of immense stones, once squared and fitted to the grooves, by way of closing the entrances. Of such a nature were, indisputably, the "tombs of the sons of Heth, of the kings of Israel, of Lazarus, and of Christ." (Clarke.) These sepulchres were discovered by this English traveller, who adduces several weighty arguments to prove, that among them was the sepulchre of Joseph of Arimathea, in which the body of the Saviour was interred. This supposition, he believes, accords far better with the scriptural account of Christ's interment, than that of the place, where the superstitious Helena caused to be erected the "church of the Holy Sepulchre." The cemeteries of the ancients were universally excluded from the precincts of their cities. These tombs are without the walls of both the ancient and modern city. The place where the church of the Holy Sepulchre stands, is within the walls of the present, and was within the walls of the old city. It is extremely probable, that the report of the tomb of Christ being where the church now is, was one of the "pious frauds," of the Catholics, invented for some reason unknown to us.

17. "North of Jerusalem." A light gray hornstone; fracture splintery, translucent at the edges, yields fire copi-

ously with steel. It resembles the hornstone of Saratoga, N. Y. but its colour is a shade lighter.

18 "From the sepulchres of the kings north of Jerusalem." This specimen is compact limestone, approaching granular limestone. The mass is nearly milk white, but the surface, on one of its sides, is of a blood red aspect, coloured perhaps, with an oxide of iron. It might be manufactured into a very handsome marble.

19. "Broken off from one of the doors in the tombs of the kings." Nos. 18 and 19 are very similar minerals, and are both from the same place.

20. "From the tombs of the Sanhedrim, north of Jerusalem." The specimen appears to be an artificial production, composed chiefly of lime, and painted on one side of a grass green colour. It is *fetid* On heated iron it phosphoresces, yielding a greenish whi e light.

21. "From the tomb of Jesse, near Hebron." This is a reddish gray siliceous limestone. "Hebron was built" says Mo-es, "seven years before Zoar in Egypt." "And Joshua blessed Caleb, and gave unto him Hebron for an inheritance." This city is situate twenty miles south of Jerusalem. Here David's first coronation took place. "And the men of Judah came, and there they anointed David king over the house of Judah." Here the rebellion of Absalom commenced. This was one of the "cities of refuge." "Hebron is now only a village, standing partly on a plain, and partly on a mountain, from which is a pleasant prospect of the plain of Mamre, planted with vineyards. The peasants of Hebron cultivate cotton, which is spun by their wives, and sold at Jerusalem and Gaza." (Volney.)

22. "From the tomb of Haggai, Zechariah, and Malachi, on Mount Olivet." Common gray compact limestone.

23. "From Mount Lebanon." A reddish gray compact limestone.

24. "From Mount Lebanon," coloured brown on one side.

25. "From Mount Lebanon, near the convent of Mar Hannah Tonere." This specimen is a fine-grained, granular limestone, of a gray aspect.

26. "From Mount Lebanon, near the cedars." Gray compact limestone.

27. "From Mount Lebanon." Dark brown hornblende-rock. It is a fragment of a globular mass, which may have

been transported from some other quarter, to the place where it was found. Judging from the other specimens, taken from different parts of the mountain, I conclude that the principal ingredient in the formation of this lofty protuberance, so well known to the ancients, and so celebrated in scriptural poetry, is calcareous matter. This conclusion is corroborated by a remark of Burckhardt, who asserts, that he had visited the summit of Libanus, and discovered that it "consisted wholly of limestone, but it was chiefly primitive limestone." He, however, informs us that he observed one "fossil shell" on the top of the mountain.

In the autumn of 1823, Mr. Fisk, accompanied by Mr. Wolff, visited this lofty eminence; on some parts of which the snow continues through the hot season, undissolved. In roughness, he found it altogether Alpine. I will give you his own language "We first ascended a very steep mountain, and then descended one of the steepest I ever attempted to pass. The road turns so often as nearly to double the distance, and yet it is almost impassable. We often crossed narrow ways, with a stupendous precipice above us of immense rocks, piled up almost perpendicularly, and a similar one below us." In another place, he says, "at half past nine, we left Tripoli, rode over a plain, and ascended the mountains, till we reached a lofty summit, with a valley before us, which I cannot better describe, than by calling it a frightful chasm in the earth. We dismounted, and descended literally by winding stairs, nearly to the bottom of the ravine, and then, after various windings and gentle ascents among the shrub oaks, we reached the convent Antonius, situate on the side of an almost perpendicular mountain."

Mount Lebanon, bleak, wild, and precipitous as it is, contains a large population. The number of Christians spread over it, is estimated at 100, or 150,000 who have, Mr. F. supposes, 100 convents on the mountain.

The ancient ornaments of Lebanon—the cedars—in procuring which, for the building of the temple and of other edifices, Solomon kept ten thousand men constantly employed on the mountain, during a considerable period, have not all disappeared. One grove of them still remains. Messrs. Fisk and King examined them "They are situate" not on the summit, but "at the foot of a high mountain, in what may be considered as the arena of a vast amphitheatre, opening to the W. with high mountains on the N. S. and E. The cedars stand on five or six gentle elevations, and occupy a spot of ground, which I walked around in 15 minutes. We measured a number of trees. The largest is upwards of 40 feet in circumference." Several others they found of nearly equal girth. The height of some of the tallest is 90 feet. The entire number of cedars, and these are all which are to be seen on the mountains, according to Mr. King, is 321. "They produce a conical fruit, in shape and size like that of the pine." Of this fruit, and also of the chips of the cedar, Mr. Fisk has had the goodness to transmit to me a number of specimens. The cones are about three inches long, and one inch and a half in their transverse diameter, are much more compact than any fruit of a similar kind in New-England.

28. "From a wall at the place where it is said that Abraham received and entertained the angels. The wall is composed of very large stones, some of them 10 feet long, and I think 3 or 4 feet high, all apparently of the same kind with this sample." This is a very singular substance. It appears to be a kind of calcareous Breccia, in whose composition is infused a small proportion of magnesia. Its exterior surface is pale red, interspersed with spots of gray. It is unctuous to the touch. It is composed, in part, of rounded calcareous pebbles, of different magnitudes, cemented together by lime. Two or three fossils appear in the mass, with which I am unacquainted. Its powder, when placed on burning charcoal, phosphoresces, giving out a very beautiful, yellow light. It dissolves in nitric acid with effervescence. "And the Lord appeared unto him, Abraham,) on the plains of Mamre: and he sat in the tent door in the heat of the day, and he lifted up his eyes and looked, and lo, three men stood by him, and, when he saw them, he ran to meet them from the tent door, and bowed himself toward the ground, and said, my Lord, if now I have found favour in thy sight, pass not away, I pray thee, from thy servant: let a little water I pray you, be fetched, and wash your feet, and rest yourselves under the tree. "Near Hebron," says Calmet, "stood the oak, or turpentine tree, under which Abraham received the three angels." This tree, Solomon affirms, though hardly credible, was standing in the *fourth century*, highly honoured by pilgrimages and annual feasts.

Not far from this spot, was the "field," which Abraham bought of Ephron the Hittite,—(the earliest purchase of land ever made) for a burying-place, and for which he gave "four hundred shekels of silver." In the field was the cave of Machpelah, where the weeping patriarch deposited the body of his beloved Sarah, the companion of his long pilgrimage, and where his own body was destined to sleep, till it shall hear the sound of the archangel's trump, calling it to life immortal. Here, too, were entombed Isaac and Rebekah, Leah and Jacob. What a company of worthies! The very dust of this sepulchral cavern will constitute a part of the noblest inhabitants of the heavenly Paradise. Well may the spot be venerated as it is, by the followers, both of the crescent, and of the cross.'

"We left the main road," says D'Arvieux, "from Bethlehem to Hebron, about a league from the latter place, and turned to the left, in order to see the valley of Mamre, where Abraham dwelt. The foundations, and some very thick walls, of hewn stone, are all that remain of the church, built here, by the bishop of Jerusalem, in the days of Constantine." Over the cave, where the patriarchs were interred, St. Helena, travellers inform us, erected a magnificent church. From the walls of one of these edifices, and, probably from the former, Mr. Fisk took the above specimen.

29. "A fragment of a column in the ruins of Capernaum." An extremely beautiful granular marble, which has all the freshness and brilliancy of a specimen recently taken from a natural quarry. It has been full proof against the attacks of the elements, during the lapse of perhaps two thousand years. Although limestone is softer than granite, it is less liable to decomposition. This remark accords with the observation of several travellers in Egypt, Greece, and Palestine. It appears, that the feldspar of the granite, is affected by the action of air and moisture, sooner than either of its other ingredients. "Of all natural substances used by the ancient artists," says Dr. Clarke, "Parian marble, when without veins, and therefore free from extraneous bodies, seems to have best resisted the various attacks made upon Grecian sculpture. It is found unaltered, when granite, and and even porphyry, coeval as to their artificial state, have suffered decomposition."

The town of Capernaum, from the ruins of which the specimen was taken,—a town, blessed by being the residence of the Saviour, during most of the period of his ministry, or rather *cursed*, for its inhabitants disregarded his celestial instructions, and have, therefore, as he predicted, been brought "down to hell,"—stood "upon the sea-coast (St. Matthew); that is, the sea of Tiberias, or of Chinnereth, and according to Carey's map, on the north shore, near where the Jordan enters it. The place is now said to be without inhabitants.

30. "From the prison of Jeremiah." Partially decomposed carbonate of lime. "Then took they Jeremiah, and cast him into the dungeon of Malchiah, that was in the court of the prison: and they let down Jeremiah with cords. And in the dungeon there was no water, but mire: so Jeremiah sunk in the mire" The prison in which the prophet was confined, it is likely, is near where the temple was situate.

31. "From Mount Carmel." Several oblong, irregular nodules of dark brown flint, enveloped, in some instances, by a covering, probably siliceous, on which the nitric and sulphuric acids produce no effect; and in others by a coating of chalk, which these acids dissolve with copious effervescence. The fracture of the flint is smooth and conchoidal. The characters of this mineral are precisely the same as those of the flint I have taken from a chalk bed in Oxfordshire, England. These specimens, if I may judge from their appearance, came from a similar locality on Mount Carmel.

But "chalk," says Mr. Woodbridge in his generally accurate and excellent system of Universal Geography, "has never been observed in America, Asia, Africa, or the south of Europe." The assertion is too strong. After examining these specimens of flint, surrounded by chalk, Mr Woodbridge could not, I am persuaded, feel inclined to maintain that there was no locality of chalk in Asia. This substance has been found in America. "About 35 miles above the mouth of the Ohio river, on the west side of the Mississippi, is an extensive chalk-bed, where vast quantities of this mineral are procured. Pervading it are found strata of flint in nodules, from two to four inches thick." (Schoolcraft's View of the Lead Mines.)

32. "A number of other specimens, from Mount Carmel." In a letter to the writer, Mr. Fisk remarks, "I had heard very often, that on one of the summits of Mount Carmel there were very curious petrifactions of fruit. The Arabs said, there were watermelons, and many sorts of smaller fruit, so perfect that, at first sight, you would take them for actual

fruit. In my late journey from Jerusalem to this place, (Beyroot,) I determined to investigate this matter; and, with two Arabs who knew, or at least pretended to know, where the watermelons were to be found, I ascended the mountain. We found no watermelons, but we found, in the mountain which is formed of calcareous stone, some very curious formations, of which I send you several samples. I am not surprised that the ignorant Arabs should have mistaken them for petrified fruit."

They are, indeed, very extraordinary siliceous concretions. A number of fragments of different sizes were forwarded, together with one entire concretion. This I shall describe. It is about the magnitude of a twelve pound cannon-ball; not a perfect globe, and yet not deviating widely from that form. Its surface is a light ash-gray, and formed of chalky carbonate of lime, which effervesces on application of the nitric acid. It bears some resemblance in its aspect, to the nodules of flint taken from chalk quarries, and exposed a considerable time to the action of the elements.

By a smart blow of a hammer, it was divided in the middle. The interior thus laid open to the light presented several interesting substances. The outer layer, nearly an inch in thickness, consists of a yellowish gray hornstone, having a smooth fracture, and yielding sparks, easily and abundantly, with steel. This surrounds a thin stratum of very beautiful milk-white chalcedony. In the centre of the concretion is an irregular cavity, lined with very perfect crystals of limpid quartz. On one side of the cavity is a mass, an inch in diameter, of a light coloured friable limestone.

All the concretions are hollow; but the cavities in the different specimens are surrounded by different materials. In one, the inner surface is composed of translucent, and almost transparent botryoidal chalcedony. In another, the surface of the botryoidal chalcedony is covered with a white, smooth, unctuous, siliceous matter. In a third, it is surmounted by a countless number of elegant, pearly, microscopical crystals of quartz. In a fourth, is a small mass of semi-opal, containing cavities.

Allusion is unquestionably had to these stones, in a paragraph of Dr. Clarke's Travels. "Djezzar Pacha, of Acre,' says he, "informed us that upon Mount Carmel, he had found several thousand large balls, and never could discover a cannon to fit them." In a note it is added, "We supposed that by these balls Djezzar alluded to mineral concretions of a spherical form, found in that mountain. As the Turks made use of stones, instead of cannot-shot, it is probable that Djezzar, who was in great want of ammunition, had determined upon using the stalagmites of Mount Carmel for that purpose." When I first read Clarke, I had not the most distant expectation of ever having the pleasure, personally, to examine specimens of these singular stones.

33. "Picked up near the shore of the Dead Sea." It is a small fragment of flint, partly of a flesh-red, and partly of a brown colour.

34. "From a mountain near the Dead Sea." This is a dark gray bituminous limestone. Before the blowpipe, it inflames, sends forth a dense smoke, a strong bituminous odour, and becomes bleached. I have never before seen limestone which contained so large a proportion of bitumen.

35. "This stone was taken from a mountain near the Dead Sea. I afterwards put it on hot coals, and it gave out a strong stench of *sulphur*, (of *bitumen*, it is presumed, as I could perceive no odour of sulphur from No. 34, which is beyond question the same kind of stone,) and, for about two minutes, a blaze four or five inches high. Before burning, it was of a dark colour, and much harder than now." "The black fetid limestone of the lake Asphaltites" (the same as No. 35,) "is," says Clarke, "manufactured and sold at Jerusalem for amulets. It is worn in the east as a charm against the plague."

A multitude of unfounded reports have long been in circuculation, and have gained admittance into many valuable works, respecting the dreariness and insalubrity of the lake Asphaltites, and of the region of country around it. It has been affirmed that fish could not live in its waters; that no substance would sink in them; that every kind of matter thrown into the lake, however heavy, would instantly be pressed to its surface; that, owing to the destructive exhalations which perpetually proceed from the water, every bird that attempted to fly over it fell lifeless on its surface; that dismal sounds issue from it, like the stifled clamours of the people who were ingulphed in its flood; and that a very beautiful fruit grows on its margin, which is no sooner touched than it becomes "dust and bitter ashes." These and a thousand other wonderful tales of a similar character, modern travellers have discovered to be entirely fictitious.

"About midnight," says Chateaubriand, "I heard a noise upon the lake, which the Bethlehemites told me proceeded from *legions* of small fish, which come and leap about upon the shore." Dr. Clarke remarks, "that the waters of this lake, instead of proving destructive of animal life, swarm with myriads of fishes; that shells abound on its shores, and that certain birds, instead of falling victims to its exhalations, make it their peculiar resort."

"We saw a great number of birds," says Mr. Fisk, "flying about its shores, and I once observed three or four flying over the water."

"The water of the Dead Sea," adds this excellent missionary, "looks remarkably clear and pure; but, on taking it into my mouth, I found it nauseous and bitter, I think, beyond any thing I ever tasted."

The waters of this lake are, indeed, heavier than those of any other lake or sea on the face of our planet. Their specific gravity is 1.211, distilled water being 1.000. They are almost completely saturated with saline matter. A bottle of this water was analyzed by Dr. Marcet of London, in 1807. In 100 grains of it he found

	Grains.
Muriate of lime, - -	3.920
Muriate of magnesia -	10.246
Muriate of soda, - -	10.360
Sulphate of lime, - -	.054
	24.580

In 100 grains of the water there are 24½ grains of salt. A person can swim more easily in the Dead Sea than in fresh water, or in the ocean. A substance which would sink in ordinary salt water, will, consequently, be urged to the surface in this sea. Strabo asserts, "that men could not dive in this water;" which is not strictly true, and "that going into it, they would not sink lower than the navel." This is probably correct. Pocoke, who bathed in it, affirms, "that he could lie on its surface, motionless, and in any attitude, without danger of sinking." This is no exaggeration. Most people can do the same, even on fresh water, provided they do not allow the gravity of their bodies to be increased by swallowing the water

Dr. Clarke is, if I mistake not, the first traveller who has asserted, that one of the mountains which enclose the Dead

Sea (a sea which is 60 or 70 miles in length, and from 10 to 20 in breadth (Marcet); once the abode of the voluptuous and inhospitable inhabitants of the plain) was anciently a burning volcano. From the heights of Bethlehem, he observed. he says, "a mountain on the western shore of the lake, resembling in form the cone of Vesuvius, and having a crater upon its top, which was plainly discernible." If this be the fact, may not the enemies of Moses and of the Bible affirm, that the destruction of the cities of Sodom and Gomorrah was not a miraculous event, but merely the consequence of a natural and necessary eruption of lava from this mountain?

From the above described specimens, and from the remarks of travellers which have been quoted, it may, I think, fairly be inferred, that a large proportion of Palestine is of limestone formation. Dr. Clarke asserts, from personal observation, that "the rocks of Jerusalem are all compact limestone;" that the numerous tombs in the neighbourhood of the city "are hewn in a hard compact limestone;" that between Nazareth and Genesaret, he saw hills of the same substance. He speaks often of the "limestone rocks of Judea;" mentions that the road from Acre to Nazareth passes over "sterile limestone;" and, indeed, asserts that the prevailing constituent of all the mountains in Palestine is limestone.

From the specimens in our hands from Bethel, from Jericho, from Capernaum, from Nazareth, from Mount Tabor, Mount Carmel, and from Mount Lebanon, on the north of Jerusalem; from David's Cave at En-gedi, on the south; and from the mountains around the Dead Sea, on the south-east; we should be led to the same conclusion: that the Holy Land, the residence of the patriarchs, the birth-place of true religion, the land which witnessed the ministry, listened to the agonies, and drank in the blood of the Son of God, is composed almost entirely of limestone.

Art. XXI.—*Notice of a Meteoric Stone, which fell at Nanjemoy, Maryland, February* 10*th*, 1825; by Dr. Samuel D. Carver.

[Extracted from two letters to the Editor, dated Nanjemoy, Md. March 10th, 1825, and April 29th, 1825.]

I take the liberty of forwarding you a notice of a meteoric stone which fell in this town on the morning of Thursday, February 10th, 1825. The sky was rather hazy, and the wind south-west. At about noon the people of the town, and of the adjacent country were alarmed by an explosion of some body in the air, which was succeeded by a loud whizzing noise, like that of air rushing through a small aperture, passing rapidly in the course from north-west to south-east, nearly parallel with the river Potomac. Shortly after, a spot of ground on the plantation of Capt. Wm. D. Harrison, surveyor of this port, was found to have been recently broken, and on examination a rough stone of an oblong shape, weighing sixteen pounds and seven ounces, was found about 18 inches under the surface. The stone when taken from the ground, about half an hour after it is supposed to have fallen, was sensibly warm, and had a strong sulphureous smell. It has a hard vitreous surface, and when broken appears composed of an earthy or siliceous matrix of a light slate colour, containing numerous globules of various sizes, very hard and of a brown colour, together with small portions of brownish yellow pyrites, which become dark coloured on being reduced to powder. I have procured for you a *fragment** of the stone weighing *four pounds and ten ounces*, which was all I could obtain. Various notions were entertained by the people in the neighbourhood on finding the stone. Some supposed it propelled from a quarry 8 or 10 miles distant on the opposite side of the river; while others thought it thrown by a mortar from a packet lying at anchor in the river, and even proposed manning boats to take vengeance on the captain and crew of the vessel.

I have conversed with many persons living over an extent of perhaps fifty miles square—some heard the explosion, while others heard only the subsequent whizzing noise in the air. All agree in stating that the noise appeared directly over their heads. One gentleman, living about 25 miles from the place where the stone fell, says that it caused his whole plantation to shake, which many supposed to be the effect of an earthquake. I cannot learn that any fireball or any light was seen in the heavens—all are confident that there was but one report; and no peculiar smell in the air was noticed.

I herewith transmit the statement of Capt. Harrison, the gentleman on whose plantation the stone fell.

* This specimen is not yet received.—Ed.

Statement of W. D. Harrison, Esq.

On the 10th of February, 1825, between the hours of 12 and 1 o'clock, as nearly as recollected, I heard an explosion, as I supposed, of a cannon, but somewhat sharper. I immediately advanced with a quick step about twenty paces, when my attention was arrested by a buzzing noise, resembling that of a humming bee, which increased to a much louder sound, something like a spinning-wheel, or a chimney on fire, and seemed directly over my head; and in a short time I heard something fall. The time which elapsed from my first hearing the explosion, to the falling, might have been fifteen seconds. I then went with some of my servants to find where it had fallen, but did not at first succeed; (though, as I afterwards found I had got as near as 30 yards to the spot,) however, after a short interval the place was found by my cook, who had, (in the presence of a respectable white woman.) dug down to it before I got there, and a stone was discovered from twenty-two to twenty-four inches under the surface, and which, after being washed, weighed sixteen pounds—and which was no doubt the one which I had heard fall, as the mud was thrown in different directions from thirteen to sixteen steps. The day was perfectly clear, a little snow was then on the earth in some places which had fallen the night previous. The stone when taken up had a strong sulphureous smell, and there were black streaks in the clay which appeared marked by the descent of the stone. I have conversed with gentlemen in different directions, some of them from 18 to 20 miles distant, who heard the noise, (not the explosion.) They inform me that it appeared directly over their heads. There was no fire-ball seen by me or others that I have heard. There was but one report, and but one stone fell, to my knowledge, and there was no peculiar smell in the air. It fell on my plantation, within two hundred and fifty yards of my house, and within one hundred of the habitation of my negroes.

I have given this statement to Dr. Carver, at his request, and which is as full as I could give at this distant day, from having thought but little of it since. Given this 28th day of April, eighteen hundred and twenty-five.

W. D. HARRISON,
Surveyor of the port of Nanjemoy, Md

Art. XXII.—*Notice of a Cave containing Bones, in Lanark, Upper Canada.** By John I. Bigsby, M.D. F.L.S. &c.

Prof. Silliman,

Dear Sir,

You are perhaps not aware that a cave containing bones was discovered last autumn, in the township of Lanark, Upper Canada, on the river Mississippi, a branch of the Ottawa. It is 23 miles north of the village of Perth. It is 10 feet below the surface, with which it communicates by a sort of shaft just large enough to admit of the entrance of a man. This shaft or passage leading down into the cave is 2 feet three inches wide by 1 foot nine inches broad The cave is 25 feet long by 15 broad, and is 5 feet high in the middle, gradually lowering at each end: at the extremity most remote from the shaft, there is a fissure 2 feet by six inches, and therefore too small to allow of further penetration. The floor of the cave is covered with fragments of the dark coloured granular limestone of which it is formed. The sides and roof are covered with small mammillary concretions of calcspar. The bones are in the state of grave-bones, very large—and were chiefly found in a heap near, but not under, the aperture from above—others were found scattered among the debris of the floor. This aperture was open when it was discovered by Mr. Colquhoun, the owner of the ground. In clearing the land he observed the hole at the foot of a tree, and curiosity induced him to descend.

Mr. Robe of the Royal Staff Corps, from whom all my information is derived, tells me that the animal whose bones are found in this cave, is much too large to have entered the cave alive or whole.

In November last I saw a hint of this discovery in a Canadian newspaper. I was at Philadelphia; but immediately wrote to this enterprising and intelligent officer who was residing at Montreal. He took horse directly, and went to the spot, at the distance of 200 miles into the forest, examined the cave, and by favour of Dr. Wilson, of Perth, brought all the bones to Montreal.

* Extracted from two letters to the Editor, dated Philadelphia, February 4th, 1825, and March 4th, 1825.

I have not yet received the bones, but they will be in New York within a few days at my disposal. I put the question respecting the matters covering the floor of the cave, in the fullest form, to Mr. Robe, and particularly drew his attention to the probable occurrence of rolled stones, mud, &c. supported or invested, together with the bones, by a layer of stalagmite—no mention is made in his letter of such appearances.

I intend to offer you a paper on the Geography and Geology of the Lake of the Woods, but I cannot now say when it will be ready; as that partly depends on a map at present unfinished. The matter would be novel and interesting, including the calcareous formation north of the valley of the St. Lawrence.

Art. XXIII.—*Notice of* Prof. Eaton's *Geological Survey of the District adjoining the Erie Canal.*

Mr. Jeffrey, the principal conductor of the Edinburgh Review, has obtained the opinion of Professor Buckland, the celebrated author of the *Reliquiæ Diluvianæ*, on the above work of Professor Eaton. In a letter to the Hon. S. Van Rensselaer, Mr. Jeffrey has given the result. Mr. Buckland says, that the "*author seems both to understand his subject, and to have done his work carefully*." The work contains indeed abundant evidence of extensive and patient examination. This point will not be affected by the adoption or rejection of Mr. Eaton's peculiar views by our geologists. In some parts there is an evident improvement upon some of his previous publications on the geology of our country. Thus at page 31, and page 62, and onwards, we find introduced "Primitive Argillite," a rock so clearly separated, and so easily distinguished in our country from "Transition Argillite," though both are united under the latter name by Bakewell and some others.

Mr. Buckland makes some objection to the *style*, and complains of Mr. Eaton for "affecting some needless novelties in technical language." However true this charge may be, the censure is feeble when compared with the commendation contained in the previous quotation. In our country, the work has been censured for this fault, and more particularly for the introduction of rocks or localities which do not belong to the district which is described. In this way unity is not preserved, and the continuity of the description is much interrupted We do not object to this in that part of the work, entitled, "General Descriptions of North American Rocks," though some have said that these can hardly belong, in a general view, to the district of the canal. But in the "Description of rocks in the vicinity of the Erie Canal," p. 47, the fault often occurs. We mention the account of the hornblende rocks near West-Point, p. 54; of granular quartz, pp. 56, 7; of granular limestone, pp. 57, 8; and many others, which are not found near the line of the canal.

If the work should pass to a second edition, which is highly probable, and even rendered somewhat necessary to make it as complete as the subsequent examinations of Professor Eaton enable him to do, and as the light thrown on the subject of the newer formations by the very able work of Conybeare & Phillips on the geology of England and Wales seems to require, we would suggest as an *improvement* of the work, that the notices of rocks which are not found along the line of the canal, be omitted in this part of the work, or be reduced to the bare remark, that they do not occur in the district, and that the remarks and localities of rocks, in other parts of the country, be taken from the text, and put into the form of notes. In this way the continuity of the geological description of the country along the canal will be unbroken. We think no one can read the work without being sensible of its interest and importance, to every one who examines the rocks of this district. The localities are given with much precision, and the traveller is enabled at once to ascertain the rocks intended by the names which Professor E. has given them. It were to be wished that the common nomenclature of the rocks had been altered with a more sparing hand. C. D.

Art. XXIV.—*On the Infinite Divisibility of a Finite Quantity of Matter* By Sheldon Clark, Esq. of Oxford, Ct.

Truth is always consistent with itself. Any proposition which involves an impossibility cannot be true. Says one, I will draw a line from A ——10—— B, and, if you will move your penknife first over half of it from A to B, and then over half the remainder, and again over half the remainder, and in the same ratio keep moving your knife, as fast as you can, and you can never move it from A to B Experience proves that one can move his knife from A to B; and what experience proves is always true: therefore the proposition involves an impossibility. The proposition is predicated on the opinion, that every finite line contains an infinite number of parts of smaller lines, which can be divided ad infinitum But it is impossible that a finite line can contain an infinite number of parts, or smaller lines; for any number of equal parts into which every finite line can be divided, will be a definite number of parts, of equal lengths; and all the parts being equal to the whole, if you keep constantly taking the parts of a finite quantity, you will, if you take fast enough, eventually take the whole. If you first take half the parts, and then half the remainder, and again half of the remainder, and so on, according to this ratio, you will eventually have but one part left, out of any definite number of parts whatever. If the line be divided into parts as small as they possibly can be, so small that no one of them can possibly be any smaller; if you have moved the knife to within the least possible part of the end of the line, or over all the definite parts of it but the very last one; if this last remainder be the least possible part of the line, how can it be divided into less remainders? If it is now the least possible part, how can it be divided into less parts? Suppose you put the point of your knife on the end of the line at B, and move it the least possible part of the line towards A, is it not clearly perceived by the mind, that the part moved over is as small as any part possibly can be; that it cannot contain parts smaller than itself? for no part can be less than the least possible; therefore the least possible part is indivisible. For this reason, when there is but one part of the line left, and that the least possible, if you move the knife any further, you must move it to the end of the line. It is asked, if the least possible part of the line has not a beginning, a middle, and an end? Every indivisible part has a beginning and an end; but there is no absolute distance between them, though the beginning and the end together make absolute distance. The least possible part is so small that it cannot be divided into halves, each of which shall have a beginning, a middle, and an end, and an infinite number of smaller parts; which is proved by the fact that we can move over it. Whereas, if the least possible part of any line did contain, and could be divided into, an infinite number of infinitely divisible parts, and we were to move, as we necessarily must, first over half these parts, then over half the remainder, and so on in this ratio, we could never. to all eternity, move over all the parts of the least possible part; for there would always be half of a remainder left. But the fact is, there is no absolute distance between the beginning and the end of the least possible part, for such a part itself is as indivisible as the centre of a circle. The impossibility involved in the proposition is, that the last remaining part cannot be divided into halves. Therefore, when in moving over any finite line, we have moved over all the least possible parts of it but one, if we move any further, we must move over that one, which brings us to the end of the line.

N. B. The reason why the lines of the Asymtotes will never come in contact, is because they approach each other so slowly. According to the nature of their approaching, it must take to all eternity for them to touch each other Suppose that one should move so slowly that it would take to all eternity to go from his house to his office, how long would he be in going half the distance? Would he be as long as he would be in going the whole distance?

How to divide a Finite Material Line into indivisible parts.

First describe a circle, and make its diameter the line to be divided. The centre of a circle is indivisible, and so is the line of its periphery, taken lengthwise; the diameter, or line to be divided, therefore, has three indivisible points: its centre, which is the centre of its circle, and its points of union, with its periphery. Each of the semi-diameters will be divided into as many parts as you describe circles within its own circle. Now if you describe its own circle perfectly full of lesser circles, that is, if you make the indivisible periphery of the first inner circle to come into actual contact with the indivisible periphery of its own circle,* and the indivisible periphery of the second inner circle into actual contact with

* Viz. of the circle of which the given line is the diameter.

the indivisible periphery of the first inner circle, and so on, you divide the diameter, i. e. the given line, into indivisible parts, and in going from the periphery of the outer circle on this line to the centre, you are continually passing over indivisible peripheries.

Art. XXV.—*On the origin of Ergot.** By Gen. Martin Field.

Prof. Silliman,

Dear Sir,

During the last summer, I spent sometime, with a view of investigating, if possible, the origin or cause of *Ergot, or Spurred Rye*, I now send you a statement of facts relating to that subject, which then came within my observation; and if you consider the same deserving a place in the Journal of Science, you will please to insert it.

I am sir,

Very respectfully, yours, &c.

MARTIN FIELD.

New-Fane, Vt. Dec. 20, 1824.

As to the origin and nature of ergot, various opinions and theories have been adopted; but the three following have appeared the most plausible, and have been the most strenuously supported. First: among the French, Tissot and others affirm, "that ergot or spurred rye, is such as suffers an irregular vegetation in the middle substance between the grain and the leaf, producing an excrescence;" and that this morbid change is produced by the extremes of humidity and heat, of the season.

Second: In England it has been the opinion of some, "that ergot is an excrescence, caused by the sting and deposition of the eggs of an insect."

And third: Others affirm, "that it is a parasitic *Fungus*, like the different sorts of blight, smut, &c."

I shall not attempt to support or oppose either of the opinions above mentioned; but shall relate such facts as have fallen under my view, without regard to any theory upon the subject.

* This paper would have appeared in our last number, but was accidentally mislaid.—Ed.

The field of rye in which I made my observations, was within fifty yards of my house, which afforded me an opportunity of examining it daily for many weeks. It was of that species, which, in this part of the country, is usually denominated the *Norway or White Rye.* and which has ever been observed to be far more productive of ergot, than the English spring rye, or that which is said to be a native of the island of Candia. But it is not recollected, that during any former season, the ergot has been found so abundant, in this vicinity, as during the last.

The Norway rye is in blossom about as early in the season, as the English spring rye ; but is two weeks later at harvest. From this circumstance, one reason may be assigned, why the former is so much more productive of ergot, than the latter. The longer the grain continues in the *pulpy* or *milky* state, the more favourable is the opportunity presented for the operation of the cause which produces the ergot. That such is the fact, experience clearly demonstrates.

The field of rye which I very frequently examined, was in full blossom, about the 30th of June ; but I discovered no appearances of ergot till the 22d of July. From that time, until the 12th of August, when the rye was harvested, it might be found of various dimensions. Upon minute examination, I discovered that every grain of ergot, as it emerged from the glume, had attached to its apex the shrivelled rind of a grain of rye, which had the appearance of once being in a healthy state. This led me to conjecture that a diseased state of the rye, was the primary cause of the ergot. To ascertain the fact, I repaired to the rye-field, where I discovered groups of flies collected, upon the heads of rye, apparently in the pursuit of something within the glume. On opening the valve of the glume, where the flies were thus collected, I found the saccharine juice, of the grains of rye, was oozing out, and would soon produce small drops. I was then convinced that it was this saccharine fluid, which was so inviting to the multitude of flies that collected upon those heads of rye, which contained any diseased grains. Having collected a number of grains, of full-grown size, and exhibiting appearances similar to those above described, I placed the same under a microscope, by which I could clearly discover a small orifice in each, near the end opposite to that to which the *thread of nutrition* had been attached. I could also discover the juice of the grain was still discharging from the orifice.

On the morning of the first of August, by observing the groups of flies, I found two heads of rye near each other, and each of which contained a grain of *punctured* or diseased rye. The culms I tied to a stake, drove between them, the better to enable me again to find them, and to observe their future appearances. At that time the *punctured* grains exhibited no symptoms of decay, otherwise than a small discharge of fluid. During the first day, the flies were busily employed in extracting their delicious beverage from the orifice of each grain, and when it did not flow in sufficient quantity for their supply, they would probe it anew On the 2d of August both grains appeared to be in a state of fermentation, and rapidly tending to decay. On the 3d, being forty-eight hours from the time when I commenced my observations, each grain had become a rotten and shapeless mass, and exhibited very little appearance of healthy rye. Then, on carefully opening the valves of the glume, I discovered in each a small black globule, the size of which was rather larger than a pin's head. These were situate at the points of the *peduncles* of the diseased grains, which afterwards proved to be ergot. During the first four days after the ergot was discovered, they grew in length very near two lines in each twenty-four hours, displacing the remains of the diseased rye from the glumes which they had occupied. On the 12th of August, the ergot had attained its full growth. The dimensions of one gr of ergot were twelve lines in length, and three lines in diameter. The other grain measured a little less.

On the 3d of August, being convinced that the primary cause of ergot was the puncture of the healthy grain by the fly, it occurred to me that perhaps it might be produced by such means as I possessed. To ascertain this fact, with the point of a fine needle I *punctured* four grains of rye, in the same head, it then being in a green pulpy state, and of full grown size. A discharge of the juice of the grains was soon discovered from the orifice of each. The flies collected as in those cases before mentioned. The result was, that on the fourth day after the operation was performed, ergot appeared in the glume, occupying the places of two of the punctured grains. The other two grains exhibited no symptoms of decay, but continued in a healthy state. From appearances, I am led to believe that in warm dry weather many grains of rye are punctured, which are not materially injured thereby. The orifice closes before a sufficient quantity of juice has escaped to produce fermentation and decay. This may, therefore, be assigned as one reason why cloudy and wet seasons, are so much more productive of ergot, than those which are fair and dry.

Under a good microscope, I occasionally examined the ergot, and also the grains of rye, in every stage of decay, but was never able to discover in either the eggs or *larvæ* of any insect. I therefore conclude that the puncture of the fly is for the purpose of extracting its food from the rye, and not for the deposition of its eggs.

The fly is of the hairy or bristly species of *Musca*, and also a species of the " blow fly." It deposits its eggs upon animal flesh, either fresh or putrid. Its wings are transparent, abdomen dark green, larger than the common house fly; in this climate, in the months of July, August, and September, the most numerous species of the fly, and very annoying to horses, oxen, and some other animals.

The above statement, contains all the material facts, which have fallen under my view, in relation to the cause of ergot; and how far they go to support or oppose either of the theories heretofore adopted upon the subject, I submit to the decision of others.

In the conclusion of this article, perhaps it may not be improper to state some facts in relation to the effect which the ergot produces upon the health of the plant, on which it grows. I was never able to discover that the culm of rye was in the least affected by the ergot ; but I have observed that invariably, where there were to the number of eight or ten grains of ergot, no healthy or sound rye could be found in the same head. In such cases it appears that all the nourishment which the culm affords, is exhausted by the ergot, and the rye suffers a severe blight.

The size of the ergot is usually in proportion, to the number of grains in the same head. For when we find but one grain in a rye-head, it is generally from ten to fourteen lines in length, and two or three in diameter ; but where there are from twenty-five to thirty grains, which is not unfrequent, their dimensions are proportionably less, being often not greater than sound rye.

Art. XXVI.—*Some Experiments and Remarks on several species and varieties of Cinchona Bark.* By George W. Carpenter.

Prof. Silliman,

Dear Sir,

In consequence of the late prevailing endemics, ague and intermittent fevers, which have been so universally felt in almost every section of our country, in many places to a very alarming and distressing degree, the article Cinchona has increased very considerably in practice and demand, and has become one of the most important articles of the *materia medica;* and as the description of the respective species and varieties are so obscure, ambiguous, and confused, that they tend rather to involve the researcher in more dense prolixity than to develop their concealed information; and as there is no method so well calculated to ascertain the relative strength of the different species of Peruvian bark as that of analysis, I have thought proper to make trial of the most important species which now occur in our commerce, by extracting the alkaline principle upon which its virtue as a medicine depends, and upon the results of which the relative strength may be accurately ascertained. I have also described these species as they now occur in commerce, which by their external characters may be severally distinguished. If you think the statement of sufficient interest to your readers, I will thank you to insert it in your next Journal.

Very respectfully, yours &c.

GEORGE W. CARPENTER,
No. 294 Market-st. Philadelphia.

Calisaya Bark.

Of this very superior species of Peruvian bark, there are two varieties in commerce.

1st. Calisaya arrolenda.

This variety is in quill from three quarters of an inch to an inch and a half in diameter, and from eight inches to a foot and a half in length. The epidermis is gray and whitish on the exterior, and of a reddish brown beneath. The peculiar features of this bark, and by which it may be readily distinguished, are the following. The epidermis is thick, and may be easily removed from the bark: hence you find in the seroons the greater part deprived of this inert portion. It has many deep transverse fissures, running parallel; the fracture is woody and shining; the interior layer is fibrous, and of a yellow colour; the taste is slightly astringent, and very bitter.

This species of bark will yield a much larger proportion of sulphate of quinine than any other bark in commerce, and consequently may justly be esteemed the best.

2d. Calisaya plancha, or Flat Calisaya.

This variety consists of flat thick woody pieces, of a reddish brown colour, deprived of the epidermis, and the interior layer more fibrous than that in the quill. This variety yields from twenty to twenty five per cent. less quinine than the former, and consequently is a less desirable article.

Superior Loxa, or Crown Bark.

Loxa is the name of the province and port of Peru where this bark is obtained and exported. It was in this province *cinchona* was originally discovered. This bark is highly esteemed by the royal family, and is that which has been selected for their use: hence the name of *crown bark.* This bark is in small quills, the longitudinal edges folding in upon themselves, forming a tube about the circumference of a goose-quill, and from half a foot to a foot in length. It is of a grayish colour on the exterior, covered with small transverse fissures or cracks; the internal surface is smooth, and of an orange red; it is of a compact texture, and breaks with a short clear fracture; it is the bark of the cinchona *condaminia*, and is known at Loxa by the name of *Cascarilla fina;* yet notwithstanding this bark appears to have had the decided preference to all other species, analysis fully indicates that this bark is not equal in medicinal strength to that denominated Calisaya. This bark is much more astringent, and less bitter than the calisaya. This species yields from twenty-five to thirty per cent. less quinine than the the former, the crystals of which are not so well characterized.

Experiments which I made upon the Carthagena bark, of rather better quality than the market generally affords, yielded about one-twelfth less quinine than the Calisaya arrolenda.

REMARK.

When the Calisaya bark was first introduced here, it was considered an inferior article, the decision being grounded upon its external characters, and would not bring its cost in South America; but such is the deception of external appearances, that when submitted to the infallible test of experiment, it was proved to be the best. Specimens of the Calisaya and Loxa barks may be procured from Charles Marshall, jun. druggist, of this city.

G. W. C.

INTELLIGENCE AND MISCELLANIES.

I. FOREIGN.

Foreign Literature and Science; extracted and translated by Prof. GRISCOM

1. *Morality of the Greek and Roman Philosophers.*—A Latin Discourse obtained the prize in the Academy of Leyden in 1823, on the question, *Whether and to what extent the philosophers* (Greek and Roman) *founded morality upon the existence and attributes of the Divinity?* Leyden, 1824. pp. 137. 4to.

The author determined to consult, in his researches, no other than the writers of antiquity, and to cite them only in their original texts. The following is the result of his investigations The ancient Greek poets are not always explicit on the relation between God and man; and the whole of them wandered in the darkness of polytheism. Nevertheless, they taught the existence of God, and even of an original or supreme deity—the chastisement of vice, and the recompense of virtue in a future life. Among the philosophers, *Pythagoras* insisted much upon the connexion between God and man, in establishing, on the system of the metempsychosis, the reward of the good and the punishment of the wicked. *Socrates* discovered the origin of justice in the divine will. He maintained that the gods have a love for men, and inferred from their justice and their universal knowledge, that they would punish the wicked. *Plato* taught the existence of one God, who formed the world by a thought of his intelligence, and he affirmed the immortality of the soul, and rewards and punishments in another life, in admitting the system of the metempsychosis. He strictly inculcated upon the minds of his pupils the identity of morality with the worship of the divinity. *Aristotle* was one of the ancient philosophers who took the least pains to found morality upon the attributes of the Deity. He proclaimed that God is just, and that the virtues of men are agreeable to him; but he established no intimate relation between man and the Divinity. He manifested, however, a great respect for him; though he seemed to prefer a general silence with regard to God, rather than to celebrate him by doctrines which appeared to him doubtful. The pride of the early Stoics induced the greater portion of them to prefer themselves even to the Divine Being;—the more modern, (Marcus Aurelius especially,) were more reasonable, and taught that it is necessary to be be virtuous and to do good to men, in order to imitate God, and to conform to his will; but they did not found this conclusion upon the doctrine of future rewards and punishments.

The author takes occasion of the extensive details he has collected relative to the uncertain morality of the Greeks and Romans, to elevate, as it deserves, the excellence of the *Christian religion*, and its vast superiority over every other system of philosophy.—*Rev. Encyc.* (*Languinais.*)

2. *Portugal.*—The king has decreed that there should be formed in his capital, an extensive Lithographic Estaolishment, under the direction of Joseph Lecocq. His allowance is fixed at five hundred dollars. By another decree, there is to be established in Lisbon, *a normal school for propagating the system of mutual instruction;* it is also to be placed under the direction of Professor Lecocq, who has passed more than a year at Paris, in studying the new system

in the normal school, founded by the Education Society, in concert with the prefect of the Seine.—*Rev. Encyc.*

3. *Astronomy.*—An amateur of astronomy at Prague, M. de Biela, an officer of grenadiers, has remarked two important facts in the last comet, which was discovered by him the 30th of December last year, and observed the next day, the 31st. The first of these facts confirms the opinion previously advanced by him, that the proximity of the comet influences the luminous condition of the sun. In fact, from the 23d and 24th of October, 1822, the period in which a comet was in its perihelion, till the 5th of December, 1823, he remarked no spot on the sun. On the 5th of December, he perceived a very considerable spot, which regularly increased upon the surface of the sun till the 13th of December. The 21st of the same month, a second large spot was seen, about leaving the surface of the sun, and which had doubtless been produced a short time before. On the 30th of December,the first spot became visible upon the other side, and continued to increase till the 6th of January, 1824, when a cloudy season prevented observation for a long time. It was calculated that the comet passed its perihelion in the nights of the 9th and 10th of December, at a distance from the sun equal to half that of Mercury. On the 7th of January, the time in which the first spot would have shown itself for the third time on the sun, it did not appear, and the sun remained free from spots until the 16th of January. If this discovery of the relation between the comets and solar spots should be confirmed, it will be of some importance; for since the observations of Herschell, many astronomers have remarked that the spots on the sun had a real influence upon our temperature.

The second remark of M. de Biela, is, that on the night of the 22d and 23d of January, the comet, besides its tail, which extended from the side opposite to the sun, had a second turned *towards* that luminary. These two tails were not precisely opposite to each other, but formed an obtuse angle. M. de Biela, who is certain that in this there was no optical illusion, either from the instrument or the eye of the observer,thinks that the most rational explanation of the second tail, is, that the comet, like many other meteors, left behind it a luminous trace over its passage, and that this second tail indicates the path that the comet had just passed over. This luminous track was neither as brilliant nor as extended as the true tail opposite the sun. It was observed only on the 22d, 25th, and 27th of January.—*Rev. Encyc. Mai* 1824.

4. Bale.—*Rural School.*—A number of philanthropists of of our town have united in founding an agricultural school for poor boys. The number of pupils will be from 12 to 20, and the direction of them will be confided to a pupil of the respectable Vehrli of Hofwyl. This school will form the fourth of the kind established in Switzerland. The three others are *Hofwyl*, canton of Bern; *Blaishof*, canton of Zurich; *Carra*, canton of Geneva.—*Idem.*

5. *Electricity.*—M. Grothus, it is said, has observed that when water is rapidly congealed in a Leyden bottle, the outside coating of which is not insulated, it acquires a feeble charge; the inside becomes positive, and the outside negative. In melting the ice rapidly, the effect is reversed; the outside is then positively, and the inside negatively electrified.—*Annals de Chimie, Sep.* 1824.

6. *A Discourse, delivered at the opening of the session of* 1824, *of the Helvetic Society of Natural Sciences, held at Schaffhausen the* 26*th*, 27*th*, *and* 28*th of July. By* Lieut. Col. Fisher, *President of the Society for the current year.*

. . . . . Nec aranearum sane textus ideo melior quia ex se fila gignunt, nec noster vilior quia ex alienis libamus ut apes.

Just. Lips. Monit. Polit. L. 1. *Cap.* 1.

Very dear Friends and Colleagues!

We are entering the tenth year, dating from the memorable epoch, in which a citizen of Geneva, a city whose right it seems to have been for ages to produce distinguished men, conceived the happy idea of founding an Helvetic Society, devoted to the culture of the *natural sciences*, and invited to his picturesque hermitage of Mornex upon Mount Saline, the few friends of nature which formed the nucleus of this association. Whatever might have been the views and hopes of this learned and zealous philanthro pist, at the birth of this society, the extension and consistency which it has acquired have unquestionably much surpassed them; and could we have the happiness to see him again amongst us,* he would enjoy with enthusiasm the circumstance which now unites upon the northern limits of Switzerland, in a little town, deprived of the resources with which the greater number of its sisters of the confederation are richly provided, the elect of the naturalists of Helvetia, under the laudable aim of reciprocating their information and their discoveries, of enjoying the personal relations which every succeeding year enhances in their estimation, and of congratulating each other in belonging to a country which the Creator has endowed with his noblest gifts.

Welcome—thrice welcome, my dear friends and colleagues,—you, whose presence now animates and adorns our happy town! I salute you in behalf of those of our venerable magistrates, who honour us with their presence, and in behalf of our government, which deigns liberally to encourage our efforts by a donation of 600 francs. I salute you in the name of my beloved fellow-citizens, who rival each other in their desires to evince to you their hospitality, and who would be glad to retain you a long time in the midst of their families; and I salute you in behalf of our Cantonal society, of which I am at present the organ, and which will have to offer you, at this session, the modest tribute of its labours of the year. But the exercise of the presidency to which I find myself called,—of a function so new to me, inspires me with a just and well founded apprehension. The fresh recollection of the superior men who have acquitted themselves of this duty in so distinguished a manner; the comparison of my feeble means with those with which they have been endowed and of which they have given proofs, alarms me in the highest degree. I have need of all your indulgences, my dear and honoured colleagues; and I claim it with anxiety, and in the name even of that benevolence, which assigned to me, at our last annual meeting, the suffrages, in virtue of which I have the honour now to address you.

In conformity to the example of my learned predecessor, Professor Bronner, I shall endeavour to trace out succinctly the discoveries made in natural science since our last annual

* Mr. Gosse, founder of the society, who was removed by death a few months after its first formation.

meeting. There is not much perhaps in this review, which lies beyond the field of physical science; but I shall venture upon a circumference more extensive, and more analogous perhaps to the title of our society, and to its constitution, which embraces, in some sort, the whole of nature, and directs by turns the attention and the researches of our numerous coadjutors* towards every object of interest which it can offer, and whose number is without limitation.

Not only are the sciences of nature and observation so connected with each other as to form an uninterrupted chain; they have become at the present time, intimately allied to the exact sciences, by the medium of the atomic theory, which, pursuing in thoughts the elements of bodies far beyond the feeble powers of our senses, has discovered, in the varied combinations of those indivisible elementary molecules, *simple relations* both of weight and volume; a discovery which has opened the way to a rigorous arithmetical calculation in cases wherein it was before necessary to remain satisfied with vague and uncertain estimates. Not only are these calculations, for the most part, the result of actual chemical analyses—they often prepare the way for them and decide upon their conclusions *a priori;* and the experience of the manipulating chemist, does but confirm what the theory had foretold by the learned and judicious application of the science of numbers. We are indebted to Higgins for having opened this path; but it was only a faint glimmering of the truth, until, by the meditations and labours of Dalton, Wollaston, Davy, and Berzelius, it assumed a high degree of interest among the physico-mathematical sciences, and became a guide and even an instrument of research in the hands of the distinguished men just mentioned, and whose simultaneous existence, and active co-operation form in our own time, an epoch in the annals of science.

Passing from these events, which are in some sort European, to those on account of which our own country has a right to our felicitation, I must refer for details to the special reports of the cantonal societies of Zurich, Berne, Geneva, St. Gall, Lausanne, Arau, Schaffhausen, and of our younger sister of Soleure, who has this year entered upon the career under the happiest auspices. It is, I repeat, to an *exposé* of

* The society has now 415 members, and 114 foreign associates.

the annual labours of these societies, which will be laid before you in the course of the present session, that I must refer for all the particulars. I shall only at this time, turn your attention to a few of the principal objects. I rank in this number the applications which have been made of the brilliant discovery of Döbereiner of the singular property possessed by the spongy oxide of platina, of becoming suddenly incandescent in contact with hydrogen gas, at the common atmospheric temperature ; and of producing acetic acid, by the combustion without flame, of alcoholic vapour. You will perceive that our learned colleague, Professor Bronner, of Berne, has succeeded in rendering more and more easy the production of the metalloïdes of potash and soda, by the dry method ; and that the experiments of M. de Serullaz upon the alloys of "kalium" with various metals have been successfully repeated in our laboratories ; and that explosive combinations have also been obtained, by means of which gunpowder may be easily fired under water. The experiments of Mr. Irminger, of Zurich, upon strontian will be admitted to possess interest, as well as the property of the salts which have this earth for their bases to give to flame a beautiful purple tint, an effect which has been already applied to pyrotechnics, with brilliant success.

Passing from the metalloids to the metals, you will have occasion to appreciate the discovery of the British Chemist Lucas, viz. that the contact of powdered charcoal with silver and copper in fusion deprives them of the small portion of oxygen which adheres to them in that condition. But we have established by our experiments, that this effect holds good, not only with respect to the metals above named, but under similar circumstances, it forms with melted steel, vegetations and crystallizations quite as remarkable. Messrs. Faraday, in England, and Berthier, in France, have examined the alloys of steel with chromate of iron ; we shall place before you essays of this kind, obtained in our own shops, and you will then witness chromated steel, perfectly ductile, the fracture of which shows the most beautiful moiré possible. We are induced to believe that the true Damascus blades are not, as has been long supposed, a medley of iron and steel, but much rather of various alloys of steel with other metals. To conclude, metallurgic chemistry has been recently enriched by the discovery, due to Professor Zain, of Copenhagen, of Xanthogene, a compound belonging to the class of cyanurets. It is well known that physics, encroaching to a certain extent upon the domain of chemistry, has attempted with success, to produce by strong mechanical pressure, combinations which until the present period had been obtained only through the agency of corpuscular attraction. We have now two examples, the one acetic acid crystallized under a pressure of 1100 atmospheres; the other a crystallization of salts contained in sea water exposed to a pressure of 4000. Guided by the profound theory of Ampère relative to dynamic electricity, our colleague, Professor De la Rive. jr. has determined by means of an ingenious apparatus of his invention. the various directions which are pursued by electric and magnetic fluid, and their reciprocal influence. The calorimotor and deflagrator of Prof. Hare, imported from America into our cabinets, opens to us the hope of contributing something to the future progress of voltaic electricity.

But our true field, that which nature displays in our mountains, and which she invites us to cultivate with activity and perseverance, is natural history. Here she exhibits to us numerous mineral and thermal waters, endowed with energetic medicinal qualities; there, geological phenomena, varying from the highest central and primitive chain, to rocks of transition, and thence to secondary and tertiary chains, and even to monuments of diluvian catastrophe. The chain of the Jura alone, presents to geologists an object of interest and curiosity the most enticing, in the fossil remains of antediluvian animals, which our clear sighted and indefatigable colleague Prof. Hugi has discovered, petrified in the lowest beds of that chain, in the vicinity of Soleure. Besides, there have been found in the coal mines of our region, and will presently be laid before you, well preserved remains of animals of a former world, no longer found upon the earth. Researches for coal, as an article for fuel, is an object of the highest interest to the whole of Switzerland in all its economical relations; and a society has just been formed at Geneva for this special object. The working of salt springs, so happily facilitated by the use of the borer, has been attended, in a neighbouring country * with brilliant success, and affords legitimate hopes of important consequences in our own. Zoology, in all its branches, presents to us a vast field.

* The grand Duchy of Baden.

Mammifera, birds, fish, reptiles, insects; Switzerland presents within her inclosure, specimens more or less interesting of the whole organic kingdom, and the same may be said of mineral varieties, as is evinced by the rich collections of these objects already formed in some of our cities, and which are receiving almost daily augmentation.

From our lowest plains to our summits covered with eternal snow, we possess also every variety of climate within the limited circle of our twenty-two republics. Meteorology will receive, we trust, from a regular and uniform system of observations, which it is now in contemplation to establish in all the chief places of the cantons, previous data for uniting and comparing. The management of our forests, an object of the first importance, will also engage the attention of our society; and in the present session we shall receive some information from our colleagues Prof. Pictet and Decandolle upon the track which they propose to follow in those two branches of philosophical research, as well as in those whose object is the hypsometrical determination of the height above the level of the sea of all the principal points of Switzerland and of the various declivities of its rivers. The hydrotechny of our country is particularly interested in these determinations; and the memorable labours of the Linth, (which cannot be recalled without honouring with profound regrets the memory of the benefactor of that country;) the success, I say, of these labours have convinced us of the importance and of the possibility of the success of these extensive drainings, which are needed in numerous swampy plains; operations which render to agriculture large quantities of unproductive lands, and cause salubrity to prevail where nought but pernicious influences held their reign. But it is time to finish these general and preliminary considerations.

I should abuse your indulgence, very dear and honoured colleagues, if I any longer interrupted your proceedings. My duty is confined to directing your observance of the *order of the day* as prescribed, according to custom, by the committee of direction, assembled prior to the opening of the session.

Bibliotheque Universelle, September 1824.

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OTHER FOREIGN NOTICES AND SELECTIONS.

7. *Ferussac's Bulletin Universel des Sciences, &c. &c.*—We have had occasion in the two former numbers, to call the attention of our readers to this work, the most extensive and varied in its plan, that has ever been undertaken. The editor of the Bulletin, in a letter addressed to us, dated Jan. 4th, 1825, expresses the hope that authors and editors will transmit through "Mr. Anthony J. Gerard, merchant, New-York, addressed à la Direction du Bulletin Universel des Sciences et de l'Industrie, rue de l'Abbaye, No. 3. à Paris," copies of the works, numbers, memoirs, and maps (*des ouvrages, brochures, mémoires, et cartes,)* which they may publish, that they may be made known in Europe by means of the Bulletin. Notices, analyses, or reviews of them, as the case may require, will be given.

The Baron Ferussac is also very desirous to procure the terrestrial fluviatile and marine shells, and the fossils and petrifactions of this country—when requested, he will make a suitable return. Some of these objects are particularly desirable to him to aid him in completing his great work, "*Histoire générale et particuliere des mollusques terrestres et fluviatiles.*" He is anxious particularly to receive specimens of the unio, anodonta and alasmodonta of Mr. Barnes, described in former volumes of this Journal.

He would be gratified by receiving in exchange for different sections his Bulletin, all the literary, scientific, and professional Journals of this country, and the reports and transactions of all its learned societies. He has furnished the editor of this Journal with a list of all the works of this kind which he had received up to the date of his letter. We subjoin this list for the information of those concerned.

North American Review, Nos. 1, 2, 3, for 1824.
Boston Journal of Philosophy and the Arts, to Sept. 1824.
New-York Medical Repository Nos. 2, 3, 4, of vol. 8.
Medical Recorder of Medicine and Surgery, for 1824.
Transactions of the Philosophical Society, vol. for 1818.
Western Quarterly Reporter, Nos. 1, 2, 3, for 1823.

American Farmer, 1819,—1823, and Nos. 1—10 for 1824.
Jour. of the Acad. of Nat. Sciences of Philad. to Sept. 1824.
Annals of the Lyceum of Nat. Hist. of N. York, Nos. 1—5.
Journal of Foreign Medicine and Science, Philad. Nos. 1, 2.
Museum of Foreign Literature and Science, Nos. 1—6.
Archaeologia Americana, vol. 1.

8. *Lychnophora, a New Genus in Botany.*—A new genus of shrubs has been found in the Alpine regions of South America, and described under this name by the Chevalier de Martius, a young gentleman whom a love of science has induced to travel extensively, not only in Europe, his native country, but in Brazil, and other parts of South America. These shrubs attain the height of six or eight feet, and the trunk and branches are covered with a very dense, fleecy, highly inflammable down, on account of which the branches are used by the natives instead of candles.* Eight species of this genus are enumerated, and minutely described by the author, seven of which are illustrated by neat lithographic plates of a quarto size. C. H.

9. *Antediluvian Plants.*—The Chevalier de Martius has also published a memoir† on some antediluvian plants, in his investigation of which he has been aided by comparing them with species which he found growing in the tropical regions. He thinks that he has identified several of these living species with some fossil species found in Europe.
C. H.

10. *Marine Fossil Plants.*—"Observations sur les Fucoides, et sur quelques autres Plantes marines, fossiles; par M. Ad. Brongniart"—20 pages quarto, with lithographic plates, Paris, 1823. In this little work the author mentions the formations in which particular classes of vegetable fossil remains occur; and in a very neat, concise manner, describes the species of which he treats, comparing them generally

* Hence the name of the genus, from λυχνω and φερειν to bear a candle.

† This memoir and also the above mentioned memoir on the genus Lychnophora, both written in latin, were published at Ratisbon, Germany, in a neat quarto form, and transmitted by the author to the editor of this Journal.

with species now extant—in some instances he observes a great similarity, if not a perfect identity. The Brongniarts are entitled to great credit for the zeal with which they have prosecuted the investigation of fossil vegetable remains—a branch of natural history, which until lately has been much neglected, and from which we may expect the most important results. C. H.

11. *Analecta Entomologica.*—A work with this title, containing 104 closely printed quarto pages, by John Wilh Dalman, M. D &c. was published in Stockholm in 1823. Several new genera, and one hundred and fifty new species of insects from Brazil, Sierra Leone, and various other parts of the world, are described, together with many other species which have been described in various parts of the transactions of the Royal Academy of sciences of Stockholm, the descriptions of which have not found a place in systematic works on Entomology. The author, in his preface, apologizes for the prolixity and minuteness of his descriptions, by adverting to the confusion which has undoubtedly been occasioned in entomology by an excessive precision of style. His descriptions are extremely minute and clear, and evince that the author possesses no ordinary share of discrimination. C. H.

12. *Extract of a letter to the Editor from Prof. Berzelius of Stockholm, dated July* 3, 1824.

(1.) *New variety of Orthite, and a new Mineral resembling Feldspar, &c.* —Nothing particularly remarkable has occurred here in mineralogy, except, that in the midst of the city of Stockholm, two minerals have been discovered, one of which appears to me new, and the other is the *orthite*, before found only at Finbo near Fahlun. For the purpose of building a church upon one of the six islands which form our city, they cut down a part of a mountain in which these minerals were found. We afterwards discovered that they are found every where in the granite about Stockholm; as yet they are not very numerous, but probably will, in the progress of time, be found abundantly. In a box of minerals which I am sending from Count Warzlmeister to Dr. Torrey, I have sent for you two specimens; the orthite of two varieties, one of which perfectly resembles the gadolinite, for which we at first took it, and the other, with a granular fracture, has a false appearance of yttrotantalite. The new mineral has the most perfect resemblance to feldspar, from which it neverthe less differs, in consequence of its great fusibility, and by the property which it possesses of being very much augmented in volume by the action of the blow pipe, when it is heated to redness. There are two varieties, one of which is white, and the other greenish. The result of a hasty analysis of it, which I have performed, gives the same composition as triphane and spodumene, with this difference, that it contains sodium instead of lithium. The greenish variety contains also lime, and a little magnesia. I presume that this may be the same mineral as the killinite, *Cleaveland*, Vol. I. p. 309.

Mr. Walmstedt, professor of chemistry at Upsal, has performed a series of researches upon prehnite, of which, as it is in Latin, I take the liberty to send you a copy.*

(2.) *Fluoric Acid—Reduction of silex, giving silicium; and of zircon, giving zirconium.*—I have made a considerably extended research upon fluoric acid, which is nevertheless far from being finished.

By way of digression, I have discovered the method of reducing silex, so as to obtain silicium, the properties of which are extremely curious. The following is the method of obtaining it: Take the fluate of lime and potash, heated near to redness to expel the moisture. Put this salt, with potassium, into a glass tube, closed at one end, and heat it by means of a lamp. The potassium gives a dull sound, and the silex is reduced. The (resulting) brown mass requires to be washed a long time, in order to remove the undecomposed portion. We then have the silicium remaining upon the filter, in the form of a brownish powder. When it is dried, it can be made to burn by heating it red hot; but if it is gently heated in a platina crucible, half covered, and if the silicium takes fire, covered entirely, it contracts by little and little, and becomes incombustible. Before it is thus heated, the fluoric acid dissolves it with the extrication of hydrogen, after which it acts only by extracting a part of the silex,

* An abstract of the results of these researches is subjoined.—*Ed.*

with which the silicium may be mechanically mixed. No acid attacks it any further, except a mixture of fluoric and nitric acid, which dissolves it readily. With the carbonates of the fixed alkalies it detonates before the heat has attained to redness, extricating from them the carbonic acid; but it does not decompose saltpetre below incandescence. It detonates, even by means of the carbonates, in the midst of melted saltpetre. With sulphur it combines at a very high temperature; the sulphuret is white and earthy, and soluble in water, with the disengagement of sulphuretted hydrogen. It burns also in chlorine. The chloride of silicium is a very volatile liquid, giving out fumes which are decomposed by water, and give silex and muriatic acid gas.

I have reduced also zirconium, by treating the double fluate of zircon and of potash, with potassium. The zirconium is a black powder, very combustible, insoluble in acids, as well in the nitric as the nitro-muriatic, but soluble in the fluoric. It presents the curious phenomenon of burning, with explosion, in a vacuum; the reason is, that it commonly contains a small portion of hydrate of zircon, the water of which oxidizes the zirconium.

The other earths have not given precise results.

13. *Prehnite—Olivine.**—A very elaborate examination of several varieties of *Prehnite* has been made under the direction of L. P. Walmstedt, professor of chemistry in the university of Upsal, by MM. P. F. Wahlberg, J. A. Hœger, and S. A. Varenius, candidates for the philosophical degree. The very discordant results, obtained by the different chemists who had analyzed this mineral, induced these gentlemen to make it the subject of their experiments. The analyses of two varieties of prehnite made by Gehlen, and published in 1813, afforded results similar to each other—very different, however, from the results obtained by other analysts. The analyses of several varieties, which were subjected to the rigid examination here noticed, all afforded results which coincided very nearly with the analyses of Gehlen. It appears therefore that the accuracy of Gehlen's analyses is pretty fully established, together with the fact

* For the two valuable tracts here noticed, one of which consists of twenty and the other of six pages, quarto, the editor is indebted to Prof. Berzelius, of Stockholm.

that the several varieties of prehnite differ in their chemical composition much less than has been generally supposed.

Another candidate for the same degree, Mr. P. N. Sevén, has examined a specimen of *Olivine* from mount Somme, near Naples. The composition of this substance, as determined by Klaproth, would seem hardly to admit of its being associated with chrysolite.

The following are the results of two analyses made by Mr. Sevén.

Silica, - -	40.08	Oxyg. 20.16	40.16	Oxyg. 20.20
Magnesia, -	44.24	„ 17.12	44.87	„ 17.37
Oxid. Ferrosum,	15.26	„ 3.47	15.38	„ 3.50
“ Manganos.	0.48		0.10	
Alumina - -	0.18		0.10	
	100.24		100.61	

These results, so widely different from those of Klaproth's analysis, clearly justify the association of Olivine in the same species with chrysolite. C. H.

14. *Méchanique Céleste.*—The fifth and last volume of this great work of M. de Laplace has made its appearance, in which the question of the form of the earth is discussed in various new points of view: viz. 1st. The dynamic effect of the presence and distribution of the waters on the surface of the globe. 2dly. The compression to which the interior beds are subjected. 3dly. The change of size which may result from the progressive cooling of the earth. The author has arrived at the following results: That the great mass of the earth is by no means homogeneous; that the beds situate at the greatest depth are the most dense; that those beds are disposed regularly round the centre of gravity of the globe, and that their form differs little from that of a curve surface, generated by the revolution of an ellipsis; that the density of water is nearly five times less than the mean density of the earth; that the presence and distribution of the waters on the surface of the earth do not occasion any considerable alterations in the law of the diminution of the degrees, and in that of weight; that the theory of any considerable displacing of the poles at the surface of the earth is inadmissible, and that every geological system founded on such an hypothesis, will not at all accord with the existing knowledge of the causes which determine the form of the earth; that the temperature of the globe has not sensibly diminished since the days of Hipparchus, (above

two thousand years ago,) and that the actual loss of heat in that period has not produced a variation in the length of the day, of the two-hundredth part of a centesimal second.

Lond. Philos. Mag. and Journ. 1824.

15. *Zoology.*—Baron Cuvier is said to be engaged in preparing for the press a great general work on Ichthyology.

16. *Fine Arts.*—Mr. Milbert, a French gentleman who has resided several years in the United States, as a naturalist in the employment of the French government, is about to publish in Paris his "Voyage Pittoresque dans l'Etat de New-York." We had the pleasure of examining his portfolio some years since, while he was in this country; and from the specimens there exhibited, we believe that this will not be excelled even by his celebrated Travels in the Isle of France, a work of a similar nature. D.

17. *M. Guinand's Flint Glass.**—Opticians and astronomers have long lamented the imperfection of refracting telescopes, from the impossibility of obtaining flint glass for lenses perfectly homogeneous, without striæ, or any other defects, and of sufficient size. These difficulties are at length reremoved by the invention of M. Guinand, an ingenious, self-taught artist, of Brenets, in the Canton of Neufchatel, in Switzerland. This man in his youth assisted his father as joiner, and at the age of thirteen became a cabinetmaker. Having seen an English reflecting telescope, he procured leave to take it to pieces and put it together again. This gave the first impulse to that object, which afterwards gave him so much celebrity. When he attempted to manufacture achromatic glasses, meeting the same difficulties which others had experienced, he began (at the age of 35) to make experiments on the manufacture of glass. With no advantages, except those which his own ingenuity supplied, he erected a furnace, with his own hands, and continued for many years a series of expensive and fruitless experiments, labouring occasionally at some mechanical employment to earn the means of subsistence, and of purchasing wood, and the necessary materials for his furnace, his crucibles, and his glass. He carefully noted the particulars of

* Abstract of a Tract of 25 pages, 8vo. London 1825.

every operation, that he might be able to repeat any experiment which might chance to be successful. At length he obtained blocks of glass which contained portions perfectly homogeneous; these he separated by sawing the blocks into sections, selecting those parts which were free from defects, and returning the others to the crucible. Afterwards he improved upon this process by casting his glass in moulds. The refraction of M. Guinand's glass varies almost at every casting; but at each casting the whole mass is so perfectly homogeneous, that two portions, taken indifferently from the top and bottom of the crucible, have the same refractive power.

M Guinand obtained such reputation by the manufacture of achromatic telescopes from his glass, that he was visited by many scientific men of different parts of Europe; and in 1805, was called into Bavaria, 260 miles from his home, in the employment of M Frauenhofer, a celebrated optician. Here he continued nine years occupied almost solely in the manufacture of glass; and it is from this period that M. Frauenhofer's achromatic telescopes have acquired so well-merited a reputation. After returning from Bavaria to his native country, he raised his discovery to a higher degree of improvement; and in the last years of his life, succeeded in manufacturing disks of eleven and twelve inches of English measure, perfectly homogeneous, and free from defects.

The pecuniary circumstances of M. Guinand prevented his divulging the process for manufacturing his glass; arrangements had been made by the French government for purchasing the secret, when the artist, verging on his 80th year, died after a short illness. His son remains in possession of the process, and it is to be hoped that an improvement which opens the way to such important acquisitions in the field of astronomy will not be lost. C. H.

18. *Belfast Natural History Society.*—The Society instituted in Belfast, Ireland, for the cultivation of Natural History, and mentioned by Mr. Maclure in his letters contained in the last number of our Journal, consists, as he informs us, of active intelligent young men, and from this circumstance, as well as from its location in the vicinity of the celebrated Giant's Causeway, we may look for interesting results from its labours. By the recommendation of Mr. Maclure, the

Belfast Society propose to offer exchanges of objects of Natural History with similar societies in this country and elsewhere, and their secretary, Mr. James M'Adam, thus writes to the editor of this Journal, under date of August 31st, 1824:

"The Belfast Natural History Society is not long established, but the members have a wish to obtain as much information as possible of the science they profess to cultivate; and in order to further their views, they are making a collection of the various objects of Natural History. A connexion with other societies will tend greatly to advance their undertaking, and they propose exchanging the duplicate specimens of their museum, for those of any other society that is willing to accede to their proposal. A correspondence may thus be opened, which may serve the interests of both.

"The specimens sent you by Mr. Maclure* were collected in the country to the north of Belfast, and are all connected with a secondary, or, as some would call it, a volcanic formation He said that such formations were of rare occurrence in the United States, and that specimens of their mineral productions would be acceptable to the cultivators of Natural History there. It is in the power of the Society in Belfast to furnish specimens, not only from the basaltic district which is in their immediate neighbourhood, but also from other parts of Ireland, and occasionally from Scotland."

19. *Artists' Lecture Room.*†—Going into our gas-works one day lately, I was surprised to find a small lecture-room and laboratory, in which a committee of the workmen lecture and experiment in turns. They have several articles of philosophical apparatus, and the external aspect of things (for I saw no more) is abundantly scientific. I obtained a copy of their printed regulations, which I thought would gratify you, and which I have enclosed.

The education of the working classes is at present occupying a large share of the philanthropists of this country. The workmen of the Glasgow works have for nearly two years been lecturing to each other on mechanical philosophy and

* A box of Irish specimens forwarded by Mr. Maclure, to the American Geological Society.

†Extracted from two letters to the Editor, dated Glasgow, Nov. 9th, 1824, and March 22, 1825.

chemistry, at their spare hours, and contributing to the support of a library. Our own men have had a library for twenty months past, which is daily increasing; and they have just started in connexion with it, a weekly lecture on philosophical subjects. A committee of ten are to lecture by turns, from some popular text-book, and perform the simpler experiments: by degrees I hope to see it yet a prosperous and useful association. An introductory lecture was delivered to them a few nights ago, by a medical friend, which, with a reply by one of the workmen, and some prefatory matter, is to be printed, and shall be sent to you. I know you will take a deep interest in all such matters.

20. *Mr. Owen and his plans of Education.**—I was very much gratified during four days that I spent at New Lanark with Mr. Owen, by witnessing what an individual with common sense and a common education (without the aid of universities or colleges) can effect towards the happiness and comforts of multitudes of his fellow-creatures. It is a severe satire on the past, and furnishes well-grounded hopes for the prosperity and happiness of future generations. I have been long of Owen's opinion, that man is a *bundle of habits*—the child of surrounding circumstances, and that education (the only thing that can distinguish him from the brutes) was the means of producing all the advantages his nature is capable of receiving; but the reforming of men after they are filled with prejudices, former experience taught me to consider as a task far beyond the reach of individual exertion; and, wishing to obtain at least partial success, I bestowed all my labour in the attempt to reform the instruction of children, and am highly delighted with the great success Mr. O. has obtained, in the only fair and impartial experiment ever made on the great mass of industrious producers of national wealth.

That he has chosen a field of experiment, the freest from impediments of any kind which the world affords, infinitely increases my gratification. This is perhaps in part the result of personal feeling; as his exertions and energies will smooth the road (even if he does not succeed) for some of my minor plans; and if he should be successful with his gigantic improvements, I can have the less doubt of establishing some of my comparatively unimportant principles.

* Extract of a letter from William Maclure, Esq. to the Editor.

Mr. Phiquepal, whom I mentioned in my former letters, is no doubt by this time on your side of the Atlantic. I have already informed you that he carried with him forty or fifty large cases of prints, instruments, and books, necessary for the elucidation of the system which he teaches. The most important object is to give, first, a correct knowledge of substances, and afterwards words or signs. As he is intimately acquainted with the properties of matter, there is every reason to expect success; and I hope his example will be followed by other schools, so far at least as to give to children ideas of things by their exact representations, instead of the vague and undefined method in common use.

21. *Optical Structure of Minerals.*—The optical structure of minerals it is well known has thrown much light upon their composition. Dr. Brewster has lately examined a specimen of the *lithion mica* of Prof. Gmelin, and has ascertained that these plates are composed of crystals with one axis, united to crystals with two axes. Now as all the uniaxal crystals of mica yet examined differ in chemical composition from the biaxal ones, Dr. Brewster recommends Prof. Gmelin to detach all the uniaxal parts if possible from the biaxal parts, and to make a separate analysis of both. If he finds what analogy authorizes us to expect, that these two portions are chemically different, the result will be a most important one, both for mineralogy and analytical chemistry. It will set aside all analyses of minerals, where it is likely that the body analysed has not been an *individual* crystal, and it may thus establish upon a firmer basis the law of definite proportions.

22. *Himalayah Mountains.**—Upwards of 25,749 feet have been stated by two eminent mathematicians, Captains Hodgson and Herbert, as the elevation, trigonometrically ascertained, of one of the Jowahir peaks. Calculations have been usually founded either upon comparison with the medium height of the barometer in Calcutta, or at the level of the sea (perhaps 1200 miles off) during the month in which the observation on the mountain was made. Even where contemporaneous observations are obtained, have we ascertained that

* Extracted from a paper by George Govan, M. D. in Dr. Brewster's Edin. Jour. of Science, Vol. II.

the alterations of atmospherical pressure in any accessible part of the Himalayah and Calcutta are cotemporaneous?

It were vain to attempt describing the enthusiasm and delight experienced by the admirers of nature, on first entering these districts. Inhabitants of the north, long exiled from the place of their birth, and contending with the fiery atmosphere of the tropical regions, can alone conceive the pleasure which many derived from the approach to a northern climate, and the gradual appearance of the features of a northern landscape, which the pines, more than any other vegetable, contributed to give the wooded heights, while the streams were more animated and cheerful, from their clearness, rapidity, and pebbled beds, so different from the sluggish and muddy waters of the plains, their unvaried surface and monotonous productions.

23. *Mr. Dalton's process for determining the value of Indigo.** In order to find the value of any sample of indigo, Mr. Dalton directs us to take one grain carefully weighed from a mass finely pulverized. Put this into a wine-glass, and drop two or three drops of concentrated sulphuric acid upon it. Having triturated them well, pour in water, and transfer the coloured liquid into a tall cylindrical jar, about one inch inside diameter. When the mixture is diluted with water so as to show the flame of a candle through it, mix the liquid solution of oxy-muriate of lime with it, agitating it slowly, and never putting any more in till the smell of the preceding portion has vanished. The liquid soon becomes transparent, and of a beautiful greenish yellow appearance. After the dross has subsided, the clear liquid may be passed off, and a little more water put into the sediment, with a few drops of oxy-muriate of lime, and a drop of dilute sulphuric acid; if more yellow liquid is produced, it arises from particles of indigo which have escaped the action of the oxy-muriate before, and must be added to the rest. The value of the indigo, Mr. Dalton considers to be in proportion to the quantity of real oxy-muriate of lime necessary to destroy its colour. He is of opinion, also, that the value may be well estimated by the quantity and intensity of the amber-coloured liquid which the indigo produces, which is found independently of any va-

* This article, and the five next succeeding, are copied from Dr. Brewster's Edin. Journal of Science, Vol. II.

luation of the oxy-muriate of lime. The following results, obtained with several samples, show the great value of this method—exhibiting the quantity of oxy-muriate of lime used to destroy its colour.

Precipitated and sublimed indigo, - -	140 grains.
Flora indigo, - - - - -	70
Another sample, - - - - -	70
Two other indigos, - - - -	60
Two other samples, - - - -	50
Another sample, - - - - -	40
Another sample, - - - - -	30 or 35.

Mr. Dalton is of opinion that to destroy indigo by oxy-muriatic acid, twice the quantity of oxigen is necessary that is required to revive it from the lime solution.—*Abridged from Manchester Memoirs, New Series,* Vol. IV pp. 437—439.

24. *Bois de Colophane.*—In the woods of Mauritius there is a tree called the *Bois de Colophane,* and supposed to be a *Bursera.* From the slightest wound in the bark of this tree, there issues a copious limpid oil, of a pungent turpentine odour, which soon congeals to the consistence of butter, assuming the colour of camphor. Like camphor also, it burns with a vivid flame, and leaves no residuum.

25. *Siemen's improvement on the process of making brandy from potatoes.*—The potatoes are put into a close wooden vessel, and exposed to the action of steam, which heats them more than boiling water. They can thus be reduced to a state of the finest paste with the greatest facility, it being necessary only to stir them with an iron instrument furnished with cross pieces. Boiling water is then added to the paste, and afterwards a little potash, rendered caustic by quick lime. This dissolves the vegetable albumen, which opposes the complete conversion of the potatoe starch into a fluid. Professor Oersted frees the potatoe brandy from its peculiar flavour by means of the chlorate of potash, which is said to make it equal to the best brandy made from wine.

Gill's Tech. Repos. No. 29, p. 322.

26. *No diurnal variation of the needle at the equator.*—M. Arago has, we understand, deduced from M. Duperry's observations on the diurnal variations of the needle, that there is no diurnal variation at the earth's equator.

27. *Increase in the quantity of rain.*—M. Flauguergues of Viviers, who has for 47 years carefully observed the quantity of rain that fell, has remarked, by taking periods of ten years, that the quantity of rain is continually increasing, and also the annual number of rainy and cloudy days, not only at Viviers, but throughout the south of France.

28. *Potassium and Sodium.*—Mr. Frederick Butz of Nion (Canton de Vaud) in Switzerland, manufactures potassium and sodium for sale, the price of potassium is L2 per ounce and that of sodium L4 per ounce.

Schweigger's Journal, X. *p.* 494.

II. Domestic.

1. *American Geological Society.*—A copy of the Vindiciæ Geologicæ of Professor Buckland, forwarded to the Society by the author, has been received.

Dr. J. Porter has presented to the Society, the New-York Medical and Philosophical Journal, in three Volumes octavo —also several pamphlets. From the same gentleman, an additional collection of minerals, in six boxes, has been received.

2. *Proceedings of the Lyceum of Natural History of New-York; (continued from Vol. VII p.* 174.)

June 16. 1823.—Mr. A. Halsey read a synoptical view of the *Lichens* growing in the vicinity of the city of New York. Vide Annals of the Lyceum of Natural History of New-York.

June 23.—Mr. Barnes communicated a supplement to a former paper on the *Chitons* brought from Peru by Capt. Ridgely of the U. S. Navy.

June 30.—The President announced the fact of his having received several bones of the *Mastodon* from Southold, Long-Island, near the sea. Dr. Akerly communicated drawings, and a description of a variety of the *Balena mysticetus*, taken near Sandy Hook, in 1821.

July 7.—Dr. Dekay read a continuation of his former remarks on the anatomy of fishes, accompanied by preparations. Dr. Akerly read a dissertation on the language of signs, more particularly with reference to those used by the native Indians of North America.*

July 14.—Mr. Barnes resumed his observations on North American shells, and exhibited several rare and new species from the coast of Peru. Dr. Dekay read a memoir on some fish received from South America, through, and presented by, Mr. Vaché. The memoir was accompanied by several highly finished drawings.

July 21.—A paper by Professor Dewey of Williams College, Mass. written in 1817, was presented to the Lyceum. His observations on the fluids contained in quartz crystals coincided in a singular manner with those subsequently made by Dr. Brewster of Edinburgh. Mr. Barnes concluded his observations on North American shells, and the Society adjourned to meet on the 1st of Sept. following.

Sept. 1.—Dr. Dekay communicated a paper on the *Salt Springs* at *Salina*, N. Y. with observations on the manufacture of salt, as practised at that place. He also read a description of the Gum Acaroides from Botany Bay, extensively used as a medicine in the eastern states.

Sept. 8.—A specimen of iron ore from Verona, N. Y. was received from Mr Stephen Smith of Salina. It proved on examination to be the brown hematite with organic remains imbedded (Entrochites). Dr. Dekay presented a specimen and description of a new and remarkable species of Coluber from Mobile, to which he gave the name of *C. sayii.*

Sept. 15.—The President read a description of a supposed new species of Ray, *(Cephalopterus Vampyrus,)* taken at the mouth of Delaware Bay, and now exhibiting in this city.—Vide p. 23 of the Annals. A communication from Mr. W. Lewis was read respecting the successful cultivation of Tea on the river Amité, near New-Orleans. Specimens of the tea accompanied the communication.

Sept. 22.—Dr. Torrey read *descriptions of new and rare plants from the Rocky Mountains*, collected in 1820, by Dr. Edwin James. Vide p. 30 of the Annals. Mr. Barnes announced the discovery of copper in the form of blue and

* This and several other papers mentioned in this notice have appeared in former numbers of this Journal.

green carbonate and pyrites at Sing Sing, a few miles from the city.

Sept. 29.—New localities of epidote and fluor spar at St. Albans, and Bellows Falls Vermont, were announced by Prof Hall of Middlebury college. Prof. ——— Lamouroux of Caen, France, was elected an Honorary Member. A paper *on the Clupea hudsonia, a new species*, was read by De Witt Clinton, accompanied by a drawing. Inserted p. 49 of the Annals.

Oct. 6.—Mr. J. Cozzens communicated a paper *on the acid of the Rhus glabrum, with observations on the juice of the Sambucus canadensis as a delicate test.* Vide p. 42 of the Annals. Dr. Van Rensselaer read a letter from Judge M'Kean relative to the recent mortality among the fishes in certain fresh water ponds near Poughkeepsie.

Oct. 13.—The President read a description, accompanied by specimens, of a new species of Gorgonia, and also of a species of Pavonia, from Hell Gate. Dr. Dekay offered a communication *on some singular fossils in the Cabinet of the Lyceum, labelled Bilobites.* Inserted p. 45 of the Annals.

Oct. 20.—Professor Renwick read *an examination of a mineral from New-Jersey,* to which he gave the name of Torrelite. Inserted p. 37 of the Annals. Wm. J. Hooker of Glasgow, and R. K. Greville of Edinburgh, Scotland, were elected honorary members.

Oct. 27.—The President delivered a discourse introductory to the lectures for the ensuing winter. Dr. Dekay read a paper on several trilobites now in the Cabinet of the Lyceum.

Nov. 10.—Dr. Dekay presented a specimen of a singular crustaceous animal, (Phyllosoma) taken in Lat. 42° N. This is supposed to be the first instance in which this animal has been found in so high a latitude. It appears to be specifically distinct from the four species described by Leach in the appendix to Tuckey's expedition to the Congo.

Nov. 17.—Dr. Dekay read a paper on animal torpidity, founded on his own observations on the animals of this country. The President read a communication on the teeth of the Megatherium, now for the first time discovered in the United States: in a previous paper the learned President had conjectured it to be the Anoplotherium, but a more minute examination had resulted in ascertaining it to be the Megatherium resembling that of Paraguay.

Nov. 24.—Dr Torrey read *a notice of the discovery for the first time in the United States, of Yenite.* Inserted p 51 of the Annals.

Dec 1.—Captain Le Conte of the U. S. topographical engineers presented a new species of Siren with a detailed *description and observations on animals of a similar nature.*—Inserted p. 52 of the Annals.

Dec. 8.—The Rev L. D. de Schweinitz presented to the Society *an analytical table to facilitate the determination of the hitherto observed North American species of the genus Carex.* Inserted p. 62 of the Annals. Dr. Akerly read a paper on the *Venus mercenaria* or common clam, with details respecting their manners and habits and observations on the article termed *Wampum* manufactured from these shells.

January 5, 1824.—Capt. Le Conte communicated a paper entitled *observations on the North American species of the genus Utricularia.* Inserted p. 72 of the Annals.

January 12.—Dr. Dekay read an analysis of a work in manuscript entitled *Toxicologie des Antilles* par J B. Madianna, M. D. Royal Physician for the island of Guadaloupe. The President read a paper on the organic remains of the region near Tappan. The specimens presented were found in sandstone, but were too comminuted to determine the class to which they belonged.

January 19.—Major Delafield presented a series of geological specimens, illustrating the rock formations from Niagara through the northern shores of the great lakes to the lake of the Woods. This interesting collection was accompanied by a paper entitled *notices of new localities of simple minerals along the north coast of lake Superior and in the Indian Territory from lake Superior to the river Winnipec.* Inserted p. 79 of the Annals.

Feb. 3.—The President exhibited for the inspection of the members a singular fish, with a memoir entitled *Description of the Saccopharynx flagellum.* Inserted p. 82 of the Annals.

Feb. 17.—Dr. Dekay communicated a paper entitled, *observations on the Stylephorus chordatus of Shaw.* In this paper the author endeavoured to show that M. Blainville's observations on this animal, as detailed in the Journal de Physique, though ingenious, are not sufficient to prove the Stylephorus to be an altered Fistularia or Syngnathus. It was also attempted to show that the Saccopharynx of the

President should be referred to the Stylephorus of Shaw. A detailed description of a bed of gypsum at Sandusky bay, Ohio, was received from Mr. Samuel Scribner.

Feb. 24.—This being the anniversary of the Society, the officers for the ensuing year were elected.*

Dr. Van Rensselaer then delivered the anniversary address and the Lyceum adjourned.

(To be continued in our next number.)

3. *Franklin Institute.* A society has been established in the city of Philadelphia in the course of the last year, under the name of the "*Franklin Institute* of the State of Pennsylvania for the Promotion of the Mechanic Arts." "The object of this Institute is the promotion and encouragement of manufactures and the mechanic and useful arts, by the establishment of popular lectures on the sciences connected with them; by the formation of a cabinet of models and minerals, and a library; by offering premiums on all objects deemed worthy of encouragement; by examining all new inventions submitted to them, and by such other means as they may judge expedient."

The members of the Institute are to consist of manufacturers, mechanics, artisans, and persons friendly to the mechanic arts; and stated meetings are to be held quarterly.

The officers for the year 1825 are,

James Ronaldson. *President.*
Mathew Carey, } *Vice-Presidents.*
Isaiah Lukens, }
William Strickland, *Recording Secretary.*
Peter A. Browne, *Corresponding Secretary.*
Thomas Fletcher, *Treasurer,*

and twenty-four *Managers.*

A regular system of lectures has been given during the last winter by the three professors already appointed; viz. Robert M. Patterson, M. D. *Professor of Natural Philosophy;* William H. Keating, *Professor of Mineralogy and Chemistry;* and William Strickland, *Professor of Architecture.*

* A list of the officers elected at this meeting was given in a former number.

A professorship of *Mechanics*, also, is created, but this chair is not yet filled. Besides the regular lectures, volunteer and occasional lectures have frequently been given, on various subjects, by several members of the Institute.

An *Exhibition* of the products of domestic industry was held, pursuant to the plan adopted by the Board of Managers, on the 18th, 19th, and 20th of October, 1824, during which time a great number of articles were exhibited, a detail of which is given in the "First Annual Report"* of the Institute. Annexed to this Report are proposals for a second Annual Exhibition, to be held on the 6th, 7th, and 8th of October, 1825, to which all persons are invited to send the products of their skill, ingenuity, and industry. The proposals for this exhibition, with the list of premiums offered, occupy eleven pages, which we would earnestly recommend to the perusal of those engaged in manufactures, and who feel an interest in the cause of the arts. C. H.

4. *South-Carolina Medical School.*—The Medical Society of South-Carolina, having organized a School of Medicine, agreeably to the powers conferred at the last session of the Legislature, the following details are made for the information of the public.

The Professors elected are,

John Edwards Holbrook, M. D. *Anatomy.*
James Ramsay, M. D. *Surgery.*
Samuel Henry Dickson, M. D. *Institutes and Practice.*
Thomas G. Prioleau, M. D. *Obstetrics, and Diseases of Women and Infants.*
Henry R. Frost, M. D. *Materia Medica.*
Edmund Ravenel, M. D. *Chemistry and Pharmacy.*
Stephen Elliott, LL. D. *Natural History and Botany.*

In order to entitle an individual to examination for a degree, it will be necessary that he shall have attained the age of 21 years, be of good moral character, and have studied medicine for two years with some established practitioner. He shall also have taken the ticket of each professor for two courses of lectures, or shall have attended one full course at some other

* Forwarded to the Editor by the favour of P. A. Browne, Esq. Corresponding Secretary.

respectable medical school, previously to his becoming a member of this institution. Students who have for two seasons taken the tickets of any or all of the professors, shall be thereafter entitled to admission into his or their lecture-room, without further expense. The lectures will commence on the second Monday in November, and will continue for five months. The anatomical lecture-room is lighted from the top of the building, and the seats are elevated sufficiently for the convenience of the students. Arrangements for private dissections are particularly attended to, and every facility afforded for the acquirement of a minute knowledge of the structure of the human frame, and the preparation and preservation of its different parts. The chemical laboratory is contained in the same building, and such apparatus procured as is necessary to a full experimental course. The library belonging to the Medical Society will be opened to the students upon the most liberal terms, and it is only doing justice to that body to acknowledge that their collection of medical works is among the largest and most select in the United States. The privilege of visiting the patients in the marine hospital and poor-house, affords the best opportunities for the acquisition of practical knowledge, without additional expense. During the daily attendance of the physicians of these institutions, such clinical remarks are made as are of importance to the medical student. All operations in surgery, occurring in these establishments, will be free to the class, in addition to such cases in private practice as may be operated on in the public institutions.

Some advantages of a peculiar character are connected with this institution, which it may be proper to point out. No place in the United States offers as great opportunities for the acquisition of anatomical knowledge, subjects being obtained from among the coloured population in sufficient number for every purpose, and proper dissections carried on, without offending any individual in the community. Those impediments which exist in so many other places to the prosecution of this study, are not here thrown in the path of the student, public feeling being rather favourable than hostile to the advancement of the science of anatomy. In addition, the southern student can no where else receive correct instruction on the diseases of his own climate, or the peculiar morbid affections of the coloured population.

THOMAS G. PRIOLEAU,
Dean of the Faculty.

Charleston, June 19, 1824.

5.—*Meteorological Tables.* By M. Jules de Wallestein, Corresponding Member of the Academy of History of Madrid, and Secretary to the Russian Legation at Washington.—We have received a memoir, extracted from the Transactions of the American Philosophical Society, in illustration of the tables mentioned in the title of this article.

M. Wallestein's observations were made between the 17th of April, 1823, and the 24th of April, 1824, with the thermometer, the barometer, and the hygrometer; and his results, obtained by great care, are obviously valuable, especially as such observations are far from being sufficiently multiplied in this country.

Those diurnal and semi-diurnal tides in the atmosphere, whose regular occurrence within the tropics has been fully established by the observations of Humboldt and others, and whose existence, in temperate latitudes, although with less distinctness and regularity, has also been proved, have been ascertained by M. Wallestein to exist at Washington.

In this city, it appears that the maximum of the barometer is at 9 A. M. and its minimum at 4 P. M.; although the fluctuations of the barometer are far from being as regular here as within the tropics. M. Wallestein found that the mean temperature of the months of May, June, and July, was almost exactly the same as that of the three preceding months.

The greatest difference of temperature was between October and September, and the least between August and July.

The mean temperature of the year was	58.5	Fah.
of summer,	67.5	Difference
of winter,	47.9	19.6.

The mean height of the barometer for the year was	29 922	
during summer,	29.910	Difference
during winter,	29 926	0.016.

In 1820, the maximum temperature observed at St. Petersburgh, Aug. 7, was 78.1 Fah. at noon.

In 1822, in July, 85.1 Fah. at noon.

At Washington, in 1823, the maximum temperature at noon was 95.9 Fah.

In 1820, at Petersburgh, Jan. 18, in the evening, the greatest cold was —25.4 Reau.

In 1823, Jan. 11, —14.2

In 1824, at Washington, the greatest cold was +11.3 Fah.

18[illegible] AN[illegible] 182[illegible] MON[illegible]	[illegible]imum. height.		Difference		SAUSSURE'S HYGROMETER.							
	Millimeter.	Eng. inches	Millimeter.	Eng. inches	Mean.	Day.	Hour.	Maximum.	Day.	Hour.	Minimum.	Difference.
	0,7526	29,631	0,0187	0,736	73,1	30	3	94,0	30	7	55,0	39,0
April.	0,7503	29,540	0,0184	0,725	71,0	13	8	95,0	4	8	48,0	47,0
May.	0,7534	29,662	0,0157	0,618	77,7	8	7	96,5	11	12	46,5	50,0
June.	0,7462	29,379	0,0229	0,901	76,5	2	6	95,0	12	4	55,5	40,5
July.	0,7502	29,536	0,0196	0,776	74,5	11	12	88,0	25	4	50,5	37,5
Augus[illegible]	0,7521	29,611	0,0239	0,941	77,6	11	9	89,5	30	4	46,0	43,5
Semte[illegible]	0,7541	29,690	0,0163	0,642	69,7	5	9	88,0	28	4	42,0	46,0
Octob[illegible]	0,7552	29,733	0,0221	0,870	64,2	7	12	92,5	13	4	50,0	42,5
Nove[illegible]	0,7505	29,548	0,0257	1,012	79,5	19	12	91,0	1	12	67,0	24,0
Decen[illegible]	0,7421	29,217	0,0308	1,213								
Janua[illegible]	0,7447	29,320	0,0317	1,248								
Febru[illegible]	0,7523	29,619	0,0213	1,099								
March	0,7435	29,273	0,0212	0,834								
April.												
Of the[illegible]												
Of sum[illegible]												
Of win[illegible]												

[illegible]824.

N. W. to N.	Calm.
"	
6	
4	
7	
4	
11	
8	
10	
9	
10	
4	
6	
8	
87	32

TABLE I.

1823 and 1824. MONTHS.	THERMOMETER. Mean temp. Centigrade.	Mean temp. Fahrenheit.	Mean temp. at noon. Centigrade.	Mean temp. at noon. Fahrenheit.	*Maximum* of temperature. Day.	Hour.	Centigrade.	Fahrenheit.	*Minimum* of temperature. Day.	Hour.	Centigrade.	Fahrenheit.	Difference. Centigrade.	Fahrenheit.
	+													
April.	18,2	64,8	21,2	70,2	21	10	25,5	77,9	28	10	10,0	50.0	15,5	27,9
May.	21,9	71,4	25,0	77,0	20	4	33,8	92,8	5	8	8,0	46,4	25,8	46,4
June.	24,0	75,2	26,6	79,9	16	12	35,5	95,9	1	6	10,0	50,0	25,5	45,9
July.	27,1	80,8	28,4	83,1	12	4	34,7	94,5	23	6	17,7	63,9	17.0	30.6
August.	26,5	79,7	28,3	82,9	8	4	35,0	95,0	24	6	14,7	58,5	20,3	36,5
Semtember	22,0	71,6	23,0	73,4	7	12	31,7	89,1	27	6	10,5	50,9	21 2	38,2
October.	13,3	55,9	15,9	60,6	5	12	25,3	77,5	19	6	—0,7	30,7	26,0	46,8
November.	6,2	43,2	7,4	45,3	22	4	15,7	60,3	30	7	—4,0	24,8	19,7	45,5
December.	3,9	39,0	6,2	43,2	31	4	16,7	62,1	10	7	—4,1	23,9	20,8	38,2
January.	5,2	41,4	6,9	44,4	11	4	20,0	68,0	28	7	—5,2	22,6	25,2	45,4
February.	2,5	36,5	4,9	40,8	11	5 30′	18,0	64,4	2	7	—11,5	11,3	29,3	53,1
March.	7,6	45,7	10,2	50,4	5	4	19,0	66,2	1	7	—3,7	25,3	22,7	43,5
April.	13,1	55,6	15,0	59,0	11	4	23,7	74,7	2	9	+4,5	40,1	19,2	34,6
Of the year.	14,7	58,5	16,8	62,2										
Of summer.	19,7	67,5	22,1	71,8										
Of winter.	8,85	47,9	10,7	51,3										

MONTHS.	BAROMETER. Mean height. Millimeter.	Mean height. Eng. inches	*Maximum* of height. Day.	Hour.	Millimeter.	Eng. inches	*Minimum.* of height. Day.	Hour.	Millimeter.	Eng. inches	Difference Millimeter.	Eng. inches	SAUSSURE'S HYGROMETER. Mean.	Day.	Hour.	Maximum.	Day.	Hour.	Minimum.	Difference.
April.	0,7637	30,068	29	7	0,7713	30,367	21	3	0,7526	29,631	0,0187	0,736	73,1	30	3	94,0	30	7	55,0	39,0
May.	0.7612	29,969	26	8	0,7687	30,265	4	8	0,7503	29,540	0,0184	0,725	71,0	13	8	95,0	4	8	48,0	47,0
June.	0.7607	29,950	12	8	0,7691	30,280	8	4	0.7534	29,662	0,0157	0,618	77,7	8	7	96,5	11	12	46,5	50,0
July.	0,7600	29,922	6	9	0.7691	30.280	18	12	0,7462	29,379	0,0229	0,901	76,5	2	6	95,0	12	4	55,5	40,5
August.	0,7609	29,957	25	6	0,7698	30,307	8	4	0,7502	29,536	0.0196	0,776	74,5	11	12	88,0	25	4	50,5	37,5
Semtember	0.7619	29,996	3	12	0.7760	30,552	7	4	0,7521	29.611	0,0239	0,941	77,6	11	9	89,5	30	4	46,0	43,5
October.	0,7609	29,957	1	6	0,7704	30,332	9	12	0,7541	29,690	0,0163	0,642	69,7	5	9	88,0	28	4	42,0	46,0
November.	0.7646	30,103	29	9	0.7773	30,603	26	4	0,7552	29,733	0,0221	0,870	64,2	7	12	92,5	13	4	50,0	42,5
December.	0,7651	30,123	26	9	0,7762	30,560	19	7	0,7505	29,548	0,0257	1,012	79,5	19	12	91,0	1	12	67,0	24,0
January.	3.7513	22,580	8	4	0,7729	30,430	25	4	0,7421	29,217	0,0308	1,213								
February.	0,7610	29,961	13	12	0,7764	30,568	11	5 30′	0,7447	29,320	0,0317	1,248								
March.	0.7542	29,694	21	9	0,7726	30,418	28	4	0,7523	29,619	0,0213	1,099								
April.	0,7575	29,824	3	7	0,7647	30,107	12	4	0,7435	29,273	0,0212	0,834								
Of the year.	0,7600	29,922																		
Of summer.	0,7597	29,910																		
Of winter.	0,7601	29,926																		

TABLE II.

TABLE

Of the state of the weather at Washington, from April 18, 1823, to April 17, 1824.

MONTHS.	*Number of days of the different variations.* Clear.	Cloudy.	Rainy.	Stormy.	Lightning & Thunder.	Fog.	Snow.	White frost.	Hard frost.	*Winds.* N. to N. E.	N. E. to E.	E. to S. E.	S. E. to S.	S. to S. W.	S. W. to W.	W. to N. W.	N. W. to N.	Calm.
April 13 (days.)	6	4	2	1	"	"	"	"	"	1	2	1	"	8	"	1	"	
May.	14	17	7	5	1	"	"	"	"	5	"	3	5	5	1	6	6	
June.	14	16	5	6	1	"	"	"	"	4	1	2	9	"	3	"	4	
July.	17	10	4	4	2	"	"	"	"	3	"	3	7	1	"	2	7	
August.	20	7	4	3	2	"	"	"	"	6	3	4	10	2	1	1	4	
September.	15	11	4	2	"	"	"	"	"	3	3	6	3	"	"	2	11	
October.	22	5	3	"	"	1	"	"	"	7	3	4	6	"	"	1	8	
November.	16	8	7	"	"	2	2	4	1	7	1	7	3	"	1	1	10	
December.	22	5	3	"	"	1	1	2	3	7	1	9	1	"	"	1	9	
January, 1824.	17	4	5	2	"	2	1	"	1	4	5	"	1	6	"	1	10	
February.	15	11	4	1	"	"	4	1	1	1	5	"	7	1	3	4	4	
March.	11	13	5	1	1	1	1	"	"	5	4	5	3	1	1	3	6	
April 17 (days.)	10	6	3	"	"	"	"	"	"	"	1	"	3	3	2	"	3	
Recapitulation.	199	118	56	24	7	7	9	7	6	53	29	44	58	27	12	23	87	32

6. *Cold at the head of Lake Superior.**—Our thermometer has frequently stood between 20 and thirty degrees below zero and one night at 12 o'clock, the mercury sunk into the ball of the thermometer—the instrument was graduated at 33° below 0, and there remained till just before sun rising.—Notwithstanding the intensity of cold, we do not suffer, as we have warm quarters and plenty of wood, and when we go out, guard against the cold by means of flannel, furs, &c.

7. *Hot Weather.*—Newspapers of the southern states speak of the extreme heat which prevailed in that region during a part of the summer of the last year. In Cheraw, South-Carolina, the mercury, in Fahrenheit's thermometer, exposed to the air in the shade, stood, at 3 o'clock P. M. of six successive days, as follows:—June 26th, 90°; 27th, 94°; 28th, 103°; 29th, 103°; 30th, 105°; July 1st, 100°

8. *Valuable Relic.*—Rarely has the death of an enemy produced such feelings as were produced by the untimely fate of Major ANDRE, adjutant-general of the British army, that amiable and gallant, though unfortunate officer, who was executed at Orangetown, or Tappan,† N. Y. on the 2d of October, 1780. Floods of tears were elicited from the officers and soldiers who witnessed that lamentable occurrence; a universal sadness pervaded our army throughout the country; and the martial spirit of the nation seemed lost in a unanimous and heartfelt commiseration.

While this unhappy young man was confined in his guard-room, previously to his execution, he occupied the most of his time in writing; but occasionally endeavoured to relieve the anxiety of his mind by sketching with a pencil or pen—an art which he possessed in a high degree. A little sketch, taken by him at that time, has been preserved among some other papers by a worthy citizen of this town, (New-Haven,) who was an officer of the revolution. This sketch exhibits a person of a youthful countenance and graceful figure, sitting in an easy and commanding attitude, with the left arm extended over the back of his chair, while the right arm rests

* Extract of a letter from Dr. L. Foot, dated Cantonment Brady, Sault St. Marie, Feb. 15, 1824.

† Now commonly called *Tappan*.

on a table or stand, on which are observed an ink-stand with a pen. It is a hasty sketch, taken on a small scale, with a pen; but is sufficiently expressive of skill in the art, and the face, particularly, is in a more masterly and spirited style than is common in amateur performances. From the facts in our possession, we cannot entertain a doubt that it is a genuine sketch from the pen of Major Andre; and we have reason to believe that it is designed to represent himself. This belief is strengthened by the thoughtful expression, air, and apparent age of the figure. Exact resemblance of countenance could not reasonably be expected, as this exactness would rarely be produced, even by professional artists, with an implement like a pen, the lines of which must be executed at once, and cannot be erased.

There are many considerations which, it is presumed, will excite a general interest in this sketch: and we are happy to state that this valuable relic is now in the hands of Messrs. N. & S. S. Jocelyn, engravers, of this city, from whose well known skill we doubt not that the public will soon be favoured with an accurate *fac simile* of the original.

9. *Dr. Robinson's Catalogue of American Minerals.*—This work was announced in Vol. VIII. p. 200, of this Journal, and has recently made its appearance in a handsome octavo of 316 pages. As far as we can judge from an examination of those localities with which we are best acquainted, Dr. Robinson has executed his task with commendable care and fidelity. His work will be to the travelling mineralogist, what the road-book, guide, and itinerary are to the common tourist: it will point the scientific traveller to those objects most worthy of his notice, and inform him whether to deviate to the right or to the left, and where he ought to pause on his journey.

Every person interested in these pursuits must have experienced the inconvenience of searching systematical or periodical works, for the localities of minerals; and he will feel himself much indebted to Dr. Robinson for acting as his pioneer, and taking him directly to his object. The author will of course watch with a vigilant eye the rapidly augmenting list of American localities, and be prepared in due season for those successive editions of his work which will probabl be called for. One addition we could wish that he would make to it, in the second edition. It would be very desirable to have an *alphabetical* list of simple minerals, and of the principal compound rocks, appended to his work, with the addition of all the pages of the work on which those minerals and rocks are mentioned.

Every mineralogist, while perusing Dr. Robinson's valuable work, will be forcibly impressed with the extent and value of the additions which, in the course of a few years have been made to our knowledge of our mineral treasures, whether as objects of utility or curiosity; and he will look forward to an extension still more rapid, keeping pace with the progressive march of settlement, culture, and mental improvement in our vast territory.

10. *Dr. Van Rensselaer's Geology.*—Dr. Van Rensselaer, of New-York, is now publishing a course of Lectures on Geology, lately delivered before the Athenæum of that city. We take great pleasure in announcing every attempt of this nature to elucidate the natural resources of our country, and from our acquaintance with Dr. V. R. we believe he will do justice to the subject.

11 *Cryptogamic Flora of North-America.*—The Rev. L. De Schweinitz, of Bethlehem, and Mr. Abraham Halsey, of New-York, are engaged in collecting materials for a Cryptogamic Flora of North-America.

12. *Fauna Americana.*—Dr. Richard Harlan, of Philadelphia, already advantageously known to the scientific world by his numerous discoveries in the animal kingdom, has now in press a work entitled "*Fauna Americana*, or a description of the mammiferous animals inhabiting the United States." Such a work is much wanted, and we are rejoiced that it has fallen into the hands of an American naturalist.

13. *Col. George Gibbs.*—This distinguished mineralogist, with his accustomed liberality, has presented to the cabinet of the New-York Lyceum an elegant collection of Siberian minerals, of great variety and value.

14. *Lehigh Coal.*—It appears from the report of the Lehigh Coal and Navigation Company, dated Jan. 10, 1825,*

* National Gazette of Jan. 20, 1825.

that "the new coal mine on the north side of the mountain presents a bed of coal one hundred feet thick." "The quantity of coal on the land of the company is supposed to be equal to a four equal-sided prism of five hundred feet on each side, and seven miles in length; the largest body of coal known."

There can be no doubt that this coal will become an object of vast national importance. It is a very pure anthracite, but sufficiently combustible, *in a proper apparatus, and with proper treatment*, to maintain a constant and (if desired) intense fire, which burns without odour or smoke—is perfectly safe although left for the night and without watching, will continue till morning, and will then be found in a state of sufficient activity. It is admirable for halls, churches, and other similar places, where it is desired to throw into circulation a large volume of warm air; and we have it on the best authority that it is excellent for the smith's forge, and for other purposes of the arts.—Ed.

15. *Mineralogy of the coast of Labrador, and of the shores of the St Lawrence.* A gentleman who lately returned to this city from the Labrador coast, and whose attention has been successfully turned to the Mineralogy of the Gaspe district, from which some very valuable and beautiful specimens of the quartz family, particularly the different varieties of cornelian, agate, opal, and jasper, have been introduced into the province, and cut into different ornamental articles by Mr. Smillie, Lapidary of this city, brought up some beautiful specimens of the sky-blue variety of the Labrador feldspar, a mineral first, and as yet almost exclusively, found on that coast. The others and almost all the different varieties of this mineral, it is stated, are found on the same coast: viz. green, yellow, red, and pearl gray; the present specimen, as stated above, is of the blue; it is hard, and takes a fine polish; the changeability of colour, from a dark gray to the most bright and vivid sky-blue, is beautiful, and makes it very valuable, and well adapted for cutting into snuff-boxes, ring-stones, &c.

The specimens alluded to were found at Mingan, and appear to be imbedded in a gray granitic rock.

The whole north shore of the St. Lawrence, from Quebec to its mouth, and the Labrador coast, offer to the geologist and mineralogist, a field for research, such as we believe, cannot be met with in any other country. It has never been examined by scientific men, or at least we have seen no work in which it was intimately spoken of. The greater part of it, bordering on the Gulf of St. Lawrence, appears to be primitive, with generally, along the rivers, the earlier formation of rocks. The Saguenay is, however, a remarkable exception to this, and as far up as Chicoutimy, 25 leagues from its mouth, the foot of the high, sometimes bald and scantily wooded, granitic mountains are washed on both sides by its waters. The *pointe aux bouleaux*, on this side of its mouth, is an alluvial deposit, and is perhaps the richest soil in the world, being composed of a species of gray marl of thirty or forty feet in depth.—*Quebec Gazette.*

16. *Eye Infirmaries.* In Europe experience has fully confirmed the utility of institutions devoted particularly to curing diseases of the eye. Institutions of this kind have recently gone into successful operation in several of the large towns in this country. The *New York Eye Infirmary* was established in August 1820, by the exertions of a few humane and charitable individuals. By the fourth annual Report, published in January, 1825, it appears that the number of patients admitted into this Infirmary during the year 1824 was 861, and the whole number admitted since the foundation of the Infirmary 3855. Through the instrumentality of this institution, by the donations of individuals, together with the bounty of the legislature of the State recently extended to this Infirmary, many have been restored to sight and usefulness, who would otherwise have remained only a burden to themselves and in most instances a perpetual charge upon the respective towns in which they resided.

We have no particular information concerning the Eye Infirmaries of Philadelphia, Baltimore, and Boston; but it is presumed that the citizens of those towns will afford such pecuniary aid as to ensure the usefulness of those important institutions. C. H.

17. *Non-descript Animal.* The Rev. Dr. Harris, of Dorchester, Mass. has noticed a very curious and beautiful animal lately discovered at Machias, in the State of Maine. It is a non-descript species allied to the Sorex cristatus of Linnæus, and seems to hold an intermediate rank between

the Talpæ, (Moles,) and Sorices, (Shrew-mice,) having in its form and habits an affinity to the former, while its teeth closely resemble those of the latter. Its colour is a striking peculiarity, being a beautiful grass-green. This animal has been named *Astromycter prasinatus*, and an exact scientific description is said to be prepared for publication.—*Machias Star.*

18. *Aerolite of Maine.*—A chemical examination of a fragment of the meteoric stone which fell in Maine, August 1823, (noticed by Prof. Cleaveland in this Journal, Vol. VII. p. 170,) has been made by Dr. J. W. Webster, of Boston, and published in the Boston Journal of Philosophy and the Arts.

The composition of this stone, according to analysis, is

Sulphur - - - - -	18.3
Silex - - - - -	29.5
Alumina - - - - -	4.7
Lime - - - - -	a trace
Magnesia - - - - -	24.8
Chrome - - - - -	4.0
Iron - - - - -	14.9
Nickel - - - - -	2.3.

19. *Mineralogical Notice.*—The extensive cabinet of minerals, comprising the entire collection of Dr. Morton of Philadelphia, is offered for sale.

This collection is inferior to few private ones in the United States. Its consists of two thousand two hundred specimens of good size, and in excellent preservation; amongst these are included most of the known genera and species, of which about five hundred and fifty are metals, and the remainder earthy minerals. In forming this collection, the proprietor has been at much expense of time and money during the ten years spent in Europe and America. The specimens of barytes, strontian, fluate, and sulphate of lime, opal, zeolite, wavellite, and the ores of lead and zinc, are particularly numerous and well characterized. A catalogue accompanies the minerals, in which is contained a short description of each specimen, with its locality. In addition to the minerals is a geological section of Salisbury craigs near Edinburgh, and a series of the greenstone rocks of Scotland.

Any gentleman or public institution, wishing to become at once possessed of a large and beautiful collection of minerals on very reasonable terms, may now have an opportunity. The whole will be disposed of for *fifteen hundred dollars.*

Persons interested will obtain further information by addressing letters (post paid) to Dr. Morton, Arch St. Philadelphia where the collection is arranged, and may be seen.

Philadelphia, June 2, 1825.

20 *Bolles's Trigonometer.* We have examined an instrument invented by Mr. William Bolles of Griswold, Conn. for the purpose of solving mechanically, questions in plain and spherical trigonometry, and called a trigonometer. The plan of this instrument, and the uses to which it may be applied, may be gathered from the plate, and the description that follows ; but they are more particularly disclosed in a pamphlet published by the inventor, a copy of which always accompanies the instrument. (See plate IV. fig. 10.)

A, D, and C, are three rods of metal, graduated to a scale of equal parts. C E is an arc on which the rod D C may be opened to any required angle : A B is a similar arc fixed to the rod A, on which, by means of a centre at *a*, the rod C can be opened to any angle. *a b* is a metallic piece carrying that centre, and having a groove along which slides the rod C. *b b* are screws to fix the rods firmly at the required angles. It is evident that by means of the arcs, the interior edges of the three rods may form a triangle similar to any given triangle ; and by means of the sliding part C, may be adjusted to any numerical values within the limits of their graduation.

How far an instrument like this will ever be applied *in practice* to the purposes for which it is designed, must depend on the accuracy with which it can be constructed at a moderate expense. Unless constructed with more exactness than most of the mathematical instruments that are commonly sold, it would be found of slight value. But if made with care, it is likely that an instrument of this kind will be found valuable by surveyors and seamen in all cases in which expedition is required without much numerical accuracy.

21. *Amethyst of Rhode-Island.*—We are informed by a correspondent, that the amethyst mentioned (in a note p. 40 of this Vol.) as being cut and set in gold, by Mr. George

Baker of Providence was prepared by *Davis and Babbitt,* jewellers and lapidaries, chambers over No. 45 and 47, Cheapside. Mr. Baker, we understand, keeps jewellery for sale, but neither cuts stones nor sets them, but employs others to perform this work. The amethyst mentioned in that note,* was ground by Mr. Davis, and set by Mr. Babbitt.

Messrs. Davis and Babbitt, (adds our informant,) "do business on a pretty large scale—they have a number of workmen, and cut their stones by water: during the past year, they are supposed to have made from six to eight thousand watch seals, all the stones of which were more or less ground by them."

22. *West Point Minerals.—Extract of a letter to the Editor, dated Nov.* 17, 1824, *from Prof. John Torrey of West Point.*—We have lately discovered some good minerals here. Compact white scapolite in large masses, associated with pyroxene, &c. It is a singular and beautiful mineral, of which I shall send you specimens. Sphene in macle crystals. Lt. Webster lately presented me with a splendid specimen of a crystal of the kind Haüy calls *caniculè*, which is about 2 inches long, and very brilliant, with perfectly *flat* sides. It was found in the same rock with the scapolite, which also contains *stilbite* and fine phosphate of lime. There are some interesting localities a few miles distant which I shall visit in a few days, and give you the results.

* Set to be worn as a bosom-pin, and presented by the Franklin Society of Providence.

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Fig. 2.

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Fig. 3.

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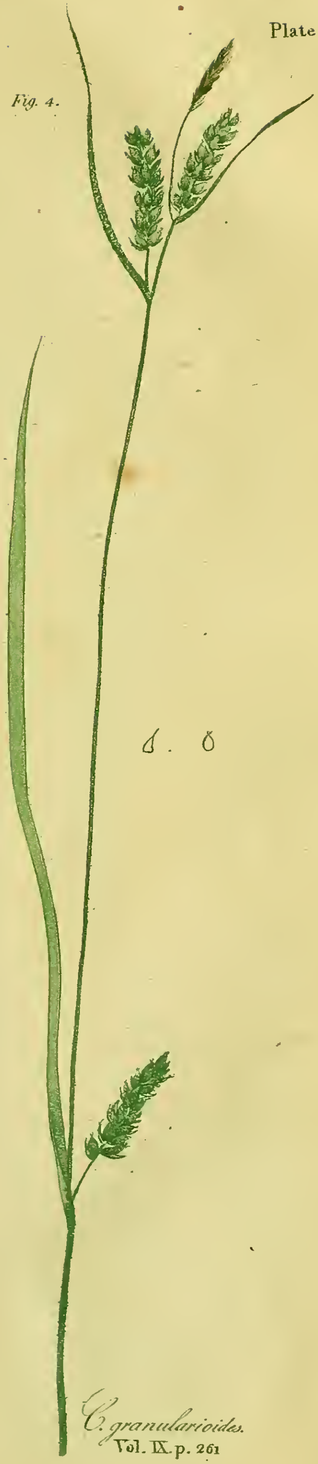
Fig. 4.



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A Doolittle sc

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A. Doolittle sc.

Fig. 1.

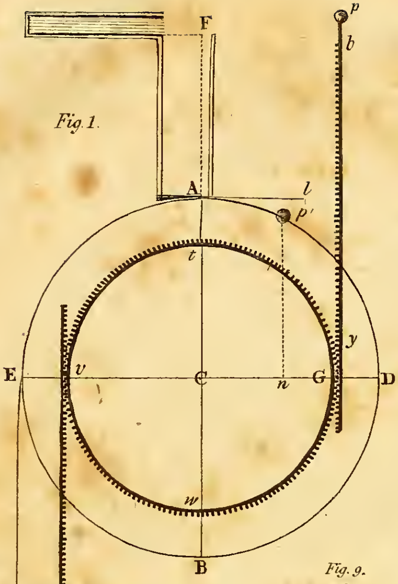


Fig. 2.

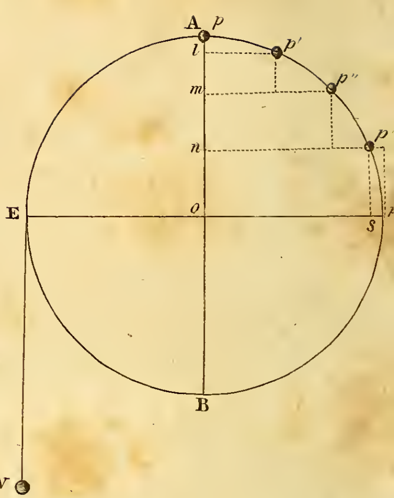
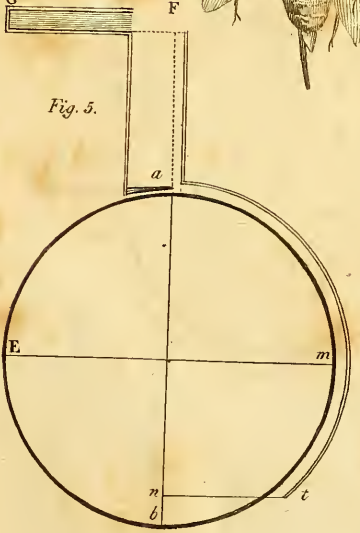


Fig. 9.

Fig. 5.



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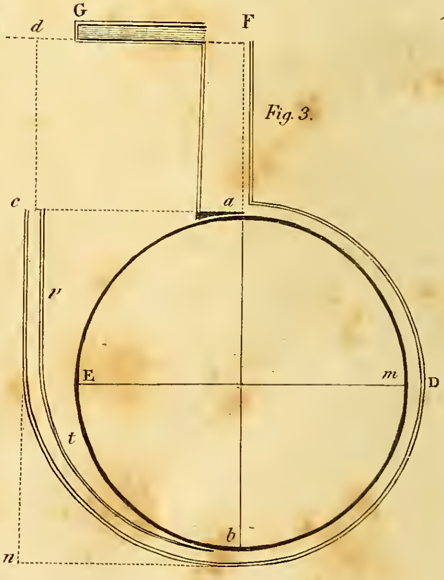
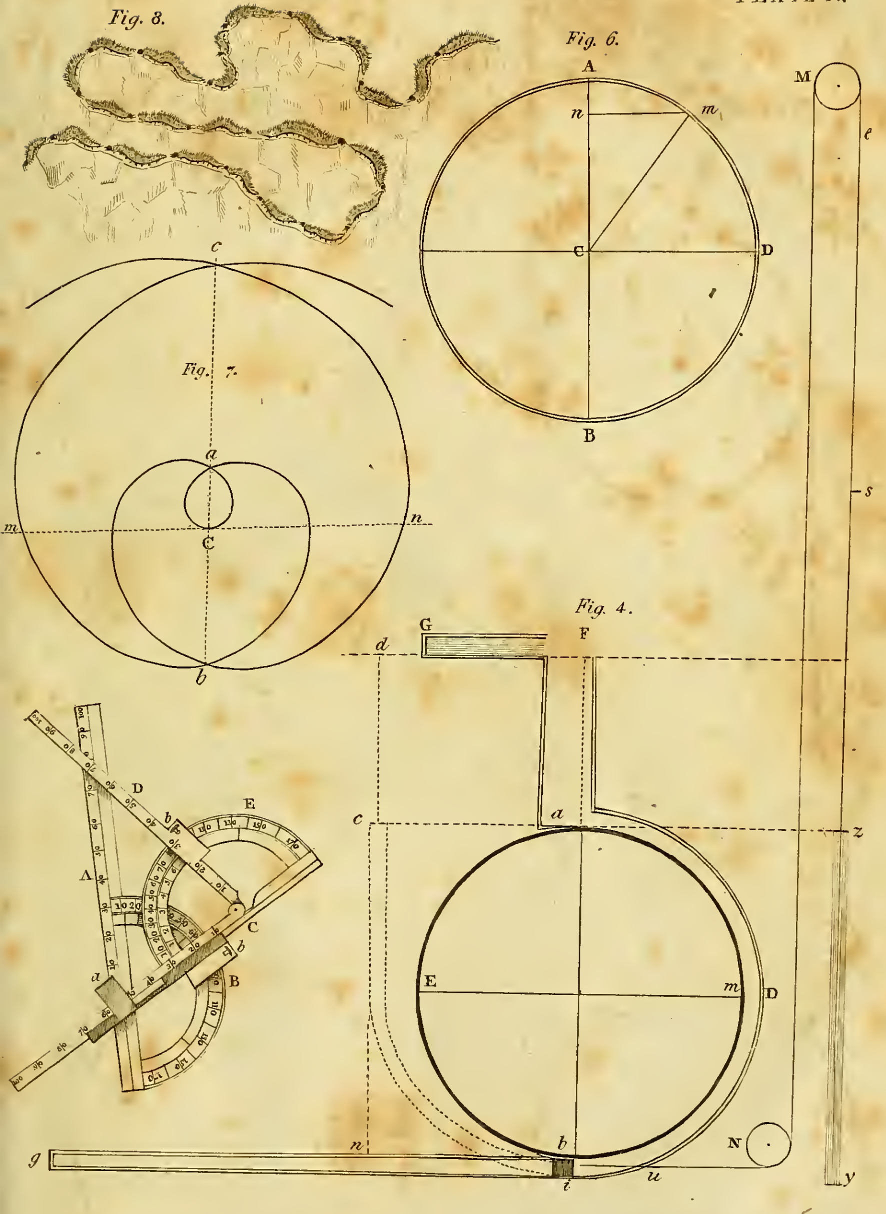


PLATE IV.



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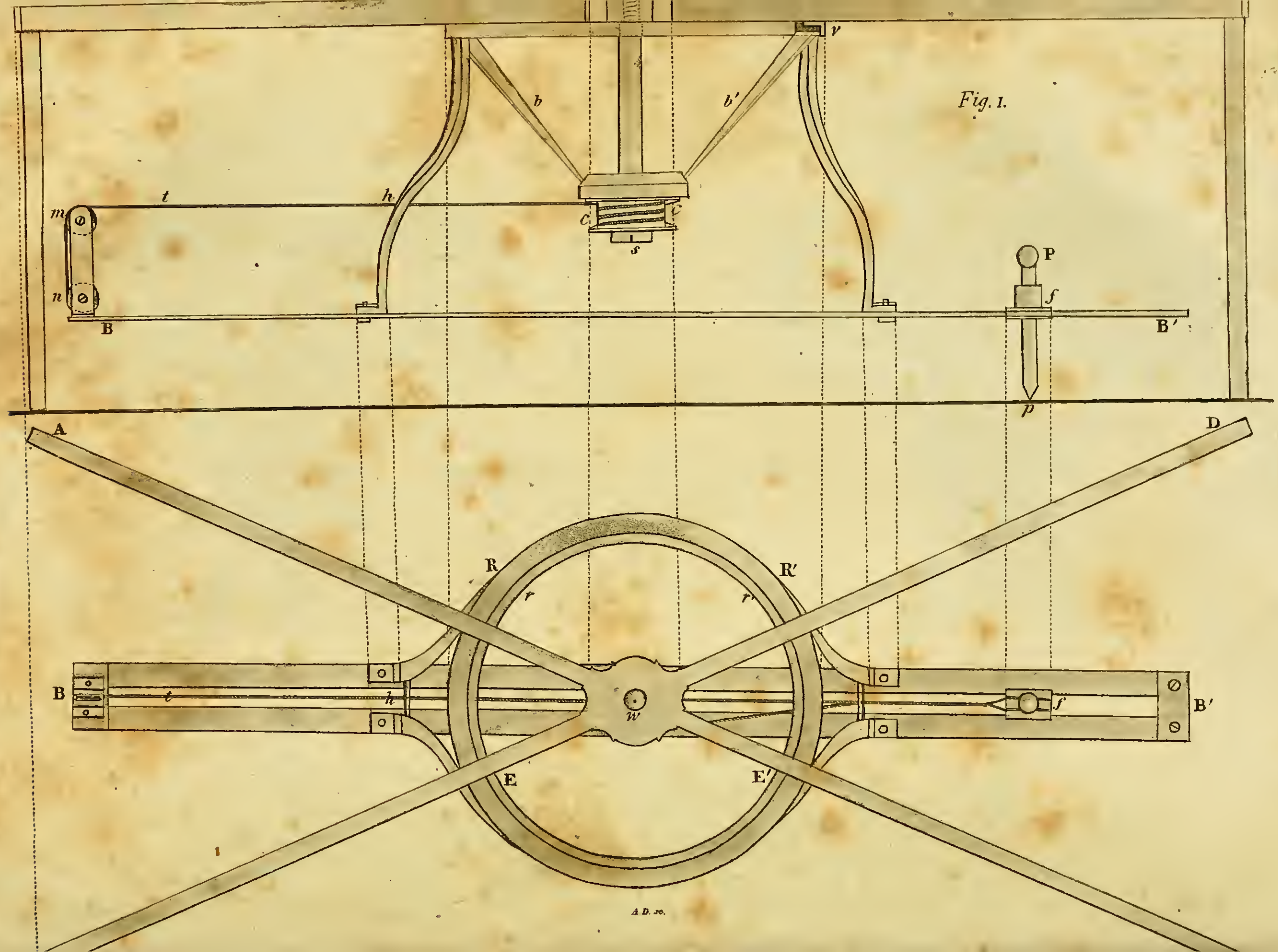
Fig. 1.
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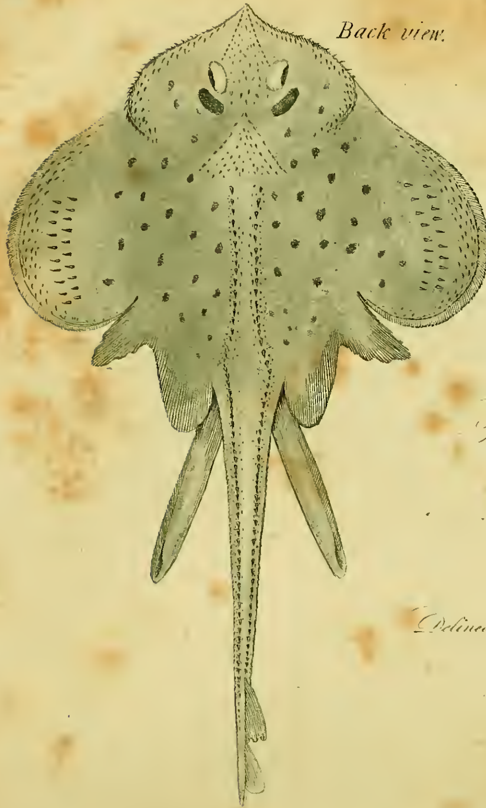

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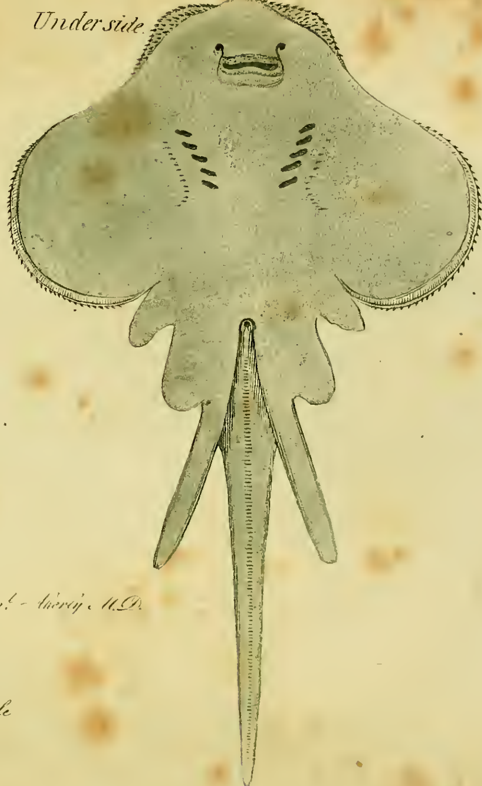

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Raja Erinaceus.

Delineated from nature by Sam.l Akerly M.D.

June 6th 1824

Engraved by A. Doolittle

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INTELLIGENCE AND MISCELLANIES.

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2. Domestic.

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John Hutchinson

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