THE

# AMERICAN JOURNAL OF SCIENCE, AND ARTS.

CONDUCTED BY

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VOL. VIII. ~~No. 2. August,~~ 1824.

NEW-HAVEN:

PRINTED AND PUBLISHED BY S. CONVERSE, FOR THE EDITOR.

SOLD BY THE PUBLISHER; BY E. LITTELL,

PHILADELPHIA, AND TRENTON, N. J.; AND

By Howe & Spalding, New-Haven; Davis & Force, Washington, (D. C.); Huntington & Hopkins, Hartford; Cummings & Hilliard, Boston; Goodale Glazier & Co. Hallowel, Maine; A. T. Goodrich & Co. New-York; Caleb Atwater, Circleville, Ohio; Thomas J. Ray, Augusta, Ga.; Whipple & Lawrence, Salem, Mass.; Edward J. Coale, Baltimore; B. D. Plant, Columbia, S. C.; Miller & Hutchins, Providence, R. I.; Thomas R. Williams, Newport, (R. I.); William T. Williams, Savannah, Geo.; Luke Loomis, Pittsburgh, Pa.; Daniel Stone, Brunswick, Me.; Professor D. Olmsted, Chapel Hill College, N. C.; John Miller, No. 69, Fleet-street, London.

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THE

*AMERICAN*

JOURNAL OF SCIENCE, &c.

## GEOLOGY, MINERALOGY, TOPOGRAPHY, &c.

Art. I.—*A Sketch of the Geology and Mineralogy of the western part of Massachusetts, and a small part of the adjoining States;* by Professor Chester Dewey, *of Williams College.*

[Communicated to the Lyceum of Natural History of the Berkshire Medical Institution, and, with additions, forwarded to the Editor of this Journal.]

The county of Berkshire, and a small portion of the adjoining states, constitute the section of country, contained in the following sketch. For the geology, &c. of the counties of Hampden, Hampshire, and Franklin, which lie on the eastern side of the county of Berkshire, the reader is referred to the excellent papers of the Rev. E. Hitchcock, in Vol. VI. of the American Journal of Science and Arts. The accompanying map is designed as a continuation of that of Mr. Hitchcock, across the county of Berkshire to the river Hudson.

Along the adjoining portions of Berkshire and the above mentioned three counties, lies the range of mountains, which commences at the northwest of West Rock, near New-Haven, Conn., and extends northwards, forming the Green Mountains* of Vermont. The Taconick range of

* Our geographers have usually considered West Rock as the origin of this range of mountains. But West Rock is secondary greenstone, and is separated, according to the statement of Professor Eaton, geographically, as well as geologically, from this primitive range. The greenstone extends from West Rock to Deerfield and Greenfield, in Massachusetts, on Connecticut River.—See Rev. E. Hitchcock's paper, Vol. I. No. 2, of this Journal, and Vol. VI. No. 1, page 44.

mountains lies along the boundary between the county of Berkshire and the state of New-York.

The latitude of the county of Berkshire was ascertained by Messrs. Ewing, Rittenhouse, and Hutchens, commissioners appointed to survey the boundary line between the states of Massachusetts and New-York. According to their Report,* the latitude of the S. W. corner of Massachusetts is 42° 3′ N., and of the N. W. corner, 42° 44′. The *course* of the boundary line is, according to their report, N. 15° 12′ 9″ E., and the variation of the needle was at that time, (July, 1787,) 5° 3′ W. The longitude of the N. W. corner is, from late observations, 73° 22′ 52.5″ W. from Greenwich, and of the S. W. corner nearly 73° 44′. The above mentioned survey gives the length of the county, "fifty miles, forty-one chains, and seventy-nine links."

That part of the counties of Hampden, Hampshire, and Franklin, contained in this sketch, is very narrow, and extends only to that described by Mr. Hitchcock, in the papers mentioned above.

The principal part of the state of New-York, contained in this section, is *transition;* the other part is decidedly *primitive,* except the narrow strip along the Hoosick and Housatonick rivers. This section is hilly and mountainous High hills or mountains and deep vallies alternately meet the eye. The scenery, generally very beautiful, is often grand. In the Taconick range, the mountains are more elevated at the southwest part of Massachusetts. Taconick Mountain, lying on the west of Sheffield, is a huge mass of mountains, with two prominent summits; the highest of which is about 2400 feet above the level of the plain. This plain is known, from measurements for the contemplated canal along the Housatonick, to be about six hundred and fifty feet above tide water.† The mountains of the eastern range are more elevated towards the north. The

*See the certified copy of this Report among the records in the office of the Secretary of the Commonwealth, Boston. From observations made to ascertain the latitude of Williams College, the latitude of the N. W. corner appears to be a little greater than that given in the above report.

† The level of the Housatonick at the south line of Massachusetts was found to be six hundred and twelve feet above tide water.

highest in this section, and in Massachusetts, is Saddle* Mountain, between Williamstown and Adams. See the Geology of Williamstown and vicinity, in Vol. I. of this Journal.

The map of this section is copied, with some alterations, from different maps of this part of the United States. Few Mountains, however, are delineated upon these maps, and the mountains of this section are very inaccurately laid down on any map yet published. Though much pains have been taken to get accurate views of the mountains, it is not to be expected that they can be delineated with perfect accuracy on the accompanying map. While the eastern part of the section lies upon a range of hills, only the general ranges have been attempted to be given, because the rocks so nearly resemble each other. More efforts have been made along the middle and western part of the county of Berkshire, because the rocks were different. Even small hills are often put down, because they show the alternations of the rocks, or the projection of one rock in the midst of others. The different coloring shows the general course and places of the different rocks. In the two counties of New-York, fewer hills are depicted, because their relative situation was less observed, and because they have less elevation, and less diversity of rocks.

### *Principal Rocks.*

These are Granite, Gneiss, Mica-Slate, Granular Limestone, Argillaceous Slate, Quartz Rock, Transition Limestone, and Gray Wacke. Mica-slate is far the most abundant rock in Berkshire county, and in the counties in Vermont and Connecticut, directly north and south ; and it forms the principal rock along the eastern boundary of Berkshire in the three adjoining counties.

* The slight resemblance to the prominences of a *saddle*, from which this mountain received its name, depends upon the form and position of the principal peaks. The same peaks, however, are not seen in the different positions from which this mountain is viewed. This mountain is erroneously called *Saddleback* on the map of mountains, published at Boston, 1820. *Saddleback* is a mountain in England.

### 1. GRANITE.

*Colored purple, and marked with parallel lines.*

Granite is found in Adams, Hinsdale, New-Marlborough, Worthington, Middlefield, Chester, and in most of the towns on the eastern part of this section. It occurs in small quantity and at a less elevation than most of the mica-slate. Though it is found in several places in nearly the same direction, it is interrupted or covered with other rocks. In Adams and Hinsdale it is in small quantity, and several hundred feet lower than the mica-slate on the east of it. In the eastern part of Middlefield, granite is a continuous rock, two or three miles in length, and more than half a mile in breadth. It is on the east side of the highest part of the range of mountains, and many hundred feet below the summit of the mica-slate on the west of it. This, like most of the granite, is coarse grained, with a small quantity of mica, and contains no minerals imbedded in it. Like that of Europe, it is not a *stratified* rock. In Chester, Sandisfield, Granville, &c., granite is found in veins or alternating layers in mica-slate, from a few feet to a few inches or part of an inch in breadth. Dr. E. Emmons has observed that the veins of granite in Chester, sometimes diminish in breadth until they can no longer be traced. In these cases they cannot be considered as *alternating* layers.

Porphyritic Granite is found in large masses in Middlefield and Chester.

After an examination of the granite in several places, I am inclined to the opinion that it must be considered as *beds* or *veins*, rather than as a continuous rock like the mica-slate. The *beds* as well as the *veins* of granite, lie in the direction of the strata of gneiss or mica-slate: for it is not *essential* to the notion of a *vein*, according to Cleaveland and the European Geologists, that it should run *across* the strata.

The appearance of the granite in this section seems more easily accounted for upon the Huttonian than the Wernerian hypothesis. If granite were formed from materials in a state of fusion, it would more probably be found at a lower level than the rocks which here contain it, than if it were merely a crystalline deposite made before all other rocks on the surface of the earth. The *fact* is that the granite is here surrounded by gneiss or mica-slate. To suppose the incumbent rocks to have been worn away so as to show the granite, involves the fundamental point of the Wernerians, viz. universal formations, and a very wonderful elevation of often very small and thin portions of granite above the common level, to form the veins in the mica-slate, as well as the action of causes more powerful than any perceived to be operating at the present time.

The bed of granite in Middlefield is far greater than any other in this section. It lies in mica-slate, and is the only granite put down upon the map.

*Singular position of Granite.*—In Chester is a mass of Granite lying in mica-slate, of which Dr. Emmons gives the following representation. (See Plate 2.)

A, is the granite, of a cuneiform shape, lying on the surface of nearly vertical strata of mica-slate. The granite is connected with nearly perpendicular veins of granite, B and C passing up through the strata of mica-slate, BD.

## 2. GNEISS.

### *Colored Purple.*

This rock seems to be of a very limited extent in this section of our country, though it is more abundant than granite. It occurs indeed in various places along the eastern part of Berkshire Co. in small quantities. In Windsor, Peru, and Middlefield, it is found as a continuous rock, several miles in length, and sometimes more than half a mile in breadth. It is a coarse light gray, or whitish rock, consisting chiefly of feldspar. I have not noticed this rock in crossing either to the north or south of the towns just mentioned. As gneiss is found however still farther north, it is probably connected with this stratum which was not observed to show itself. In New Marlborough, about a mile east of the meeting house, is another appearance of gneiss, the extent of which is not well ascertained. I have put upon the map, the gneiss of the south east part of this section, on the authority of Mr. Hitchcock in his papers already referred to, and have supposed it to be connected with the gneiss of Middlefield. But I am not certain of the gneiss in that part of the section.

### 3. MICA SLATE.

*Colored Green.*

This rock constitutes the principal part of the rocks of the range along the eastern boundary of Berkshire. Under this name is included much that has generally been called gneiss. The mica-slate, which appears along the middle of Berkshire county, is the common variety, and readily distinguished. But farther east it is less slaty and the ingredients are mingled much more imperfectly. It has more of the appearance of layers, like gneiss. It is, however, the mica-slate, described by Cleaveland and others, in which the "two ingredients alternate in distinct layers." This is the reason that it has been often mistaken for gneiss. A careful examination, however, proves it to be destitute of feldspar. When I have attempted to melt it by the blow pipe, only mica has been found, showing its destitution of one of the essential ingredients of gneiss. It seems very certain that mica-slate is a far more abundant rock than has heretofore been supposed. Other geologists have lately expressed the same opinion of this rock. It lies on both sides of the gneiss, and much of it at a higher elevation. Indeed I am rather inclined to the opinion that the gneiss should be considered as beds in the mica-slate, than as one of the general strata. I have not, however examined with sufficient minuteness to state this to be the fact.

The mica-slate appears under a variety of forms. The two most common are those already mentioned; the one, the common slaty variety, and the other, in which the ingredients are in "distinct layers." Besides these, there are several others like those mentioned by Mr. Hitchcock, Am. Journ. Vol. VI. p. 23—4. It often splits into *tabular* masses, and sometimes has a very distinct *grain*, so that it may be split into most convenient forms for building stones. A ledge was shown me by Dr. E. Emmons at Chester, where the strata were nearly perpendicular, and easily divided into narrow tables, from four to twelve inches thick, and many feet in length. The line of the grain of this stone is inclined to the horizon about 30°, and dips towards the north, so that while it is in the nearly perpendicular plane of the strata, it is oblique to the horizon and the general level of the strata. The mica-slate may often be split in this manner; but a great portion of it is destitute of *any grain.*

In the town of Windsor, Mr. Hitchcock observed a rock, which seems to be *conglomerated mica-slate.* The same kind of mica-slate is often to be found along the middle of Berkshire Co. towards the foot of the eastern range of hills, and along the east side of Taconick range. The quartz occurs in it in considerable masses, besides the portion which seems to enter strictly into the composition of this kind of slate.

Various minerals are contained in this rock. Along the eastern part of the section, it contains vast quantities of garnets, generally small, sometimes an inch on the linear edges. Also, staurotide, cyanite, schorl; the staurotide being in large crystals and very abundant in Worthington. In the south part of Berkshire, in Great Barrington and Sheffield, the mica-slate is so filled with garnets as to look at a little distance like the most beautiful puddingstone. One mile east of the meeting house in Sheffield, this rock may be found extending miles to the north; a similar rock may be found composing a small insulated hill about a mile S. W. of the meeting house, where the road crosses its southern base. This rock, with its beautiful garnets and staurotide, occurs again, in abundance, nearly south from this plane, in Salisbury, Con. There is a very great resemblance between the mica-slate containing these imbedded minerals, as it is found on the east and west side of the eastern range of mountains, though separated by an interposed stratum of limestone, and a stratum of mica-slate destitute of these minerals. On the east side, however, as at Chester, Middlefield, &c. the mica-slate also contains chlorite, crystals of calcareous spar, stilbite, chabasie, cyanite &c. neither of which have I ever found in the mica-slate on the west side of the range, although garnet and staurotide are so abundant in it.

The mica-slate of the Taconick range is far coarser than that of the eastern ridge. Taconick Mt. is a huge mass of mica-slate. The same kind of rock continues along the highest part of this range, and is crossed by the road passing from Pittsfield to New Lebanon Spring; at the summit of the same hill between Lanesborough, and Hancock; and apparently terminates with this ridge at the south part of Williamstown. It is found again farther south and west in Hancock along the eastern foot of the hills which here form the western boundary of the state. It disappears before you reach the place where the range is broken through by Hoosick river. On the north side of the Hoosick, however, it appears again, apparently a continuation of the hill which terminates at the south part of Williamstown, and extends towards the west as you proceed northwards, forming the southern part and perhaps the summit of Mt. Anthony in Bennington, Vt. The south declivity of this mountain extends southwards to the middle of Pownal, and its rock seems to be a continuation of this coarse mica-slate, which was before mentioned as appearing on the west side of Hancock, and extending along the boundary line towards the north. I have been thus particular in designating the places where this rock appears, because this point is essential to a right understanding of the position of the argillite in Berkshire county, and the south-west part of Vermont, and is conclusive of the place where, at least, we are not to look for *transition* rocks.

This stratum is separated from the other mica-slate by the primitive limestone. It often contains some talc, forming *talco-micaceous slate*, especially along the eastern base of the Taconick range, while the higher parts are often the coarse mica-slate without any mixture of talc.

A Geologist, in passing from the east across Berkshire Co. into the state of New-York, would naturally anticipate his approach towards a different formation, as he examined the mica-slate of the western boundary of Massachusetts; and he would pass only a short distance farther west to be satisfied that he had come upon the transition series of rocks.

Associated with the mica-slate of the eastern part of this section are

*Trap or Hornblende Rocks.* Cleaveland.

This name, as is observed by Prof. Cleaveland, "in fact conveys no definite idea of any one species or sort of rocks."*

*Cleaveland's Min. and Geol. 2d Ed. p. 743. There never was a more conclusive reason for discontinuing the use of a name. While some of the rocks are pure hornblende and others aggregates, the name does not even show the nature of the rock. A part of the rocks too, have no resemblance in their form, to that which led Werner to call them *trap* rocks. In the index to the Geology of the Northern States, p. 32 and 134, Hornblende Rock includes only the *primitive* trap rocks, with sienite, which was not ranked with them by Werner, and excludes all the *transition* and *secondary aggregates* of hornblende and feldspar. Because of the similarity of the ingredients, however, the generic name will probably be continued. Much of the confusion attending this part of the science would be avoided by giving a tabular view of the rocks comprised under the general term Trap Rocks, and by describing the several rocks in their order, under this generic name. To show the rocks of this section, I have put the account of the trap rocks in Rees' Cyc. into a tabular form. See also Art. Mineralogy in the New Ed. Encyc. for a similar view.

TRAP OR HORNBLENDE ROCKS.

*Primitive Trap.*

1. Common hornblende, as a rock.
   Var. 1. Granular hornblende.
   2. Hornblende slate.

2. Hornblende and Feldspar.
   Var. 1. Primitive Greenstone.
   2. Do. Greenstone Slate.

3. Intimate mixture of hornblende and feldspar with some mica.

*Transition Trap Rocks.*

1. Transition Greenstone. } Known by their transition associates.
2. Do. Amygdaloid. }

*Secondary Trap Rocks.*

1. Secondary greenstone, or greenstone trap.
2. Basalt.
3. Wacke, &c. &c.

*Sienite* must form another section, though no reason can be given, as it is now defined, why it should not be ranked with the hornblende rocks.

To designate the rock intended by an observer, it is necessary to resort to the several subdivisions.

The hornblende rocks of this section are all *primitive.* They are 1. *Hornblende* and *Hornblende slate*, occurring as rocks, in which the hornblende is "nearly or quite pure."* 2. *Primitive Greenstone*, or aggregate of hornblende and feldspar, in which the "hornblende predominates, and very frequently gives to this aggregate more or less of a *greenish* tinge, especially when moistened."* This mineral often has a slaty structure, forming a variety, *primitive greenstone slate.* These rocks are always associated with "gneiss, mica-slate, or argillite."* 3. Hornblende and Mica, the former in larger quantity and sometimes a little feldspar. It may be called *micaceous primitive trap*, or *micaceous greenstone*, with more propriety.

The preceding rocks are abundant along the eastern part of the section, often associated, and always in beds in the mica-slate. They are too abundant to need a specification of their localities, though I have not observed them to form very large beds. About a mile east of the meeting house in Middlefield is a beautiful greenstone slate. Indeed that town, as well as the others in that line, contains all the above varieties of primitive trap.†

Associated with these rocks, is

### *Sienite.*

This is an aggregate of hornblende and feldspar, in which the "feldspar is the most abundant ingredient, and the quantity of hornblende is sometimes small."* I have never observed this rock in great quantities. It is sometimes *porphyritic.* In Rees' Cyc. it is stated that the feldspar of the real sienite is of a *red* color. In what is called Sie-

* Cleaveland's Min. and Geol. p. 743, 745, and 750. The composition of these rocks, given in Rees' Cyc. is the same as that quoted from this work.

† On the high marshes, in the town of Peru, which rest on this rock and mica-slate, is found the rare plant, *Eriophorum cespitosum*, Ph.; and in Stockbridge in an elevated marsh at the foot of a hill of mica-slate grows the *Eriophorum alpinum*, L. and *Carex lenticularis*, Mx.

nite in our country, the feldspar is whitish. At least in this section, this aggregate has always a whitish aspect, from the white or yellowish white colour of the feldspar.

As we descend from the eastern range of hills, into the vallies of the Housatonick and Hoosick rivers, we leave the hornblende entirely. None of it is found in the mica-slate of the middle and western parts of Berkshire Co. Only small fragments of the hornblende aggregates are washed down, by the streams into the eastern part of these vallies.

Besides these hornblende rocks, there is another rock, associated with them, which is composed of hornblende, quartz and mica, or of hornblende and mica-slate. This aggregate has often appeared more abundant than either of the hornblende aggregates already mentioned. Occasionally the quartz nearly or quite disappears, and the mixture is hornblende and mica. In Sandisfield, Tyringham, Middlefield, &c. this aggregate may be found. It passes into primitive greenstone slate, and differs so little from it in its general appearance that a specific name may not be necessary.

On the rocks of hornblende is generally found the fine epidote of Middlefield, Chester, and Worthington. In fissures in mica-slate, and on hornblende in Chester, is found stilbite, chabasie, crystals of carb. of lime, &c.

The mica-slate contains numerous beds of

### *Serpentine.*

Serpentine is ranked with the *rocks* by Jameson, Bakewell, MacCulloch, &c. It is scattered, like the primitive hornblende rocks, widely on the eastern part of the section. It is *primitive* serpentine, and very different from that which occurs in the lower series of rocks, having that sub-crystalline appearance so peculiar to primitive rocks. It is found in large beds in Middlefield, Russell, just without the map at the south-east of Middlefield, and Windsor. I mention these three towns, because they extend over that *breadth* of country, along which both to the south and far north into Vermont, the serpentine is found in extensive beds. See the subjoined catalogue of simple minerals.

### *Diallage Rock?* Jameson.

In the mica-slate at Chester, Dr. Emmons has found a rock, not extensive, which contains a mineral resembling diallage. I am not certain, this is the mineral, for I have not sufficient means of comparison. If it be diallage, the aggregate is diallage rock. I mention it for investigation. It is highly probable too that among the aggregates, of which augite forms an ingredient, Dr. MacCulloch would find augite rock.

Connected with mica-slate is

### TALCOSE SLATE.*

*Colored yellow and dotted.*

A stratum of this rock, composed of talc and quartz, is given by Mr. Hitchcock, Vol. VI. page 26 of this Journal. As it comes just within the limits of my map I have laid it down, not without strong suspicion that, at least from Plainfield southwards, it is merely mica-slate of a finer and softer texture. Though lighter colored, it strongly resembles certain varieties of mica-slate.

Associated with the mica-slate in the western part of the county of Berkshire, is

### *Talco-micaceous Slate.*

By this name is intended that kind of mica-slate which contains a small quantity of talc. The talc is sometimes a mere "glazing," as is remarked in the Geology of the Northern States, page 147. This rock is a variety of the *talcose rock* of the Geology just mentioned; but it differs

* It is very desirable that this name should be confined to the compound intended by Mr. Hitchcock. While talc, steatite, or soapstone, need no other name for geological purposes, this compound deserves one. Talcose slate is descriptive and appropriate. It may not be the rock intended by Bakewell indeed; but his language is so indefinite, both in his definition of talcose slate, and in his remarks upon the substitution of talc for mica in some rocks, (Geology, 1st Ed. p. 71 and 358,) that the fact is of little consequence. This talcose slate is one variety of talcose rock in the Index to the Geology of the Northern States, pages 34 and 147. But it is desirable to limit the term still more. This is done by confining it to a rock composed of "talc and quartz."

so much in its composition as well as situation from the others included under the same name, that a specific name seems important. It occurs at a lower level, and is associated with the mica-slate of the Taconick range. It is found on the west side of Saddle Mountain, in Lanesborough, near the meeting-house in Lenox, on the northern part of Great Barrington, and at the east foot of Taconick Mountain: also along the hills west of Williamstown. It is not a very extensive rock, and must be considered as merely an associate of the principal rock, mica-slate.

The preceding rocks, mentioned under mica-slate, seem to me to occur in beds, and none of them to form distinct strata. This view of these associated rocks is consistent with fact, and assimilates our geology more to the European.

### 4. GRANULAR LIMESTONE.

*Colored yellow.*

Although this mineral is not considered by the generality of geologists, as one of the continuous rocks or strata, but as forming only beds in the primitive strata, yet the extent of it in this section renders it proper to treat of it in this connexion. Coarsely granular limestone is found occasionally in small beds or in large masses in most of the towns along the eastern part of this section. It occurs thus in Becket, Middlefield, and Savoy. There are, however, two nearly parallel ranges of granular limestone, extending through Berkshire county. The eastern range may be traced from Stamford, through Adams, Windsor, Washington, New Marlborough, into Canaan, Con., and thence southwards to Washington, in Con. The western range lies through Bennington, Vt., Williamstown, Lanesborough, West Stockbridge, and Salisbury, Con. Both ranges run nearly parallel with the western boundary of Massachusetts, and extend far north and south into the states of Vermont and Connecticut. The limestone is decidedly *granular*. In the eastern it is more coarsely granular and more highly crystalline. This difference is very obvious in the limestone of Adams, and that in Williamstown at the N. W. base of Saddle Mountain, only three miles distant from each other.

The limestone of the western range is often distinctly crystalline, and always granular. Generally, as we approach the western side of it, its grains become finer, and the crystalline texture partially disappears. This may be noticed in Egremont, Alford, Williamstown, Pownal, and Bennington. In Hinsdale, a very coarse and highly crystalline limestone contains plates of mica, diffused through it. On the west side of the hill which lies between Lanesborough and Hancock, and the mica-slate of whose summit exactly resembles that of Taconick mountain, is granular limestone, extending some miles, and exactly like that on the other side of the hill in Lanesborough. It is, indeed, like the latter, excellent marble.

The limestone has great variety of color, from snow white to blue or very dark gray. The colors are often mingled in stripes, clouds, &c.

The two ranges are separated by hills of mica-slate, and both ranges are inclosed in the same rock. The western range especially is associated in a great part of its course with magnesian carbonate of lime. Both these minerals often extend several miles in width. They are colored on the map, as one rock.

*Marble.*--The ranges of granular limestone yield an abundance of excellent marble. The *white* is wrought in New-Marlborough, Sheffield, West Stockbridge, Lanesborough, New-Ashford, and Adams. The *clouded* is obtained at most of these places, especially Sheffield, West-Stockbridge, and Lanesborough. Beautiful *dove* colored marble, as well as *white*, is now wrought in New-Ashford. The marble of Lanesborough has been worked extensively in Pittsfield, and has hence acquired the name of Pittsfield marble. In this town, however, no marble is found; at least none is *quarried.* The marble generally occurs in strata of a thickness very convenient for splitting, or sawing into *slabs* or tables. The removal of the common limestone, often resting upon the marble, is sometimes very expensive. I have known the sum of 300 dolls. given for removing the limestone from one mass of white marble.

At the bottom of a *quarry* in West-Stockbridge, small blocks of very fine grained marble, white and taking an exquisite polish, have been found, which are supposed to indicate a superior quality of marble at a greater depth. It is a common remark of the workmen, that the quality improves as its depth increases.

The *elastic* marble of Lanesborough and West-Stockbridge has long attracted the attention of mineralogists. The artificers consider it a poorer kind of marble, less compact and fine; and some of them have made the remark that most of their coarser marble is somewhat elastic.

The value of the marble annually wrought in the county of Berkshire, is estimated at about $40,000. Travellers who have not been accustomed to such abundance of this beautiful mineral, have often admired the multitude of white marble monuments in our church-yards, and expressed their surprise at its commonness in ordinary dwelling houses.

Where the limestone joins the mica slate, the two often run into each other, forming, with the quartz and sometimes talc mingled with it, a singular aggregate, scarcely capable of being named, and not worth the trouble of doing it. Near Williams College, is a bed of limestone which contains a large proportion of quartz. It is a fine-grained, compact mineral, harder than the true granular limestone, and sometimes much divided by irregular seams which are lined with talc. This bed may be traced for the distance of two miles—white and gray—and often divided by natural seams into rhomboidal masses of various dimensions.

*Caverns* are said to be uncommon in granular limestone. In this section, however, are several. They are at Bennington, Adams, Lanesborough, West-Stockbridge, and New-Marlborough. The walls are covered with semi-crystalline calcareous incrustations; and stalactites and stalagmites, are found in them. The caverns at Bennington and New-Marlborough, have several rooms, some of which are large. That at Lanesborough is a long and narrow cavern, which appears to have been formed by a subterraneous stream of water, which has probably found a passage at a lower depth.

The granular limestone alternates several times in this section with mica-slate. The alternations in Salisbury, Con. were noticed by Prof. Silliman, Am. Journ. Vol. II. p. 211.

Although I have spoken of the granular limestone as two ranges, I have avoided calling them strata, as there is nothing which prevents the ranges from being composed each of many extensive beds. Still this would not be the natural conclusion, though it may not be easy always to show the continuity of the beds.

### 5 QUARTZ ROCK. Cleaveland.

*Colored Vermilion Red.*

This rock occurs in beds. It forms hills, sometimes of miles in length, and from a few hundred to one thousand feet in elevation. It is often distinctly stratified, and the strata, often nearly perpendicular, have the general inclination of the other rocks. It is sometimes distinctly granular, and at others, compact and fine grained. It is generally associated with granular limestone, and is found with both the ranges of it. The *white cliffs* of Monument Mt., which add so much to the beauty of the scenery in view from the village in Stockbridge, is this rock. On the hill farther south, on which the monument is now to be seen,* the quartz is brownish. The hills of quartz rock† are commonly precipitous on one side. The precipice at Monument Mt. is on its eastern side. At Sheffield, Washington, and Williamstown, the precipices are on the west side of the hills. This rock is easily broken off at its numerous seams, and the bottom of the precipices is covered with fragments of from a small size to many tons in weight. Besides the general stratification, this rock is usually crossed by

* The *monument* is a pile of quartz stones, containing several loads, collected by the Indians. The tradition is that the stones were heaped over the body of a female Indian, who was dashed in pieces by leaping from the cliffs above. This monument gives name to the mountain, and is only a few rods west of the highest part of the road, leading from Stockbridge to Great Barrington, which passes over this part of the mountain. On examining the monument no bones were found under it.

† The hard surfaces of this rock seem to be the natural soil of several well known species of *Gyrophora*. At Monument Mt. and on Stone Hill, in Williamstown, they are abundant upon it. *Endocarpon miniatum*, I have found only upon limestone.

seams oblique to the lines of the strata. The seams are so numerous, that it is easily obtained for building stone.

Near the foot of the hill, on the W. side of Washington, a little S. E. from the village of Pittsfield, the quartz rock is brownish red or brownish gray, and very remarkable for resisting the action of fire. It is used for the walls and hearth of the furnace in Lenox, and for the same object was transported at great expense to Bennington, Vt. until the same rock was discovered near the furnace in that place. A similar rock is found in Williamstown. It is not known to what this peculiar property is to be attributed, the existence of which in quartz rock is the more singular, as this rock usually cracks on the application of high heat. Indeed this is the common method of getting quartz rock into manageable fragments. I have, however, seen *this* stone after it had sustained the highest heat of the furnace for months, and found its surface merely glazed by the high temperature.

Near this rock in Washington, but at a greater elevation, is a variety of quartz rock, of a whitish aspect and full of ragged and irregular cavities. It is pretty extensively wrought into *millstones*, after the manner of the Paris burhstone. It is an excellent stone for this use. It corresponds to the general description of burhstone, and passes familiarly under the name of *Pittsfield burhstone.* I have never seen in it those "siliceous threads" which are so common in the burhstone of Paris. In its general appearance, it is very different from the Paris burhstone, as well as that of Georgia. I see no reason why it should not be called burhstone, unless this mineral actually belongs to *secondary* rocks. The rock at Washington certainly is surrounded on all sides with *primitive* rocks, and separated from even the *transition* rocks by several different strata extending for miles to the limit of the primitive formation. A similar variety of quartz rock is found in Williamstown, and has been employed for the same purpose. In Williamstown and Bennington rolled masses of quartz occur in large quantities.

Quartz rock is liable to disintegration, especially where it lies but just beneath the surface of the earth. In the south part of Cheshire, this rock is disintegrated to a great extent, and an excellent sand, nearly white, is found over acres of ground. Even the ledges of the rock at this place, which appear firm, on being moderately struck, break off into masses which fall to sand. No peculiar reason for the disintegration at this place is known to exist. The rock, before disintegration, appears to be the same as that at other places, where no such process is going on. This sand is employed in sawing marble into slabs, and in the manufacture of glass. It is said to have been transported to the glass factory in Utica, N. Y. It appears to be inexhaustible, and is excellent for the composition of *crown* and *cylinder* glass.

In several places in this section, there is a *quartzose Breccia*, or rock of *conglomerated* quartz. It is always connected with the quartz rock. About four miles from Pittsfield, in the S. W. part of Hinsdale, are large rocks composed of variously shaped, not rounded, fragments of quartz cemented generally by *fibrous brown Hematite*. The iron ore is sometimes a mere lining of the fragments and sometimes nearly half an inch thick. It has very much the appearance of having been subjected to a high temperature. Some have thought they discovered indications of an expired volcanoe. This is doubtless mere imagination.

In Great Barrington and Sheffield, the fragments are cemented by a *quartzose* cement.

### 6. PRIMITIVE ARGILLACEOUS SLATE.*

*Colored Blue.*

This rock is found along the foot of the hills of the Taconick range of mountains. In Williamstown it forms considerable

* I have called this rock *primitive argillite*, because it is associated and alternates with primitive rocks, and is destitute of organic remains. There seem to be conclusive reasons against the removal of this rock from the primitive class, as Bakewell has done. His great reason for doing this is, that as some argillite contains organic remains, no argillite can be primitive. But while argillite is found in the primitive rocks, and alternating with some of them, (Cleaveland's Min. and Geol. p. 449 and 740,) there must be the same reason for considering it *primitive*, as for ranking some kinds of limestone, greenstone, serpentine, &c. among minerals of the *primitive* formation. To remove all argillite into the *transition* and *secondary* rocks, is to blend the different rocks, and make the divisions, so generally adopted, without the least use. The writer on organic remains in

hills. It occurs also in New Ashford, Richmond, West Stockbridge, Egremont and Sheffield. It is more extensive along the boundary line between the states of New-York and Vermont, associated with the limestone and mica-slate, as in the county of Berkshire. The same stratum may be traced in a direct line from Williamstown over North West Hill, through Pownal and Bennington in Vt. On the west side of the Taconick range in the state of New York, this argillite is also abundant. See the "Geological and Agricultural Survey of Rensselaer County," pages 9 and 18, and Mr. Barnes' "Section of the Canaan Mountain," Vol.V. p. 11, of the American Journal of Science and Arts. This rock appears therefore to alternate with the western range of mica-slate, and talco-micaceous slate associated with it. On the east side it can scarcely be considered a continuous rock; at least it cannot be traced through the whole section. But on the west side, it appears to be abundant and continuous, and to form a regular stratum. It extends farther south in this section than the county of Rensselaer, though I am not able to state its extent at the south.

This argillite is found also in small quantities in the mica-slate in the eastern range of mountains. I have seen it in New Marlborough, and it is found in Plainfield, still farther east.

This stratum of argillite has a shining aspect, and is very different from that along the Hudson river.* It is sometimes tortuous. In other parts its strata are easily divisible into large tables, forming *roof slate*. It is wrought extensively in Hoosack, Lebanon, and Hillsdale.

the New Ed. Encyc. seems desirous of placing argillite as one rock by itself; but he acknowledges that organic remains have never been found in the older varieties of it, meaning the argillite found in the rocks, generally denominated primitive. With the same acknowledgment respecting some limestone, he appears to consider it all as one *formation*. Surely this will reduce all rocks to one formation.

* While Prof. Eaton is disposed to consider the argillite along the border of Massachusetts as *transition*, he says, however, that it is separated from that of the Hudson, "throughout the whole extent, by a continuous north and south range of well characterized metalliferous limestone; and it agrees in character with the European specimens of shining argillite." Geol. and Ag. Survey of Rensselaer County, page 10.

The argillite along the east side of the Taconick range, has sometimes a little talc mixed with it, forming *talco-argillaceous slate.*

Beds of argillite, resting on limestone, are found low down in the valley of Williamstown.

The *primitive* argillite is not disintegrated so rapidly as the *transition.* The soil of the argillaceous district is more fertile and productive than of any other portion of the section, except the alluvial. This fact has been remarked by agriculturalists, and corresponds with the statement of some English geologists. The same fact is noticed in the Geology of Rensselaer County, page 23.

On the use of *roof slate* upon buildings, it may be proper to mention a fact stated by a very respectable gentleman of Troy,—that the smaller pieces of slate were found to make a *more durable roofing* than the larger, the former being much less liable to crack and loosen by the action of heat and cold than the latter.

The argillite seems to pass into chlorite slate occasionally, or, at least, chlorite slate is associated with it, and talco-micaceous slate, in several places. Chlorite slate occurs in Pownal, Petersburg, &c. On the east side of the Taconick range, it often contains magnetic oxide of iron, in octoedral crystals. In Petersburg it forms considerable hills, and is found in considerable quantities in the towns south of this place.

In the south of Bennington, Vt. is a small hill of argillite, which approaches the variety, called *graphic slate.* Its colour is dirty black, fracture rather earthy, and streak often black. It contains crystals of sulphuret of iron, which are often changing to the hepatic sulphuret. The soil arising from the disintegration of the slate, is nearly black. The whole hill has the appearance, which might result from a recent combustion. Several years since a shaft was sunk here for the purpose of finding *coal.* It was not indeed continued through the rock. The geologist is aware that coal is not to be expected at this place, such is the geological position of the rock. The principal road from Bennington to Pownal passes over the side of this hill of argillite. The slate here is also tortuous, noticed by Prof. Silliman, Vol. IV. p. 43.

### 7. TRANSITION LIMESTONE.

*Metalliferous Limestone.* Eaton.*

*Colored light brown.*

This Limestone forms a range, about as continuous through Rensselaer and Columbia counties, as is the primitive limestone through Berkshire county. Its extent southwards has not been ascertained; but it continues northwards beyond the limit of the section, as Prof. Eaton believes, to Lake Champlain.* It is distinguished by its somewhat earthy fracture, and its tendency towards the slaty structure; and is associated to some extent with quartz. Though some of it differs but little from the newest primitive in Berkshire Co., yet its connexion with that which possesses the preceding characters has convinced geologists that it belongs to the *transition* series. It is doubtless the oldest transition rock in this section of the country. The limestone of Hoosack, Petersburgh, Lebanon, Canaan, Hillsdale, &c. belongs to this stratum. It occurs in beds also still nearer the Hudson.

The mineral spring at New Lebanon is in this rock. The latitude of this spring was found by Rittenhouse in 1787, to be 42° 27½′ N. The temperature of this spring is about 70° Far.

### 8. TRANSITION ARGILLITE.

*Colored Carmine.*

This rock lies next west of the transition limestone, and joins upon it. It is much less shining than primitive argillite, and is more full of seams, running in various directions. It resembles the argillite along the Hudson. Between the two, indeed, lies the gray wacke several miles in width. But as strata of argillite occur in the gray wacke near the Hudson, and occasionally farther east, which differ not essen-

* Geological and Ag. Survey of Rensselaer County. See also Mr. Barnes' Section of the Canaan Mountain, Am. Journ. Vol. V. p. 10, for some notices of this rock.

tially from that on the west of the transition limestone, there is reason to conclude that this stratum of argillite extends to the Hudson. If this be true, the stratum of gray wacke actually lies over and upon the argillite.* The only reason for doubt is, that the inclination of the gray wacke and the occasional interposition of narrow strata of argillite, might lead to the conclusion that the argillite and gray wacke alternate with each other. I have often thought, when examining these rocks, that this is the fact. Future observations, especially upon the situation of the gray wacke on both sides of the river, will doubtless determine which is the fact.

From examination of the argillite in Columbia Co. there cannot be a doubt that the argillite of the Hudson extends a considerable distance to the east,—the fracture, variety of color, seams, facility of disintegration, and general appearance, all concurring to prove the rock in different places to be the same stratum.

Very few petrifactions have been found in this argillite, at least in this section. Perhaps the only one is the *orthoceratite*, mentioned in the Geol. of the northern states, page 167. This rock, however, contains beds of *siliceous slate*, which affords petrifactions. The siliceous slate near the city Hudson, contains *pectenites* and *terebratulites*, and is found in extensive beds.

The rapidity with which this argillite is disintegrated on proper exposure has already been mentioned in this Journal, Vol. II. p. 248.

### *Glazed Slate.* Eaton.†

This curious variety of transition argillite is found at Troy, Lansingburgh, &c. and would probably be found generally along the Hudson by passing to a certain depth in the common argillite. The structure is distinctly slaty, but the lamina have a much finer and more compact texture than the common argillite above. It is full of irregular seams, or the lamina are of very irregular form, so that it easily breaks into a multitude of lenticular, splinte-

* See note, page 21.

† See his Geol. Survey of the County of Albany, and also of the County of Rensselaer.

ry fragments, whose surfaces are uniformly *glazed*, as if by a jet-black varnish, and then polished. The *glazing* is probably carburet of iron, or black oxide of manganese. I examined this mineral at the north part of Troy, where great quantities were thrown out for the short canal constructed for sloop navigation. It contains flattened masses of quartz, sometimes crystallized, whose surfaces or the surface of the argillite in contact, are beautifully marked with *longitudinal striæ*. Sulphuret of iron is found in it, which Professor Eaton supposes, with much probability, to be the cause of the *hepatic* springs along the Hudson. This slate is abundant on the opposite side of this river.

### 9. GRAY WACKE.

*Colored bistre brown.*

This is an abundant rock. It is obviously a *mechanical* deposite, consisting more commonly of rounded masses of quartz, or quartz and feldspar, held together by an argillaceous cement, which may be claystone. The cement is sometimes the larger part of the rock, and sometimes the reverse. The cemented masses, not always rounded but sometimes angular, differ very much in magnitude as well as quantity. Some masses resemble a coarse *pudding-stone;* others appear *porphyritic*, till closely examined; and others have a homogeneous slaty appearance, so fine are the mingled materials. The colours too are very different; generally some shade of green, often gray, bluish, or dark brown. The surface of the rock often changes from the natural colour of the rock, like greenstone trap, by the action of the weather, the surface becoming brown from the higher oxidation of the iron. The general varieties are the common gray wacke, rubble stone, and gray wacke slate. There is another variety wrought for building stones, in which the materials are so fine that the rock may be polished, but the structure is not slaty. It might be called *compact* gray wacke. The grains are as fine as those of many compact limestones. The common variety and rubble stone, often contain seams of quartz, dividing them into *trappose* or prismatic forms. The action of the elements is continually breaking down the larger rocks through these seams.

Rubble Stone is more abundant some distance from the river, and generally lies on more elevated ground. The mountains in Grafton are composed of it, and it is found on the summits of others.

Near the city of Troy, the gray wacke corresponds more perfectly with the European descriptions of this rock. It contains, with the materials before mentioned, fragments of argillaceous slate, siliceous slate, and lime stone, and has a partially slaty structure.

The extent of the gray wacke in the southern part of the section, has not been satisfactorily ascertained. I believe, however, it becomes less abundant in this quarter on the east side of the Hudson.

Though separated from this stratum of gray wacke by a range of hills, the lowest parts of which are several hundred feet above the valley of the Housatonick, masses of rubble stone, and sometimes of the common gray wacke, are found in Berkshire county. I have seen them from the weight of a few pounds to that of several hundreds and sometimes tons in weight, in Pittsfield, Stockbridge, and Sheffield. They are found also in Williamstown; and some have lately been found by Dr. Emmons, high as the range of mica-slate, in Chester. They are always rounded masses, and so exactly like the gray wacke of this stratum, that one cannot fail to believe that they have been transported by the agency of water from this, their original place.

Gray wacke contains organic remains. On the west side of the Hudson, at Newburgh, Cattskill, &c. they are abundant in this rock. Some specimens seem to be composed chiefly of *terebratulites*. In the gray wacke in this section, I believe they have not yet been discovered. It is probable, however, that they will yet be discovered in the neighbourhood of Hudson, since they are found at a short distance on the other side of the river. I have a mass of petrified shells, which were picked up at a small stream in Nassau. This place is in the region of gray wacke. But it is impossible to ascertain the geological relations of these shells, so completely are they detached from the rock which contained them. As they effervesce with acids, they probably belonged to the shell limestone.

### 10. OLD RED SANDSTONE. Werner.

This rock is mentioned on the authority of Prof. Eaton.* It is found in small quantity in Grafton and Sand Lake, and in large quantity in Nassau. It appears to rest on gray wacke.

### 11. TRANSITION SHELL LIMESTONE. Cleaveland.

*Colored Orange.*

Near the city of Hudson occurs in quantity a shell limestone, which corresponds in its relation to argillite and gray wacke, and in its general character, to the oldest shell limestone, or transition shell limestone, described in Cleaveland's Min. p. 163—4, and by European geologists. I have therefore, given it this appellation. The extent of it I am not able to state. It contains an abundance of petrifactions. It is wrought as marble, and, as it takes a fine polish, the differently colored shells give it a beautifully variegated appearance. It is well known in most cabinets of minerals. It is associated with compact, bluish limestone without shells. To this rock probably belongs the limestone containing *terebratulites*, mentioned by Prof. Eaton, as found in the town of Schaghticoke. The same organic remains are found in the shell limestone at Hudson. To the same rock may be referred the compact limestone, found by Professor Eaton a few miles south of Troy.

## ALLUVIAL.

The common alluvial deposites of sand, gravel, beds of potters' clay, &c. are found abundantly along most of the streams. The alluvion of the Housatonick, often from half a mile to a mile in width, and the wider alluvion of the Hudson in this section, have yet presented nothing of special interest. Buried trees of different kinds are found on these rivers at various depths, more or less decayed according to obvious circumstances.

* Geol. and Ag. Survey of Rensselaer County, p. 11.

On the bank of the Hoosick in the south part of Pownal, Vt. is a considerable bed of

### PUDDINGSTONE AND SANDSTONE.

This seems to be an *alluvial formation.* The road from Williamstown to Pownal, at what is commonly called the *dug-way*, passes at the foot and over a part of the bed. It lies close to the Hoosick, in large rocks on the side of a hill, and forms the south front of the hill from the river to an elevation of more than one hundred feet. The masses seem to be not attached to the rocks about it, for one has moved down the hill. The bank of the river is gray granular limestone. Passing another small bed of the puddingstone a few rods north, we come upon argillite. The puddingstone lies, therefore, upon limestone or limestone and argillite. It is a very singular deposite. It is composed of rounded masses, sometimes four inches in diameter, and grains of quartz, limestone, siliceous slate, argillite and chlorite, cemented by a whitish argillaceous and siliceous cement. Sometimes, it is wholly composed of grains, and becomes *sandstone*, much resembling some coarse *gritstones*. Half a mile south, in a bank of fine sand, similar sandstone is found in strata, from half an inch to two or three inches thick. Both kinds of this stone are slowly disintegrated on exposure to the weather. In the large masses the cement is so strong, that the fracture will pass through any of the aggregated minerals.

The formation of this stone is not easily accounted for, even on the supposition that the valley was once the bed of a large lake. The quantity of rolled minerals in this puddingstone, similar to those now washed along in some of the streams, and the quantity of rolled quartz in the plain for a mile south of this rock, favour such a supposition. But in what manner they should be collected chiefly on the northern banks and on the side towards which the stream now runs, and how the materials of the puddingstone should be collected in such quantity at this one place, is a point of very difficult solution.

*Inclination of the strata, general direction, &c.*

The inclination of the strata is towards the east, varying between 15° and 70°. The same rock appears to be more inclined at one place than another, probably owing to some cause which may not have affected the inclination at a great depth. The inclination is different, however, from what is to be expected from the language of geologists. For the more elevated parts of the primitive range are at the east, and yet the lower rocks dip under the higher; that is, the argillite of the Hudson seems to dip under the gray wacke east of it; the gray wacke, under the transition limestone; and this, under the primitive argillite; and in Berkshire county; the mica-slate dips under the primitive limestone; and this, under the mica-slate east of it, and so on, till the highest mica-slate inclines as if it must dip under some other primitive rocks still farther east. The mica-slate becomes more inclined at the east, and in Chester some of its strata are almost perpendicular. It is in these nearly perpendicular strata, that veins, or layers of granite occur, of the same inclination. Does not this inclination mark the *geological* summit of the mica-slate, though it is at a less elevation than the mica-slate upon the hills a little west of this?

Dr. E. Emmons, of Chester, from whom I have received many valuable remarks on the rocks, has observed that the inclination of the mica-slate in Norwich, on the east of Chester, is towards the west. An examination of the rocks north and south of this place, with particular reference to this point, is very desirable. It may be, however, that the mica-slate of this section belongs to the granitic range farther east, the valley of Connecticut River, with its interesting minerals, being interposed between, and thus apparently separating rocks which are actually connected beneath its surface. The inclination of the strata in Mr. Hitchcock's paper, seems to favor this hypothesis.

I have observed only a very few even *apparent* exceptions to this inclination to the east. One is in the granular limestone at the N. W. base of Saddle Mt. The inclination of some of the limestone is to the west; of some, nearly perpendicular; while that of the greater part is to the east.

In the bed of limestone near Williams College, there passes a rock of mica-slate, containing considerable quartz and some talc. This rock appears to have heaved the limestone in opposite directions. The limestone on the west of this rock and actually in contact with it, inclines to the west at an angle of 41° with the horizon; but at a few feet below the surface, the limestone bends more to the west and has an inclination of only 9°. The appearance, when this rock was laid bare, was such as must have taken place if the limestone, when in a yielding state, had been bent upwards by the mica-slate, and then solidified. As the rock has been uncovered for several feet in depth, it is evident that the inclination of the mica-slate is to the east; and the limestone is so covered that the distance it extends to the west cannot be ascertained. A few rods distant is another similar appearance, caused by the same rock in a parallel stratum.

The mica-slate, as well as the argillite, often presents tortuous strata. In New Marlborough, a mile east of the meetinghouse, is a singular instance. It may be traced for several rods. A large mass beside the road, resembles a pile of huge *saddletrees*, placed closely upon each other, the lower ones indeed having a greater proportional horizontal distance between the parts than the upper. Had the rock been bent upwards by a force acting from below, and then hardened in that position, it must have taken the form this mass presents. Many similar irregularities in the rocks might be mentioned. They serve to convince us how much is to be done, before a correct knowledge of the causes, which have given to the crust of our globe its present appearances, will be attained.

The general course of the strata may be seen, pretty nearly, upon a map of New-England, and of the state of New-York, east of the Hudson, from the direction of the larger rivers. The course of the stratum of mica-slate, is nearly parallel with the western boundary of Mass., quite to Long Island Sound. This is the range, there containing more gneiss, which was crossed by Prof. Silliman, and noticed in this Journal, Vol. II. p. 201.

The granular limestone of this section, about eighty miles in length, preserves a very direct course, in a line parallel to that of the mica-slate. The eastern range of it seems to be continued from New-Marlborough, through

Canaan and Cornwall, to Washington, Con., and thence through Brookfield, &c., to Reading, in the same state. See Geology of the Northern States, page 158.

The western range seems to be separated from the eastern in Canaan, Con., by a hill of mica-slate along the east part of Salisbury. This mica-slate belongs to the same stratum which separates the two ranges farther north. The western range of limestone is therefore continued from Sheffield through Salisbury, and along the adjacent parts of Connecticut and New-York. The general course of this range, if continued, would pass near Kingsbridge, in the neighborhood of the city of New-York. And as granular limestone is found along this course in some of the counties north of Kingsbridge, it is very probable that the limestone of Kingsbridge belongs to this range of limestone. These considerations render it improbable that the Highlands of New-York, belong, *geologically*, to the ranges of mountains in New-England. The rocks of the Highlands reresemble those of the range east of the Taconick range ; so that, if they belong to our mountains, the granular limestone of Berkshire county must lie on the western side of this range of mountains, and most of that in Connecticut, and at Kingsbridge, must lie on the east side of the same range. Such a supposition is opposed by those observations which have shown the continuity of the granular limestone of Berkshire county, in nearly a direct course towards Long Island Sound. An examination of this part of the state of New-York, would indeed be the *experimentum crucis*, and will amply repay him who shall be able to do it. This examination is very desirable, to settle with certainty several points in our geology.

In the examination, it will be necessary to trace the transition argillite south of Columbia county, and to ascertain whether it be limited on the south by the primitive rocks of the Highlands. This examination must be extended eastward of the Highlands, over the counties of Dutchess and Putnam, to the line of Connecticut. The remarks on the geology of Dutchess Co. in Bruce's Mineralogical Journal, are too brief, and were not designed to throw any light on this particular point. From the notice of the Highlands, in this Journal, Vol. V. p. 232, it would seem that the gneiss of this interesting place rises up through the transition argillite, as this rock lies upon the gneiss, both north and south. Examination would show whether the argillite lies along the east side of the Highlands also. Until the examination be made, the Highlands may as well be considered a part of the primitive range of the west side of Lake Champlain, as of that of New-England.

## ORES.

The principal ores in this section are those of iron and manganese. The two are associated at the beds of ore, but the latter is not found, in quantity, except at Bennington, Vt. The large beds of iron ore are in Salisbury, West-Stockbridge, Richmond, Lenox, and Bennington. It will be seen by the map that these beds lie almost in a direct line, which is nearly parallel with the western boundary of Mass. That of Kent, in Con. lies but a little east of this line. Beds of iron ore are found, on the same line, north of Bennington, at least to Brandon, in Vermont, and southward to Amenia, N. Y.* These beds are near limestone, but on beds of clay, and covered only with the common earth. The situation of all is very similar. As mica-slate is found on both sides of them, they must doubtless be considered as lying in this rock, though the clay indicates that they are a later deposite than the rock itself.

Oxide of manganese is found also on the east side of Saddle Mt. in mica-slate. Near this, has been taken also some sulphuret of lead. The place is concealed by the discoverers.

The bed of oxide of manganese, announced in this Journal, Vol. IV. p. 189, I have not yet been able to discover.

The bed of iron and manganese, mentioned in the Geology of the Northern States, page 124, I have not visited. It lies on the general line just mentioned.

Loose masses of iron ore, similar to that at Salisbury, Lenox, &c. are found occasionally in most of the towns along this line of *iron ore beds*.

This *line*, it will be observed, runs several degrees east of north. It seems to have little connexion with the variation of the magnetic needle, as this variation upon both

* In this same line, still farther south, in Pawlings, N. Y., is a similarly situated bed of iron ore, as yet but little explored. C. H.

sides of this line of iron ore has been for many years to the west of north. Even if beds of iron ore extend to the north pole upon a great circle of the earth of which this line is a part, the north magnetic pole would, from the discoveries of Capt. Parry, be about thirty degrees west of this circle or line of iron ore. The variation of the needle appears, in this part of the country, to be decreasing, and from observations made by surveyors is about the same as it was fifty years ago.

The beds of iron ore in Somerset Vt., the well known bed of Hawley distinguished for its beautiful micaceous oxide of iron, the specular ore of some of the towns south of Hawley, and the coarse iron ore of Middlefield, seem to me to be in a line very distinctly separated from the other, as well by the nature of the ore as by its geographical position.

## MINERAL SPRINGS.

The principal is the well known spring at New Lebanon, very near the boundary of Mass. Only a small quantity of solid matter is contained in its waters, according to the analysis of Dr. Meade. In Williamstown is a spring, possessing similar properties. The gas which issues from it is common atmospheric air. It contains a small quantity of carbonate of soda.

*Hepatic waters*, or springs containing sulphuretted hydrogen, are not uncommon along the Hudson. The one at Bath, opposite Albany, attracted some attention a few years since. At Adams, Pittsfield and Great Barrington, are springs, whose waters have a favourable influence upon many cutaneous diseases. At Hinsdale is a *hepatic* spring, around which the earth is covered with sulphur in dry and settled weather, from the decomposition of the sulphuretted hydrogen which rises from it.

Springs from which nitrogen gas issues in some quantities are found in the S. E. part of the town of Hoosick, Geol. and Ag. Survey of Rensselaer county, p. 29.

## SIMPLE MINERALS.

This section contains a great variety of interesting minerals, some of which are rarely found in our country. The most important localities are Middlefield and Chester. Most of the minerals of these towns have been discovered by Dr. E. Emmons of Chester, an indefatigable and acute observer. Most of them I have examined, and seen them in place. In the account of them I am aided by a paper of Dr. E. upon the minerals of these towns, read before the Lyceum of Nat. Hist. of the Berkshire Medical Institution. This paper mentions about forty species of minerals, besides nearly as many varieties and sub-species. It is probable that other towns, if they were as thoroughly examined, would be found nearly as rich in mineral treasures as Middlefield and Chester. The former town belongs *naturally* to the county of Berkshire. Many minerals which have already been announced, are mentioned for the sake of additional remarks. The order and names in Cleaveland's Mineralogy, 2d Ed. are generally followed.

## CLASS I.

### 1. MURIATE OF SODA.

Spring at New Lebanon. Also, in wells and springs along the Hudson. Eaton.

### 2. CARBONATE OF SODA.

Springs. Pittsfield, Williamstown, and Adams.

### 3. CARBONATE OF LIME.

#### 1. *Crystallized.*

In lenticular crystals in Williamstown on granular limestone. Also, in Chester in fissures in mica-slate with chabasie and stilbite. Here are some interesting forms of the crystals. 1. A *six sided table*, truncated on all its angles, terminated at each extremity by planes. 2. *Lenticular*, resulting from the deeper truncations of the angles of the preceding. 3. A *six sided prism* terminated by a six sided pyramid—rare. 4. *Hexaedral prism*, which appears so truncated upon the alternate planes of the extremities as to form *pentagonal* sides, and terminating in three *pentagonal* faces. Also in Bennington.

Var. *Laminated.*

Adams, Stockbridge, and West Stockbridge, in granular limestone. As it will not take a polish, it is a troublesome mineral in marble. It often spoils a large table. The workmen call it *spar*. Abundant in Bennington,—used as a *flux* at the furnace.

2. *Granular Limestone.*

Very abundant. See the preceding Geol. Sketch. Occurs sometimes between the strata of mica-slate in Chester,—highly crystalline. Emmons.

3. *Fibrous Limestone.*

Between the layers of fine grained gray wacke, Troy,—in small quantities, beautiful. In W. Springfield, in veins in fine red sandstone. Emmons.

4. *Compact Limestone.*

Hudson, with *shell limestone*—fine, close grained. Also near Troy. Eaton.

5. *Agaric Mineral.*

Found by Mr. Root, of the Berk. Med. Institution, in a cavern in West Stockbridge. It is fine, white, earthy, particles slightly cohering—in small quantity.

6. *Concreted Carbonate of Lime.*

Stalactites, stalagmites, and incrustations, in the caverns of limestone. See the Geol. Sketch. These are highly crystalline, of a dirty white. Between the layers of the calcareous rocks in New Ashford and Lanesborough, earthy incrustations of carbonate of lime are frequent. They sometimes form small elevations, or rise in stalactites half an inch long.

*Calcareous tufa*, deposited from springs in Williamstown, and in quantity from that of New Lebanon. The latter often presents fine *mammillary* and *verrucose* forms. It has often been deposited about vegetables, which have entirely decayed and left only their exact form.

7. *Argentine.*

Beautiful—Southampton mine and Williamsburgh, just beyond the eastern limits of the map. See this Journal, Vol. VI, and VII. In Williamsburgh, it occurs in comparatively large masses—decrepitates and phosphoresces on a hot iron, like that from Southampton.

8. *Magnesian Carbonate of Lime.*

Associated especially with the west range of primitive limestone. Most of the limestone in Pittsfield, Lenox, and Stockbridge, is of this variety—coarse and fine granular, white and gray, with a foliated fracture. In Sheffield, it is often *fetid*, a new variety.

Var. 1. *Rhomb Spar.* Bitter spar.

In separate small crystals on gray limestone, Williamstown. In roundish masses in the steatite of Middlefield with green talc. Some of it is of a fine white, close grained, and so compact that the *rhomboidal* tendency is scarcely discernible; other specimens differ only in the distinctness with which the fracture shows the multitude of rhombs which compose the mass. Lustre somewhat pearly and shining. Other specimens are yellowish brown, with a high pearly lustre, and translucent;—the rhombs are very distinct. It is a beautiful mineral. It occurs also in the west part of the town associated with tremolite. Emmons.

Var. 2. *Dolomite.*

Sheffield, Great Barrington, Stockbridge, Lee, Pittsfield, Adams, &c. Generally whitish; in Stockbridge, near the meeting house, gray. In Middlefield, it occurs in mica-slate, dirty white, finely granular, phosphoresces by friction. Emmons. In New Marlborough, containing augite, as well as tremolite. Somerset, with iron ore.

Var. 3. *Magnesian Limestone.*

Abundant—the common variety—in large beds. In Bennington is a large mountain of it, lying directly north of the great bed of iron ore and manganese, and formerly used as a flux in reducing the ore. When burned, it resembles dolomite. As the vegetables have been destroyed by fires on this mountain, great quantities, even acres of this limestone, are entirely exposed to view from the village of Bennington, and may also be seen from the summit of Saddle Mountain, &c.

9. *Fetid Carbonate of Lime.*

White and coarsely granular in Stockbridge—very abundant. Small specimens lose their fetid odour, after a little time,—at least, some of it is thus affected. In Williamstown, dark coloured and fine grained, very fetid,—in loose fragments. Also, in Bennington—nearly black. In Alford, abundant, and very fetid, and not so coarsely granular as that in Stockbridge. It has been supposed without the least reason to be plaster of Paris.

10. *Ferruginous Carb. of Lime.*

Bennington.

### 11. *Marl.*

#### Var. 1. *Earthy Calcareous.*

In beds in Pittsfield and Lenox—seems to be chiefly carbonate of lime, often containing many decayed *snail* shells. A large bed in Sand Lake. Eaton.

#### Var. 2. *Earthy Argillaceous.*

It abounds at Hudson—has the appearance of clay, effervesces rapidly with acids, and is said to contain Sulphate of Magnesia.

*Schistose marl* or *argillaceous limestone*, containing forty per cent of lime, and disintegrating on exposure, is found at Schaghticoke. Eaton.

### 4. PHOSPHATE OF LIME.

In Chester, disseminated in granite; also, the var. *apatite* in yellowish green crystals, and granular masses—phosphoresces on hot iron with a pale yellow light. Also in mica-slate, in roundish masses; its powder digested in water changes vegetable blue to green; its colour is greenish. Emmons.

### 5. SULPHATE OF LIME.

In the hard waters that issue all along the range of limestone. In small crystals near Hudson in clay?

### 6. SULPHATE OF ALUMINE AND POTASH. Alum.

Effloresces on the aluminous slate at Pownal. Found in abundance at New Lebanon, in the same slate. Eaton.

## CLASS II.

### 1. QUARTZ.

### 1. *Common Quartz.*

#### Var. 1. *Limpid.*

Hexaedral prisms terminated at one extremity by a six sided pyramid—two sides often wider than the others—at Lenox, Williamstown, Lee, and Lansingburgh. Also in Chatham. Eaton. In Middlefield, in minute pyramids, in cavities of serpentine lined with quartz. Emmons. Quartz with *dendritic* forms, Southampton mine. Emmons.

#### Var. 2. *Smoky.*

Often occurs in granite. In hexaedral prisms in Stockbridge. On Monument Mountain a crystal was found nearly a foot long, and some inches in diameter, and must have weighed several pounds. It was broken by the discoverer, and I have only a large fragment of it. It is very beautiful. Middlefield in rolled specimens, on the banks of streams. Emmons.

#### Var. 3. *Rose Red.*

Williamstown, only a specimen. In Chester, it is found in granite. Emmons.

#### Var. 4. *Irised.*

In rolled masses—beautiful—in Middlefield. Emmons. Plainfield. Porter.

#### Var. 5. *Greasy.*

Williamstown, New Ashford, Lenox, and Middlefield.

#### Var. 6. *Tabular.*

Middlefield. Emmons.

Var. 7. *Granular.*

In vast quantity. See Geol. Sketch. More or less is found in all the towns.

Var. 8. *Sand.*

This mineral, so abundant in Cheshire, should form a variety. See the Geol. Sketch.

Var. 9. *Blue Quartz.*

Cummington. Porter. Grayish blue, differs but little from the smoky.

Var. 10. *Laminated.*

New var. found in Chester by Dr. Emmons. It is distinctly laminated, the folia separate by a blow, like those of laminated calcareous spar. It is partially translucent, though the faces of the lamina have not a perfect crystalline smoothness, and marked with oblique striæ.

2. *Amethyst.*

In the trap rocks at W. Springfield. Emmons.

3. *Ferruginous Quartz.*

In Middlefield.

Var. *Yellow and Red.*

Form a considerable rock, in Pittsfield, composed almost entirely of small crystals. Also in Bennington. Eaton.

4. *Fetid Quartz.*

Abounds in Williamstown, New Ashford, Middlefield and the towns about it. It is often the *greasy* variety.

5. *Chalcedony.*

In Serpentine, in Middlefield, and in Hinsdale.

6. *Cacholong.*

On hornstone, and chalcedony in Hinsdale.

7. *Siliceous Sinter.* Hyalite.

Occurs in serpentine in Middlefield. Emmons. It sometimes is nearly stalactitical, Porter, and is of a dirty brown colour.

8. *Opal.*

*Common* is found in Hinsdale. *Ferruginous opal* in Middlefield. Fracture conchoidal, smooth—texture compact—colour reddish brown with whitish spots—lustre resinous and shining—fragments splintery—resembles and differs from ferruginous quartz. Emmons.

9. *Hornstone.*

Dark coloured in Williamstown. Dark blue in Serpentine at Middlefield. Emmons. Yellowish and covered with cacholong, at Hinsdale. I have received a specimen from N. Carolina, which exactly resembles this.

10. *Burhstone.*

Washington. See Geol. Sketch.

11. *Jasper.*

Red, striped, bluish, in small rolled masses through this section. Green jasper, at Troy. Eaton.

12. *Agate.*

Found in Middlefield and Chester, not very abundant. It consists of a ground of yellow jasper, with bands of blueish white chalcedony. One specimen weighed almost two hundred pounds. Emmons. It seems to be one vast agate, composed of a multitude of small ones. Some of these have been broken out, of a spheroidal shape. Sections of it, polished, would be very beautiful. This may be *agate jasper.* Jameson.

The crystals of quartz in the mine at Southampton often project from a base of agate. The bands are zigzag, like those in fortification agate, and seem to be quartz of different colours, or quartz passing into chalcedony, often beautiful.

### 2. FIBROLITE ?

Beket. This mineral is in minute fibres, harder than quartz, dark coloured, infusible. Occurs only in small quantities, and is nearer Fibrolite than any thing I can find.

### 3. CYANITE.

In mica-slate in Chester, quite common. A darker variety than the common is in dark mica-slate, generally in single prisms. Emmons. Also in Blanford and Granville. This mineral is abundant in this section. Occasionally it is disintegrating, and is recognized with difficulty.

### 4. STAUROTIDE.

Very common in the towns about Middlefield. Prisms sometimes three inches long; and with Cyanite and Garnet, it constitutes the greater part in some mica-slate. Emmons. Also in Sheffield, Salisbury, &c.

### 5. TOPAZ ?

In Middlefield, connected with serpentine are very small crystals or fragments, some of them prismatic, and tetraedral, of a yellow colour, brittle, and harder than rock crystal. Unless they are an uncommonly hard variety of *yellow quartz*, they are topaz, which they much resemble. They lie loosely in an earthy ground of some disintegrated minerals.

Subsp. *Pycnite.*

In Chester in detached pieces of gneiss; colour bluish green,—six-sided prisms, terminated by planes, with the angles truncated—imperfectly foliated perpendicularly to the axis, lustre of lateral planes vitreous—infusible, sp. gr. towards 4.0—less hard than Beryl which it resembles—largest crystals an inch and a half long, and half an inch in diameter,—several prisms sometimes united parallel to each other. Emmons.

6. SILICEOUS SLATE.

In rolled masses in Berkshire county. In beds in transition argillite, Troy, Hudson, &c.

Var. *Basanite.*

In Williamstown—rolled pieces.

7. MICA.

Var. 1. *Lamellar.*

Of various colours, along the eastern range of mountains. Sometimes green at Cummington. Porter.

Var. 2. *Prismatic.*

In Chester, in coarse granite with the preceding. It occurs in fine filaments which gradually pass into *rhombic* prisms. Emmons. It is abundant and beautiful. Also in Worthington. The fibres are often "as delicate as those of amianthus." This mineral, found also in Saratoga county, heretofore rare, has now become plenty.

Var. *Plumose.*

This name which has often been applied to some varieties of mica, is intended as descriptive of the mineral. The fibres are not easily separable, like the *prismatic*, and diverging upon each side of the line—they have a truly *plumose* appearance. It occurs in masses which have a relatively close or compact appearance, but the fracture of which shows the *feathery* structure. It is found in Williamsburgh.

### 8. SCHORL.

#### Var. 1. *Common.*

Small six sided prisms in mica-slate, Williamstown. In some of its forms it is a very common mineral in the primitive rocks. In the veins of granite found in the mica-slate of Middlefield, Chester, and the town east of it, Norwich, schorl occurs in nine sided prisms with triedral terminations, and also terminated by four faces, one of which is perpendicular to the axis, and sometimes by six faces. Emmons.

#### Var. 2. *Tourmaline.*

*Indicolite* and *green tourmaline,* are found in a vein of granite in mica-s ate, with siliceous feldspar, beryl, prismatic mica, garnet, green feldspar, and rose red quartz. These kinds of tourmaline are the same as those found in Chesterfield. One crystal of the green has been found there, two inches in diameter. The locality is two miles south of the meeting house in Chester. It is well known that the rubellite of Chesterfield is often contained in prisms of green tourmaline; the contained mineral, however, is sometimes nearly white: is it the *white tourmaline?* or *white rubellite?* The large crystal of green tourmaline at Chester, contained one of indicolite. Emmons.

### 9. FELDSPAR.

#### Var. 1. *Common.*

Abundant in the granite, often decomposing. Often in crystals in Middlefield and Chester, forming porphyritic granite.

*Green Feldspar.* "This rare sub-variety" is found in Chesterfield. Also abundant in the granite at Chester. Emmons. Rather pale green, colour not uniform, structure foliated, less lustre than the lighter varieties.

Var. 2. *Siliceous.*

Bluish white, lamina often curved, and sometimes of a "stellular form"—abundant in Chester. Emmons. It is the same as that at Chesterfield. It is probably in the same bed as that at Chesterfield.

*Albite.* The siliceous feldspar of Chesterfield passes into a granular variety, almost exactly resembling the albite of Sweden. In Chester, it is fine and coarse granular.

Var. 3. *Glossy.*

Quadrangular prisms in granite, abundant at Chester. Emmons.

Var. 4. *Compact.*

Found sometimes with the preceding.

10. JADE.

Subsp. *Nephrite.*

Found on Westfield river. Very tenacious, scratches quartz, pale green, oily aspect, splintery fragments, and fracture dull—rare. Emmons.

11. BERYL.

Six sided prisms and amorphous, often fine delicate green—sometimes five inches in diameter, in granite at Chester and Norwich. Emmons. Also, in similar and large crystals in Worthington—sometimes whitish.

### 12. SCAPOLITE.

Gray and white, lustre somewhat pearly, scratches glass, sometimes a four sided prism--prisms generally irregular, compressed, deeply striated longitudinally, often intersecting variously—melts into a porous, *yellowish white* glass or enamel with ease. Chester, with hornblende, augite, &c. Emmons. This mineral differs from tremolite, which it much resembles. The product of fusion does not exactly agree with the description in Cleaveland's Min.

### 13. GARNET.

The localities which abound with this mineral have been mentioned in the Geol. Sketch. Very large crystals are found in Hawley, in chlorite slate. The garnet is found in Florida. The common form is he dodecaedron with rhombic faces. About Middlefield, it has also the form of the *trapezoedron*, and the dodecaedron truncated on its solid angles so as to form long hexædral faces. Emmons. The principal var. is the common garnet.

Var. *Melanite.*

In hornblende in Chester.

### 14. EPIDOTE.

Upon hornblende rocks, in Worthington, Middlefield, and Chester—color, some shade of green. Sometimes also in grains.

Var. *Zoisite.*

Gray, flattened prisms, striated. Chester.

### 15. IDOCRASE.

Hyacinth red,—lustre vitreous—fracture uneven. Emmons. Occurs in imperfect crystals, sometimes nearly a quarter of an inch in diameter. It fuses into a yellowish glass, which is translucent. There is little reason for doubt about this mineral, though so rare in our country. The form seems to be a prism terminated by low pyramids Found in Chester associated with actynolite, epidote chlorite, &c.; and also in Worthington. Emmons.

16. PREHNITE.

In the secondary greenstone at West Springfield, in radiated masses.

17. STILBITE.

White, lustre pearly, exfoliates on hot coals, melts with intumescence; occurs in four sided prisms, whose bases are parallelograms, also nearly a rhomb, and in radiated flesh-colored or reddish masses. Sometimes a row of crystals extend side by side for several inches. Found a mile E. of the meeting-house in Chester, and in other places in fissures of the mica-slate and hornblende rocks. Emmons.

18. ZEOLITE.

Associated with the preceding mineral, are sometimes found fibrous masses, which exactly resemble *fibrous* zeolite.

19. CHABASIE.

White and yellowish, often translucent, scratches glass, crystals nearly cubes, and sometimes nearly half an inch in diameter. Occurs with stilbite and carb. of lime in mica-slate.—Chester. Emmons.

There are beautiful crystals of this mineral.

### 20. Nacrite?

On the mica-slate of Chester, is found a mineral, incrusting the rock, which may be nacrite. I have not been able to examine it minutely, and merely mention it. Easily fused. It may be a new variety of stilbite, occurring as an incrustation—its colour is a dirty yellowish white.

### 21. Tremolite.

#### Var. 1. *Common.*

In flattened or bladed crystals in Great-Barrington, Sheffield, and New Marlborough in dolomite. At the last place, the dolomite resembles that at Kingsbridge, N. Y., and also contains augite. Though the dolomite of Great Barrington containing the bladed crystals is generally very friable, I have found a large rock, which is very hard, and contains the same kind of crystals with augite. They are found sparingly also in Pittsfield. In Middlefield in large masses of aggregated flattened crystals with rhomb. spar. Emmons. These crystals often pass off into a perfectly *granular* tremolite. This is a new and very distinct variety, and greatly resembles the *white coccolite* of Phillipstown, N. Y. *opposite* to Newburgh and a few miles from the river; but the product of fusion proves our mineral to be granular tremolite. The constituents of coccolite and tremolite are nearly the same, and the two minerals seem to be nearly related. The locality, at which the bladed crystals are abundant, is in Muddy Brook in Great Barrington, three miles from the plain in Stockbridge, and on the left of the road leading to New Marlborough. In this friable dolomite I have found oblique four sided prisms of tremolite, which were friable, but hardened somewhat, like the dolomite, on exposure to the air. They are probably the primitive form of tremolite.

#### Var. 2. *Fibrous.*

In Lee, Sheffield, Salisbury, and Canaan, Con. The masses, whose fibres are sometimes more than two feet long, contain parallelopipeds of sulphuret of iron.

Var. 3. *Baikalite?*

On the dolomite of Sheffield, I found radiated and fascicled Tremolite, yellowish white, and lustre silky. The fascicled was bluish white.

## 22. ASBESTOS.

Var. 1. *Amianthus.*

In very strong and flexible fibres in steatite, Middlefield. Emmons. Windsor—Porter.

Var. 2. *Mountain Cork.*

In fine specimens at Benington.

Var. 3. *Common.*

With the preceding--also, in Windsor--dark gray, and with stiff fibres. Porter.

Var. 4. *Ligniform.*

White and yellowish white, fibres stiff and brittle, traversing serpentine in veins at Middlefield. Emmons.

Var. 5. *Compact.*

In Middlefield with serpentine. It is often so near both these minerals, as to render it difficult to determine to which it belongs.

## 23. AUGITE.

In magnesian limestone at Muddy Brook in Great Barrington and in New Marlborough. It occurs often in four sided prisms, rather flat, yellowish white, and like that at Kingsbridge, N. Y. These prisms are sometimes truncated on their edges. Also in six sided prisms. Some of the flattened prisms so much resemble those of tremolite, with which it occurs, that it is difficult to ascertain what they are without seeing the action of the blowpipe. Also in Hinsdale with plumbago, resembling a similar mixture from Ticonderoga; and also at Chester, greenish, gray, brown, yellowish, tending to crystalline forms. In Chester is a beautiful *white* augite, finely granular or compact, structure foliated with considerable lustre. The *green* also occurs in large aggregated grains, resembling the *green coccolite* of the Highlands, N. Y. The minerals from both these localities want the peculiar lustre of the green coccolite, from Essex Co. N. Y., but seems to be the same variety. Augite occurs in mica-slate, and has actynolite, scapolite, &c., often associated with it. Augite is an abundant mineral among our primitive rocks.

### 24. HORNBLENDE.

#### Subsp. 2. *Common Hornblende.*

Very abundant in the eastern part of this section—of various colors—sometimes in distinct crystals, and often in crystalline masses. The *lamellar*, *fibrous*, and *slaty* varieties, are common, especially the first and last. Also, the aggregate described by Cleaveland, "composed of channelled, cylindrical or very minute prisms, either parallel or diverging, and sometimes intersecting each other." These channelled prisms are often long and beautifully diverging, and form the *fasciculite* of Mr. Hitchcock.

#### Subsp. 2. *Actynolite.*

The *common* varieties, as *massive*, *acicular*, *fibrous*, and sometimes nearly *glassy*, and in crystals more or less regular, light to dark green, occur in Middlefield, Chester, &c. and are found associated with talc in a line which extends far into Vermont. It is an abundant and beautiful mineral. It is sometimes so diffused in minute crystals through augite and other minerals, that it is not easy to determine what the specimen is, unless we are able to trace its connexion with other more characteristic specimens.

25. AMIANTHOIDE ?

Very minute fibres, associated with actynolite, idocrase, and hornblende—fusible into a dark dull enamel. Emmons. I mention this mineral to excite attention to it. It may be fibrous actynolite, and it may be amianthoide. The two seem to be closely related, and do not differ very greatly in their composition.

26. DIALLAGE ?

In Diallage rock ? Chester. It resembles *metalloidal diallage.* It differs so much from hornblende in its general appearance, that I suspect it to be diallage. In the serpentine of Middlefield is a foliated mineral in small quantity, which seems to be metalloidal diallage, though it is rather finer grained than the European which I have seen.

27. SERPENTINE.

In immense quantities in a bed two miles long in Middlefield, two miles south of the meeting-house. It often forms ledges from 50 or 80 feet in height, and is of various colors, light and dark green, and dark reddish brown like specimens from England. In a neighboring brook, it is white and cream colored, sometimes spotted, translucent, and beautiful. Both *precious* and *common* serpentine are found here. The green and brown are acted upon by the weather, and the surface becomes of a reddish yellow color, and they sometimes disintegrate into a reddish earth. The rocks break into angular fragments, with an obvious tendency in many cases to prismatic forms. In Russell, a little east of south from this place, it occurs in large beds, of a very dark green, nearly black, and has been polished for marble. (See Am. Journ. Vol. III. page 238, for a particular account of the serpentine in Russell.) Indeed the serpentine in the whole range will take a fine polish. Another bed is east of the meeting-house in Middlefield, connected with the great bed of steatite. Serpentine is found also in the N. W. part of

Windsor, in Worthington, Florida, Plainfield, and in the towns in the same direction in Vermont. In Florida, some of it is very hard, contains crystals of sulphuret of iron, and is exactly like specimens from Zoblitz in Saxony. With the serpentine is often found magnetic oxide of iron, hyalite, chalcedony, talc, asbestus, &c.

### 28. TALC.

#### Var. 1. *Common.*

White, greenish white, and deep green; often in large folia with rhomb spar in the bed of steatite in Middlefield—beautiful. In masses of small scales with actynolite. In Chester, brown talc forms veins in mica-slate—Emmons. In Savoy is a narrow stratum of brownish or dark gray talc, which exfoliates, even in the flame of a candle, much more than this mineral usually does. A very thin leaf will often divide in this way into fifty folia, swelling into a large mass and winding about in a curious manner. It contains ten per cent. of *water*, to which this great exfoliation is probably owing, as this is a much larger quantity than is given in any analysis of the mineral. This talc is doubtless the same as that mentioned in this Journal, Vol. VII. p. 55. If a new name be necessary for this variety, can it be *Vermiculite* with propriety? For this is an established name of certain organic remains found as petrifactions.

*Remark.*—This talc fuses into a *dark colored* enamel. The *books* say that the enamel of talc is *white*. The lighter colored varieties do indeed melt into a white enamel; but the darker give a dark enamel, without exception, so far as I have examined; and I have tried several from different places which did not exfoliate in the remarkable manner just mentioned.

#### *Fibrous Talc.*

The lamina sometimes divide so as to present this subvariety.

Var 2. *Indurated Talc.*

In the limestone near Williams College, from half an inch to three inches thick—brown or gray.

Subsp. *Steatite.*

Var. *Common Steatite and Potstone.*

These two varieties are associated in a large bed at Middlefield, two miles east of the meeting-house. It has been extensively quarried for building, and transported to Boston and other places under the name of *freestone.* It resists the action of fire, when applied against the sides of the lamina. Occurs in layers a few feet in thickness, which were sawed into convenient blocks for transportation. It has been removed from one place for some rods in length, and from a few to fifteen or twenty feet in depth. The potstone is only a finer variety, and generally darker colored. Both varieties were common in the fireplaces in Boston. In Windsor is a locality of fine steatite. It was formerly wrought into *inkstands,* and the Shakers now manufacture the same article from the same material. In Worthington also.

An examination of the steatite shows the propriety of making it a subsp. of talc,—it is so closely composed of scales of talc, closely compacted, when compared with foliated talc of the common variety.

In Lee, a part of an Indian pot, formed of Steatite, was found a few years since, having upon it one of the *ears* which supported it. Some of the steatite is fibrous.

*Crystallized Steatite.*

In Middlefield two miles S. of the meeting-house between layers of the Serpentine. See Am. Journ. Vol. V. p. 289, Vol. VI. p. 334. This is a rare mineral. The crystals project into a layer of fibrous talc or ligniform asbestus, which lies down closely upon the mass on which they are formed.

### 29. CHLORITE.

Deep green–structure distinctly foliated. Middlefield and Chester, in small masses, and also mica-slate. Emmons. Among the older primitive rocks, chlorite seems to be composed of more distinct folia. Also, in the vallies on both sides of the Taconick range of mountains. The *common* var. is very abundant in Williamstown, associated with quartz. It is found along the Hudson also.

*Chlorite Slate.* Abundant in Williamstown and Petersburgh. Also in Pownal, Great Barrington, and in various places in Rensselaer and Columbia Counties.

### 30. GIBBSITE.*

Discovered by Dr. E. Emmons in an iron mine in Richmond. It occurs in *incrustations* and *stalactical* and *mamillary* forms, partially crystallized. In Lenox, small mammillary bodies upon *brown* hematite. Most of it seems to be composed of radiating fibres. It is also diffused through disintegrating quartz. Besides these forms, it is found *compact and earthy*, resembling an indurated clay, in the same mine in Richmond.

### 31. ARGILLACEOUS SLATE.
[See the preceding Geol. Sketch.]

The var. *Aluminous Slate* occurs in Pownal in argillite. Also in New Lebanon and Troy; Eaton.

*Graphic Slate*, in small quantity with argillite in Lanesborough and Williamstown. Abundant at Bennington in a hill of argillite. See the Geol. Sketch. When this mineral is thrown into melted nitre, carbonic acid is rapidly extricated, as from charcoal or plumbago in a similar situation.

*Glazed Slate.* Troy, &c. Eaton.—See the preceding Geology.

* May not those minerals, which are composed of the nearly pure earths, with propriety be arranged in a separate class.

### 32. CLAY.

#### 1. *Porcelain Clay.*

In Savoy, in a bed three feet deep and of unknown extent, several feet below the surface. Discovered in digging for ore, connected with mica slate. It resembles the porcelain clay of Monkton, Vt. It forms a very cohesive paste, white, and crucibles moulded from it and burned in a common fire were sonorous when struck. It contains coarse particles of quartz, but when *sifted*, forms a very fine clay.

Similar clay of a finer quality has been given me, and is said to be found in large quantity in Canaan, Ct. but I am unacquainted with the locality. Also in Plainfield; Porter.

#### 2. *Potters' Clay.*

Abundant generally.

#### 3. *Lithomarge?*

A clay, much resembling Lithomarge, is found in the iron ore in the W. part of Bennington. I saw none of it at the great orebed.

#### 4. *Yellow Earth.*

When washed, a yellow ochre is deposited from the water. Williamstown.

## CLASS III.

### 1. SULPHURETTED HYDROGEN GAS.

In the *hepatic* waters mentioned in the Geol. Sketch.

### 2. SULPHUR.

Hinsdale, in cavities of a mica slate rock, consisting chiefly of quartz. It is a brown powder, from its mixture, probably with oxide of iron. Also in Middlefield and Chester; Emmons. It is a fine powder, and not very abundant in the rock; enough however to cover it with flame when thrown on the fire. The mica in this rock is a very bright green, and has sometimes been considered as oxide of chrome.

Pulverulent sulphur is found also in Tyringham, in mica slate, and in Wilmington, Vt.

Also in Cummington, in the singular mineral discovered by Dr. Porter.

### 3. PETROLEUM,

Rises in small quantity on the surface of rather stagnant waters, in many places.

### 4. GRAPHITE.

*Foliated and granular* with augite at Hinsdale. Sometimes it is nearly slaty, and in considerable quantity. Also in New Marlborough.

The *foliated* variety is often found along the eastern part of this section, diffused through augite, granite, and various minerals. It is often called sulphuret of molybdena, as graphite is not supposed to be so distinctly foliated. Most of it, however, is certainly graphite. Also in Cummington.

### 5. PEAT.

A bed of vegetable matter, approaching this substance, under the bed of marl in Pittsfield. In Canaan, N. Y. Barnes.

## CLASS IV.

### 1. SULPHURET OF IRON;

Too common to mention localities,—associated with most rocks and minerals. In Chatham, N. Y. in flattened or spheroidal masses, with radiations from the centre, and the masses often divide by a natural seam into equal portions. It is sometimes *capillary.*

*Hepatic* sulphuret of iron in mica slate, Williamstown. In Chester, this mineral yields abundance of sulphuretted hydrogen by the action of sulphuric acid. In Hancock, Richmond, and Petersburgh, the crystals of the sulphuret, are often more than an inch on a side. In Lee, it is in *compact* masses. If my informant is to be credited, this mineral is occasionally thrown out of the side of a hill in Pownal—he brought some of the crystals. The action of the water in forming, with the mineral, snlphuretted hydrogen, which was suddenly evolved or expended, would account for the fact. May we not in this way account for those fires which are reported to have been seen in various, though not numerous, places? One has been reported to me on the most credible authority. The gas took fire and burnt vegetables or scorched them, near where it issued. The place, abounds in sulphuret of iron. Much money has formerly been expended in digging for *imaginary* silver ore, in Williamstown, Adams, and Savoy, where nothing but sulphuret of iron occurred or was to be expected.

### 2. MAGNETIC OXIDE OF IRON.

In mica slate and chlorite slate, and in serpentine, generally of the primitive form. It is sometimes massive, weighing some pounds. Emmons. Also, at Somerset, with dolomite.

### 3. SPECULAR OXIDE OF IRON.

In large folia, cemented with serpentine. The *micaceous* oxide, abundant and beautiful, at Hawley.

### 4. BROWN OXIDE OF IRON.

This is the principal ore of iron at the several beds mentioned in the preceding Geol. Sketch. The varieties are the *Hematitic* in all its various forms; the *Compact;* and the

*Ochry brown.* The formation of the *cylindrical* and *stalactical* hematite seems to be involved in perfect darkness. They are sometimes equally solid throughout, and the fibres radiate from the axis; at other times, they contain a less perfectly crystallized cylinder along the axis; and in other specimens, the central cylinder is mere yellow oxide of iron, upon which the process of crystallization has not even commenced. Some of the cylinders, formed of radiating fibres as before, are hollow, or may be easily made so. They are often formed on the inside of hollow spheroidal masses of the ore, and their terminations are always downwards. But it is not easily conceived how the action of fire should melt and thus crystallize the ore on the inside, while the outside of these *metallic geodes*, often not half an inch thick, is entirely without any appearance of fusion or tendency towards crystallization: neither how the action of either fire or water should form the cylinders with the central part such as it often presents. The smooth surfaces of the ore are often beautifully *irised.*

Iron ore is also found at Middlefield, but not of a quality for manufacture. Emmons.

### 5. ARGILLACEOUS OXIDE OF IRON.

The *granular* and *compact* varieties are found in Bennington and Salisbury.

*Bog iron ore* is found occasionally in the low grounds. In Sheffield, in some quantity.

### 6. SULPHATE OF IRON,

Effloresces on the rocks near the S. village in Adams. Also in a loose earth, near the *Shaker village* in Tyringham.

### 7. CHROMATE OF IRON.

In Cummington with steatite. Porter. It much resembles that from Maryland.

### 8. SULPHURET OF LEAD.

Specimens of *common galena* have been brought to me from Adams. A bed of the ore is said to be on the E. side of Saddle Mt. In Williamstown, in small quantity. In Livingston, near Hudson, in a large bed.

### 9. ZINC.

Some form of zinc exists in the iron ore at Salisbury. A large quantity of the artificial laminated mineral, *Cadmia*, described in this Journal Vol. VI. p. 180, has been found in the chimnies of the furnaces.

### 10. OXIDE OF MANGANESE.

Var. 1. *Radiated.*

In distinct short four sided prisms on the compact variety—has a fine lustre—in a loose mass of several pounds found in Pittsfield.

Var. 2. *Compact.*

Bennington—abundant. It occurs in small quantity at the other ore beds. Also, Sheffield, West Stockbridge, Adams, and Cummington.

Var. 3. *Earthy.*

Colour brown and brownish black, fracture and texture earthy, very light. Bennington. Also at Richmond with Gibbsite; Emmons.

Var. 4. *Siliceous Oxide of Manganese.*

In small quantity.

### 11. SULPHURET OF MOLYBDENA.

In beautiful plates or lamina—more brilliant lead colour, and less dark than foliated plumbago. I have some regular hexaedral plates, which were closely united, forming a six sided prism, in quartz. Chesterfield.

### 12. RED OXIDE OF TITANIUM.

In small prisms in quartz associated with Dolomite in Pittsfield—rare. Also in flat plates in quartz in Middlefield; Emmons.

### 13. FERRUGINOUS OXIDE OF TITANIUM.

It has some resemblance to schorl; but is infusible—occurs in smallish long imperfect nearly black prisms in granite—rare. Chester; Emmons.

### 14. SILICO-CALCAREOUS OXIDE OF TITANIUM.

In Middlefield in imperfect prisms, rather lighter colored, but much resembling that of Brattleborough, Vt.

## MINERALS OMITTED.

*Anthracite.*

This mineral is found in small quantity in gray wacke slate, especially at Schuyler's quarry, Troy; Eaton.

*Vert Antique?*

This is a magnesian mineral found in a bed in gneiss on the river in Becket, and colored greenish by serpentine. It may, as Dr. Emmons supposes, be a serpentine marble.

It is a tough mineral, and takes a fine polish. In some specimens, the quantity of serpentine is very small, and the colour yellowish white. In other specimens the serpentine is distinctly to be seen. The mineral effervesces with acids, and the crystalline structure of the limestone or of the magnesian limestone, is obvious. I have supposed it a magnesite; but its characters would place it under the general description of *Vert Antique.*

### *Cummingtonite.*

I have given this name to a mineral found by Dr. J. Porter in Cummington. It appears to be a variety of epidote. Its colour is gray, sometimes with a faint reddish tinge, unless when acted on by the weather, when its colour is yellowish. It is in indistinct prisms, with oblique seams like zoisite, and in radiated or fascicled masses, which are composed of slender prisms. Lustre somewhat shining or pearly. It is nearly as hard as quartz, and sometimes makes a slight impression upon rock crystal. Before the blowpipe it blackens, and a small portion melts, when the heat is very great, into a black slag, which is attracted by the magnet. Its point of fusion seems to be about the same as that of zoisite. After allowing for some absorption, the sp. gr. may be taken as about 3.42. It is so peculiar a mineral, that it deserves, even as a variety, a particular name.

With quartz and garnet, it forms a large mass in Cummington. The cavities in the rock contain pulverulent sulphur of a dirty greenish colour; and minute crystals of magnetic oxide of iron are also found in it.

### *Yenite.*

This mineral is found at Chatham, Con. It is foliated in its structure, but less distinctly lamellar than specimens which I have seen from Europe. It is dark green, opaque, hard as yenite, and easily fusible into a dull black globule. From a partial analysis, it seems to have the composition of the European yenite, and the silex and iron are nearly in the proportions given by analysis. Sp. gr. 3.83. When melted, the globule is like that of the European yenite, attracted by the magnet. It is also in the form of flattened imperfect prisms. The composition of this mineral, according to authors, is variable, and a small portion of alumine and manganese, as well as silex, lime and iron, are found in it. In the mineral from Chatham, is a little alumine and manganese, and it appears to contain less lime, and more silex and iron than the European specimens. To the eye it resembles hornblende. But its specific gravity and composition seem to prove it to be yenite.

*Sulphate of Magnesia,*

Effloresces on clay in the bank of the Hudson, three miles above the village of Lansingburgh. Eaton. It is said to be found also in the argillaceous marl about the Hudson.

*Galena.*

Livingston, Columbia county, N. Y. The mine I have not visited; but the ore is said to be very abundant.

*Nephrite.*

Salisbury, Con. found by Mr. C. A. Lee. It is somewhat lamellar, and exhibits imperfect prisms by fracture, and is less bluish white than that of Rhode-Island. Its hardness, toughness and fusion, prove it to be the same mineral.

*Calcareous Tufa.*

At the Falls in Canaan, Con. It is finely characterised, but is more compact and hard than it commonly is. Found by Mr. Lee.

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Art. II.—*A List of Minerals and organic Remains, occurring in the Canadas.* By John Bigsby, M. D. F. L. S. and M. G. S. Lond.

TO PROFESSOR SILLIMAN,

Sir,

I respectfully solicit a place in the American Journal of Science for a list of minerals and organic remains occurring in the Canadas, which has been read before the Lyceum of Natural History of New-York.

From this list I have scrupulously rejected all minerals of doubtful character, and have never adverted to localities which have been already announced; without some purpose evident in the context.

With respect to fossils, I wish this communication to be considered as a transient notice, to assist temporarily in the study of the secondary formations of North-America.

All the substances here mentioned, have been examined by the geologists of this country, and of Europe, and are to be found in their cabinets.

In the plurality of cases, for obvious reasons, I shall avoid a detail of mineral characters, and confine myself to rapid sketches of geological relations.

*Beryl.*—Rainy Lake, two hundred and thirty miles north from Lake Superior. I found only two specimens, the largest of which is one quarter of an inch long, and one sixteenth of an inch broad, in a well characterized six sided prism, translucent, pale green; imbedded in porphyritic granite, in which a brown feldspar is predominant, the mica being black and scanty. It occurs on the east side of the lake, subordinate to vast tracts of gneiss, which runs E. N. E. and changes in places, by insensible degrees, into mica-slate, chloritic and greenstone slate, and sienite. This lake is two hundred and ninety-four miles round, as measured by circumnavigating it from point to point only, of the successive bays.

*Schorl.*—In the Lake of the Thousand Islands, below Kingston, in Upper Canada; north-east coast of Lake Huron, in two distant places; Cape Tourment, thirty miles below Quebec, Malbay, &c. Lower Canada: velvet black, opaque—in six and nine sided prisms, usually small, but rarely ten inches in length, and one and an half inches in breadth—sometimes curved. It abounds in fragments in the puddingstone of the Thousand Islands, interposed between gneiss and horizontal limestone.

The most remarkable deposit with which I am acquainted, is on Yeo's Island, one of the Thousand Islands, near the upper end of Tar Island, and on the south side of the English channel. Yeo's Island (about three hundred yards long,) is divided by a ravine into two unequal parts, on the south-western of which, and on the face of a shelving mound of bleached, close-grained granite, is situated the bed of schorl. It is twelve paces in diameter, and is nearly circular. It does not consist of schorl only, but is a confused aggregate of white translucent quartz, of opaque, cream colored feldspar, of greenish yellow mica, and the schorl, intermixed in shapeless masses of from one to three feet in diameter. The quartz and feldspar are in their usual forms. The mica is brass yellow, with a delicate tinge of green. It is in flakes an inch square, grouped confusedly, and so tough that, although it is in masses a yard in diameter, small fragments are procured only with difficulty. The schorl occurs as a very close lateral accretion of large crystals, with broken terminations, cemented by a film of mica, and dipping into the rock southerly, at an angle of 70°. They have here no determinate number of sides; but resemble a fascis, composed of unequal rods.

From this, the principal deposit, several ramifications pass off to the sides of the island, wanting only the mica. Schorl is met with in other parts of the island, in six sided prisms, of four and eight inches in length, imbedded in veins of quartz and feldspar, coarsely mixed. The containing rock is gneiss, fine grained, of a south-west direction, and south-east dip; but often passing into granite.

*Epidote.*—In the trap of Montreal; in druses of acicular crystals—and stellular, radiated, acicular, in the rolled amygdaloids frequent in Lake Huron. It is of universal occurrence in the gneiss and granite of Canada.

*Axinite.*—At Hawksbury, on the river Ottawa, sixty miles north-west from Montreal, lining a drusy cavity, in a rolled primitive mass; in finely characterized, though rather small, rhomboidal oblique four sided tables.

*Garnet—Precious.*—Plentiful, in gneiss and mica-slate. Rare in Lake Superior, and in the countries immediately north of that lake; while they abound in Lake Huron, and especially at Malbay, ninety miles below Quebec, where they form rock masses, in closely aggregated crystals, sometimes eight inches in diameter.

*Staurotide.*—Rainy Lake, and River Lacroix, (or Namaycan,) the outlet of Lake Lacroix, a large body of water north-west of the Grand Portage on Lake Superior, and in long. 92° 20′. In Rainy Lake, these crystals are extremely small; in very oblique four sided, and in six sided prisms, and in twin crystals. In both localities they are numerous, and imbedded in the same gneiss, which, with frequent transitions into mica-slate, greenstone, &c. here overspreads a great extent of country.

In the river Lacroix, the staurotide occurs in the second portage from the lake, and is frequently an inch long, and two thirds of an inch broad; and in excellent condition.

*Amethyst.*—Lake Superior. Found also by Major Delafield; (a remark which extends to all the minerals found in Lakes Superior and Huron.) It presents itself in six sided prisms of good color, in druses and geodes of amygdaloid. This rock occurs in great quantities, on the north shore of this lake, and in the adjacent islands. It is intimately connected with the old red sandstone formation, is adjacent to, and passes into clay porphyry, which graduates into the sandstone. Limestone, with orthoceratites, trilobites, encrinites, and other fossils, characteristic of the oldest secondary rocks, is also close at hand.

*Rock Crystal.*—Quebec, in transition limestone; Lake Huron, in transition greenstone; Lake Superior, in amygdaloid, &c. Rock crystals are found in the fissures and cavities of the limestone of Quebec, in extraordinary quantities, and of great brilliance. They are generally superimposed laterally, or terminally, seldom imbedded. Their form is the six sided prism, with the ordinary pyramidal acumination. They are often much flattened, seldom equi-angular, and frequently the prism disappears, leaving a dodecahedron. The crystals are single or agglutinated; being in the latter case, full of rents, and of brown earthy matter; and in rare instances, contain a drop of pale bituminous liquid. They are either colorless, or dark smoke brown.

*Radiated Quartz.*—Point Marmoaze, Lake Superior, in amygdaloid, nearly filling a geode with imperfect crystals, radiating in a stellular form from three centres.

*Milky Quartz.*—In the outlet of Lake Ontario, four miles below Kingston, this species of quartz exists in large strata, subordinate and conformable to gneiss, and in the calcareous puddingstone covering it.

*Chalcedony.*—Near Gravel Point, (Lake Superior,) in clay porphyry, in veins. At Points Gargantua and Marmoaze, and in the district of the Mammelles, in that lake, as botryoidal coatings to druses in amygdaloid.

*Carnelian.*—District of Gaspè, four hundred and fifty miles below Quebec, in rolled masses, white, red, yellow, brown; color uniform or in clouds; transparency and lustre excellent. In the amygdaloid, and its accompanying conglomerate, of Lake Superior. Its usual color is delicate red.

*Fortification Agate.*—Lake Huron, imbedded in rolled masses of amygdaloid. Gaspè, in pebbles on the sea-shore. In the porphyry of Lake Superior, and plentiful, large and fine, in the amygdaloid of the latter lake.

*Striped Jasper.*—North-west of Lake Huron, as nodules in transition quartz rock—grain fine, color good, red, brown, yellow, green, white, black. On the north shore of Gun-flint Lake, and in the East Lake of the Height of Land, between Lake Superior and Hudson's Bay, both about seventy miles from the Grand Portage of Lake Superior, are considerable deposits, in trap, of jasper; in the first mentioned place red, with rusty brown spots, and, in the East Lake, marbled in a beautiful manner with green and red.

*Common Jasper*—is present with the striped variety of Lake Huron.

*Pitchstone.*—In Michipicoton Bay of Lake Superior, I found large rolled masses, rendered porphyritic in parts by glassy feldspar. It is jet black. The fixed rock of the locality is greenstone; but those of the opposite (southern) shore of the Bay are amygdaloid and sandstone.

*Fibrous Prehnite.*—At Point Marmoaze, in Lake Superior, as small mammillary coatings on druses, and in amorphous masses. Major Delafield found this mineral in the Pay Plat of this lake. The color is fine, and the other characters distinct.

*Radiated Zeolite.*—Gargantua. Point Marmoaze, in amygdaloid. At the former place, brownish red, and bright flesh red, and at the latter, green also. The brownish red variety is imbedded in the trap, without the intervention of any other mineral; the other in masses of calc.

spar; the radiating fibres passing at the circumference insensibly into calc. spar. It is very handsome, and is almost identical with the Italian zeolite. White fibrous zeolite is not uncommon in the druses of the Trap Mountain of Montreal, associated with tables of feldspar, pyrites and chabasie.

*Stilbite.*—In the amygdaloid of the north shore of Lake Superior. It is red, indistinctly crystallized, encrusting nodules of calc. spar, and lining druses. It occurs likewise in the conglomerate, interstratified with the amygdaloid.

*Chabasie.*—Montreal Mountain, in a druse with zeolite; form well defined, color perhaps originally greyish white.

*Aventurine.*—North east shore of Lake Huron, twenty miles east of the French River. The mineral inserted here under this name, has been also recognized by Dr. Troust and others, of Philadelphia. It is a pale flesh-red feldspar, largely crystallized, and forming part of a vein of porphyritic granite of great size, traversing gneiss. It is almost every where full of brilliant golden points, which sparkle with increased force, if held in particular lights. This porphyritic granite prevails greatly in large contemporaneous masses, and wandering veins, in all the sienitic (or rather granitic,) districts of Lake Superior; but is most abundant in the gneiss of Lake Huron, and of Lakes Lacroix and Laplarie, in 92° 20′ and 93° west longitude, and north from Lake Superior. This gneiss is of imperfect or tortuous stratification; full of hornblende in beds, laminæ, and also disseminated. It seems to belong to the transition, or to the younger of the primitive rocks; judging from its constant proximity to red sandstone, the oldest organic limestone, and to trap.

Where the aventurine occurs, the gneiss is stratified in large and bold curves, which often run into knots of concentric layers, many yards broad; but its general course is N. W., N. N. W. or N. by W. with a corresponding easterly dip. Very frequently it passes into a granite.

*Glassy Feldspar.*—Lake Superior, in pitchstone porphyry. In Lake Huron, and Gun-flint Lake, in greenstone porphyry. In Lakes Superior and Huron, they are splendent, transparent imbedded four sided prisms, of a pale wine-yellow color. In Gun-flint Lake, they are in six sided prisms also—equiangular—sometimes one and an half inches long, and one inch in diameter. They are greyish white; and although transparent in the fresh fracture, become opaque by weathering. The rock in which they occur is part of a trap formation which occupies the north shore of Lake Superior, from long. 87° 20′ to 91° 40′; and most probably farther west. I have only seen the greenstone porphyry of Lake Huron, as a bowlder. It differs from that of Gunflint Lake, in its crystals being confluent.

*Labrador Feldspar.*—A fur-trading establishment of M. Bourassa is placed in a district of this mineral. On the north-east coast of Lake Huron, sixty miles west from Penetanguishine, a British naval station, and ninety miles east from the French River.

It occurs here in rock masses, constituting the islands and main of this intricate country. With respect to its extent, I can only say it is five miles across, in the canoe route along the north shore. On its western confines it is divided from the great gneiss formation, stretching to the French River by an interval of water and woods, two miles broad; but on the east I clearly perceived it to graduate into the gneiss of the locality. My opportunities for this examination were remarkably good, from our having wandered thereabouts for several hours, in search of the true route, which we had lost. The gneiss in which it occurs is the same as that affording the aventurine, except that its stratification is better marked, and that each of the ingredients, hornblende, feldspar, quartz and mica, are more disposed to arrange themselves in separate laminæ. The mica is in very small quantity. The more common directions, however, here, are north-east and north; but with great divergencies; rendered more numerous, and even inexplicable, by the broken nature of the ground, and by the sweeping cycloidal curvatures common to the gneiss of this part of Lake Huron—each bend being from 50 to 100 yards long.

Entering the district of Labrador feldspar from the east, we first perceive the feldspar to have a remarkable lustre and transparency, to increase in quantity, and in the size of its facets. Soon, stratification becomes obscure—and at length is indiscernible; the feldspar constituting nearly the whole mass. It always contains slender strings of greenish hornblende without any particular direction.

and some small but brilliant garnets. I noticed a vein of massive garnet, one foot thick, in an isle three miles east from Bourassa's House. I found a loose mass, two hundred and fifty pounds weight, eleven miles east of the French River, of sienite, composed of black hornblende and gray feldspar, having a very strong purple iridescence. The hornblende must, therefore, occasionally be abundant in this rock.

The Labrador feldspar is of greenish bluish, and hyaline gray, in facets, usually about half an inch in diameter; but often much larger. The iridescence is purple, green, and rarely flame colored, and is only observed in a few solitary spots until dipped in water, or polished, when it overspreads nearly the whole mass.

Judging from the extensive range of country over which bowlders of Labrador feldspar are scattered, the fixed rocks consisting of this mineral with which I met in Lake Huron, are only the southern portion of a large deposit situated in the unexplored forests included between Lakes Simcoe, Huron, Nipissing and the Ottawa or Grand River. From the French River, eastwards, the Labrador feldspar overspreads the northern parts of Lake Huron in vast quantities, seldom however very iridescent. The sandy Hills* of the east shore of that lake,* and Lake Simcoe are loaded with it;—and it is traced, rapidly diminishing in quantity, across Lake Simcoe to Ontario, lying upon the great beds of clay and sand which occupy this interval.—Even as far down the north shore of Lake Ontario as Kingston, solitary masses may be observed.

The small bowlders of blue Labrador feldspar found by my friend Dr. Lyons in the Island of St. Helen, opposite to Montreal, I scarcely believe to belong to this formation as it forms part of a micaceous aggregate, is whiter, and can be referred to a nearer origin, Lake Champlain.

*Mica.*—Ottawa River at the portage of the Grand Calumet, 200 miles from Montreal, in what I suppose to be Dolomite, subordinate to primitive white marble. It is in unequiangular six sided tables.

* Containing horizontal layers of alasmadonta, cyclades, planorbis, &c. and frequently several miles inland from the present shore of the Lake.

Yellow mica in small spangles is plentifully intermixed with the alluvial sand of the valley of the River St. Charles near Quebec.

It is in plates a foot in diameter in porphyritic granite at Cap Tourment; and on the north east shore of Lake Huron, 50 miles east of the French River: and at the Grand Calumet Portage on the River Ottawa.

*Chlorite Earth.*—Lake of the woods; Rainy Lake, Lakes Superior and Huron.

This is a plentiful mineral. In the Lake of the woods it is a conformable vein in Greenstone running E. by N. dipping northerly. It is from 9 to 12 inches thick—its texture is coarse earthy, soft fissile, slightly slaty—and contains octohedral crystals of iron ore and cubic iron pyrites. In Rainy Lake, Lake Superior, and near the Sagamuc River in Lake Huron it occurs under similar circumstances. it is found in gneiss 3 miles North from the Giants' Tomb in the last named Lake, on a barren islet.

*Green Earth.*—Lake Superior. In Amygdaloid in coatings, and disseminated.

*Common Serpentine.*—Lakes Huron and Simcoe—rolled. At Greenville on the Ottawa, 65 miles north west from Montreal, and at Gananoque 20 miles below Kingston, U. C. it occurs in large and small irregular masses in a calcareous cement—subordinate to gneiss in the latter case. I am not disposed to regard this rock as a breccia.

*Ligneous Asbestus.*—North west coast of Lake Huron in veins traversing transition Greenstone.

*Basaltic Hornblende.*—Lake Huron—Montreal Mountain—Banks of theRichelieu near Chambly, L. C. In all instances, in a compact trap.—In the rock of Montreal the terminations project and display the four trapezoidal faces, corresponding to four of the lateral planes, as is common in this mineral.

*Common Actynolite.*—Crow Lake, 30 miles north of Lake Ontario, in the township of Marmora. I have seen a fine specimen from this locality, in possession of the late Mr. Spilsbury, surgeon in the Royal Navy, Kingston, U. C.

*Glassy Actynolite.*—York, U. C. In a rolled aggregate of petalite, quartz, tremolite, and calc. spar. It is a very handsome groupe of crystals, " of a fine green colour, cemented together by lamellar carbonate of lime. They are nearly transparent, almost cylindrical, with the exception of a few, which belong to the bis-unitaire and tri-unitaire of Haüy. The same form is found at Franklin, New-Jersey."*

*Glassy tremolite.*—York, U. C. In white, glassy, short and indistinct diverging fibres, dispersed among the petalite, minutely, and in large masses.

*Petalite.*—This rare mineral, not hitherto found on this continent, occurs on the north shore of Lake Ontario on the beach in front of York, the capital of Upper Canada, a few yards to the right of the wharf, used by the Steamboat Frontenac. It is a rolled mass weighing about a ton, and has much glassy tremolite interspersed, and two large veins of irregular shape, of an aggregate of actynolite and calc. spar. Close to this bowlder lies a still larger of the ophicalcic family† from Grenville or Gananoque, and strewn around are loose greenstones, sienites and some Labrador feldspar.

The town of York is situated on clayey alluvion, containing in spots, many crystalline quartz nodules; the ancient banks of the Lake are about a mile in the rear; but at the distance of several miles east and west, they form its immediate shores in the slopes of the "Burlington Heights" and the very picturesque cliffs of the "York Highlands" three hundred feet high, and consisting of grey and blue clay, which now and then alternate with horizontal bands of ferruginous sand.

At York the alluvion overlies a brown horizontal limestone, abounding in trilobites, orthoceratites, and other fossils of the older secondary formations, and abutting northwardly, forty miles from Lake Ontario, on gneiss and sienitic rocks.

*Anthophyllite.*—Fort Wellington, U. C. In a large rolled aggregate of crystallized quartz, calc. spar and apatite. A remarkably well characterized example, recognized by Dr. Hyde Wollaston, and Mr. Lowry of London. I had considered it zoisite.

* Dr. Troust, Journal of the Academy of Natural Science, of Philadelphia, Vol. 3. p. 234.

† A term used by the French Geologists to designate a rock composed of marble and serpentine.

*Sahlite.*—Hawksbury, Ottawa. A very large rolled mass intermixed with quartz and containing imbedded sphene.

*Common Augite.*—Imbedded in the trap of Montreal mountain. Professor Silliman first detected this mineral in the above locality. It occurs in acicular crystals in the trap around the village of La Prairie, L. C.

*Coccolite.*—Fort Wellington, U. C. Montreal, on the shores of the St. Lawrence—green, in rounded grains in white calc. spar—rolled.

*Calc. spar.*—Is found at the Grand Calumet on the Ottawa, in primitive marble, in sky-blue transparent masses, with striæ indicative of a cleavage parallel to the diagonal of its rhomb. White calc. spar occurs in veins in the gneiss of Cap Tourment, L. C. and very largely in the sienite and greenstone of Lake Superior.

*Marble.*—West Branch of the Ottawa, leading towards Lake Nipissing four hundred and fifty miles north west from Montreal. Lake Chat, on the Ottawa, and the parts of that river about the Portages de la Montagne and Grand Calumet—in all these instances subordinate to gneiss. It occurs also in the neighbourhood of Berthier, forty miles north east from Montreal; and is frequent in the state of bowlders along the north shore of Lake Ontario, derived perhaps from the body of this rock existing at Marmora, up the river Trent. It is every where white, highly crystalline, and often contains galena minutely disseminated.

*Satin Spar.* In the Amygdaloid of Lake Superior at Point Marmoaze, and in the Pay Plat according to Major Delafield, who also found it in the trap of the Outard Cliff, overlooking the lake of that name, in longitude 90° 5′ north of Lake Superior.

At Point Marmoaze it is in veins from a quarter of an inch to one inch thick, vertical, running obliquely to the stratification, several in company, nearly parallel, and ramifying rectangularly. These veins consist of two tables, separated by a rift in the middle. The fibres are usually perpendicular to the axis of the vein; rarely oblique. The mineral is white, with a slight tinge of red, occasionally.

*Fibrous Arragonite.*—In compact secondary limestone at La Chine, eight miles west of Montreal, presented to me by Dr. Lyons. In veins one inch thick composed of two tables, one of which is white, and slightly translucent; the other is white, hyaline, with high translucency. This limestone forms a horizontal girdle around the trap mountain of Montreal, whence, as from a centre, large veins or dykes of trap radiate into the adjacent limestone, to the distance of two miles, in some cases, to my own knowledge, and even to La Chine, according to information received from M. Burnet, chief engineer to the La Chine canal. The limestone in its upper strata is brown and crystalline; but black, compact and slaty below. It contains in immense quantities the organic remains peculiar to the mountain limestone of England and Ireland.

*Common Apatite.*—Fort Wellington, U. C. In a rolled aggregate of quartz, anthophyllite and calc. spar. In six sided prisms from one sixth to one fourth of an inch in diameter, usually short, sometimes long, confusedly aggregated, sometimes in great numbers; they are often equiangular, and are more or less truncated on the lateral and terminal edges, now and then so much as to produce four and five sided prisms. They are opaque—the colour being greenish white, green and light blue, I have one fine crystal in which these colours blend in clouds.

*Fibrous Gypsum.*—In limestone on the river Ouse, which enters Lake Erie on the north shore. Indians have brought this mineral from near Cabot's Head in Lake Huron; that from St. Martin's Islands near Michilimacinac has been long known.

*Selenite* has been found on the Great Manitouline in Lake Huron by Lieut. Bayfield, Royal Navy; and has been received from that vicinity by Mr. Schoolcraft. It is in nodular geodes, whose sides are brown limestone wholly occupied by favosite. The same geode sometimes contains radiated celestine. Selenite is found abundantly in the horizontal limestone of Hudson's bay. I have seen it from thence in transparent masses of very large size.

*Fluor.*—At the bay of St. Pauls, sixty miles below Quebec, in the ravine of the stream which turns the seignioral mill, disseminated plentifully in green crystalline masses, in white marble which is a thin layer in compact blue limestone, alternating with gneiss.

It is found in the transition limestone of Cape Diamond, in a druse superimposed on white calc. spar. If any crystalline forms existed in this specimen, they were destroyed in detaching the mass. Nothing now remains but a fragmented crystalline purple mass. The specimen was given to me in 1819 by Lieut. Skene, superintending engineer of Quebec. My friend Dr. McEwen of Philadelphia, has also met with fluor in this locality.

It is present in the secondary limestone of Montreal, filling fissures in the calcareo-quartzose veins common at the foot of the mountain. It is purple and massive.

It is plentiful in the sienite of the north mainland of Lake Superior, opposite Peck Island, and likewise six miles east of the Written Rocks, filling fissures—it is purple, translucent, crystalline, and separated from the sides of the cleft by a film of white calc. spar—in amygdaloidal trap, on calc. spar, three miles east of Point Gargantua—purple and green—(Major Delafield.) It is abundant, lining fissures, together with sulphate of Barytes, in the porphyry of the large and lofty island, three miles east of Gravelly Point, and sixty three miles east from Fort William. It is here green, and highly translucent—a specimen from this locality presented to me by Lieut. Bayfield, Royal Navy, (employed by the British Government in a naval survey of Lake Superior,) possesses a numerous groupe of well defined octohedral crystals, the largest of which are one quarter of an inch in diameter. This porphyry is a part of that before alluded to, as in intimate connexion with amygdaloid and red sandstone.

*Barytes.*—Large tabular fragments of this mineral accompany the green fluor of the porphyry of Lake Superior. It appears to be the gray, straight, lamellar sulphate.

*Strontian.*—Foliated sulphate of strontian exists in rounded imbedded masses, from one to six miles in diameter, in horizontal azoophitic limestone, (resting occasionally directly on gneiss,) two miles N. E. from Kingston, on the shore of Lake Ontario. It is white, faintly translucent, and is in large crystalline facets—never (as fas as I am aware) in prismatic forms. It is plentiful.

It occurs in a very similar limestone on the right bank of the Ottawa, near the head of the Long Sault, sixty miles from Montreal; but here it is in small oblique four sided prisms, superimposed on white calc. spar, sky blue, transparent, and with broken acuminations.

Fibrous sulphate of strontian, of a white, or sky-blue color, is imbedded in the limestone of Kingston, (U. C.) in balls from one to twelve inches in diameter—solitarily, or forming a confused aggregate with white calc. spar and cubic iron pyrites. This mineral is here in bundles, promiscuously arranged, of diverging acicular fibres—usually closely compacted; but now and then having angular interstices, and even forming a confused reticulation in very small fasciculi.

The same fibre or prism is sometimes four and six inches long, but commonly much less.

In June 1819 I discovered a small druse of this mineral in the limestone of the chasm of the Falls of Niagara. A few weeks afterwards, Dr. Morton of Philadelphia, met with another in the same place.

I have detected two druses of this species of strontian in the brown fine grained limestone of the narrows of Lake Simcoe, towards the river Severn, which discharges into Lake Huron. It is in small groupes of diverging slender fibres resting on white calc. spar and quartz crystals. This limestone is horizontal, and is crowded with organic remains, especially terebratulæ, orthoceratites and asaph trilobites,—it is close to the older rocks. Exactly this form of the fibrous variety occurs in the nodular masses of the Grand Manitouline, containing selenite.

*Muriate of Soda.*—Springs of this salt have been discovered along the whole north shore of Lake Ontario. The first intimation of their existence is usually given by cattle. They are tolerably copious, and although very weak at the surface, are more concentrated below; where they are no longer diluted by rains and infiltrations from marshes.

They occur in swamps based on horizontal limestone, containing productæ, orthoceratites and others of the more ancient fossils.

The following is the situation on this lake, of the springs with which I am aquainted, but I confess not to have made sufficient inquiries on the subject hitherto. Besides many smaller salt licks, in the front of lot No. 10 in Concession Bay of the township of Murray, one mile and a half or two miles north west from Quintè Carrying place, there is a saline spring which discharges as much as a common pump.

It has been penetrated for sixteen feet, and yields about a peck of salt for every seventy gallons of water; but it is supposed to be weakened at present by the brackish, stagnant water, which surrounds the spring in patches for one quarter of a mile square. There are several salt springs in the township of Percy county, Northumberland, at which much salt was made during the late war between Great Britain and the United States. There are several also in the township of Whitby, East Riding of the county of York, issuing from clay and increasing in strength with the depth from which it is raised. Others are at Chinkecushè on the river Credit, in the township of Toronto, another in the seventh concession of Esquising, and many about Burlington Bay and St. Catharines ;—some of which are worked.

Indians report that on the south shore of Muddy Lake, a part of Lake Huron, there are brackish marshes.

*Sulphur*—in yellow pulverulent efflorescences, and in tufts of minute capillary crystals, coats the moist calcareous shale at the foot of the horse-shoe fall of Niagara, and within the curtain of falling water.

*Bitumen.*—Mr. Bird, late Astronomer to the boundary commission under the 6th and 7th articles of the Treaty of Ghent, showed me masses of fetid pale brown limestone from the south shore of Lake Erie, which when held before a fire for a few moments shine and become viscous from a thin coating of bitumen which then becomes apparent by liquefaction. Major Delafield has limestone from the north west of Lake Huron holding this substance in still greater quantities.

*Coal.*—Minute seams of coal, jet black, shining, very light and brittle, have been found in the cliffs of the Grand Battery of Quebec, and in Cape Diamond;—in both cases, in black transition limestone.

*Scaly Graphite.*—In large bowlders of translucent quartz, on the Ottawa, in the township of Hawksbury. In bowlders of white feldspar at the fort of Cape Tourment;—in both instances disseminated in small crusts or scales.—The granular form of this mineral has been brought in considerable quantities from a creek 3 miles east of Kingston, U. C.

*Variegated Copper Pyrites*—occurs in abundance among the beds of magnetic iron ore of Crow Lake, in the township of Marmora. It has a purple tarnish.

*Copper Pyrites*—occurs in amorphous masses in various parts of Lake Huron. It is disseminated in gneiss on the north east coast, and imbedded in a vein of quartz traversing greenstone at the foot of the narrows of Pelletau in the north west of that lake. In Lake Superior, it is not uncommon, (but always in small quantity) in the druses of prehnite, zeolite and calc. spar so common in the amygdaloid of the north shore. Point Perquaquia, on the north side of Michipicoton Bay, has long been celebrated for its copper. I was there in the summer of 1823, for a few minutes, but could only discover yellow and green coatings on a large vein of quartz in greenstone, with copper pyrites sparingly interspersed.

*Iron Pyrites.*—I have an octohedral crystal of this ore nearly two inches in diameter, from the township of Yonge, U.C. I was there shown a vein of iron pyrites 1½ feet thick, of parallel sides, and visible for about a yard. It is in primitive quartz, at the bottom of a round cavity about 12 feet in diameter, in a mound of quartz, evidently the effect of an explosion. It is in the woods half a mile north from the high road from Montreal to Kingston, and 10 miles above Brockville. The sides of the cavity are studded with iron pyrites, and profusely invested by a yellow and white efflorescence, and by acicular crystals of what I have only ascertained to be an aluminous salt, but of what precise kind I cannot say. Fifteen years ago a man was seeking some stray cattle in this neighborhood, and on a sudden heard a loud explosion. Having approached the spot, he found it enveloped in a sulphureous smoke, which soon passing away disclosed the appearances above described.*

*Iron Sand.*—Granular ; in great quantities at Batiscan in Lower Canada.

*Magnetic Oxide of Iron.*—The compact, or rather the fine granular form, often contaminated with sulphur abounds in the primitive region about the Crow Lake, 30 miles north of Lake Ontario The specimens I have seen were in quartz rock, and had a specific gravity of 4.62. I have seen it from thence in groupes of large octohedrons. Granular masses occur in the gneiss of the bay of St. Paul, L. C. and it abounds near the falls of the Chaudiere on the Ottawa.

It occurs in the trap of the Montreal mountain ; but only in small quantity.

* See the note at the end of this article.

*Specular Iron Ore.*—At Fort Wellington, U. C. and Hawksbury, on the Ottawa, coating granitic bowlders in amorphous masses—and on the north east shore of Lake Huron imbedded plentifully in granite. It has a purple tarnish, and from the quantity I have met with rolled, thereabouts, is most probably in place not far off.

*Meadow Iron Ore.*—At Three Rivers and Batiscan strewn on the ground in marshes and woods.

*Bog Iron Ore.*—At Batiscan, Three Rivers, Bay of St. Paul, Carrying-place of the Bay of Quintè, &c. &c. &c.

*Black and Brown Hematite.*—In very small quantities lining fissures of transition quartz, at encampment Douce in Lake George, below the Falls of St. Mary.

*Sphene.*—At Hawksbury, on the Ottawa, in a rolled aggregate, many tons in weight, of white crystalline quartz and sahlite. It is imbedded in the former mineral in oblique tetrahedral prisms opaque, chesnut brown, usually small, but sometimes $\frac{3}{4}$ of an inch long. Recognized by Dr. Hyde Wollaston.

*Foliated Galena.*—In large rolled lumps in the alluvion or diluvion of Fort Wellington, imbedded in the transition quartz of La Cloche, on the north shore of Lake Huron, in thready veins in the transition greenstone of the north-west main of that Lake. It is abundant in the gneiss and granite in the rear of Kingston, U. C. and occurs sparingly in the limestone of the Falls of Niagara; but more plentifully in that of the river Ouse of the north shore of Lake Erie.

*Yellow Blende.*—In imbedded crystalline masses in the shell limestone of the Falls of Montmorenci, in that of Montreal, and of the Falls of Niagara; where it is of great beauty, and in nodules, each weighing some ounces. In all these three localities it is coated with white quartz. At Niagara it occurs in the common crystallized forms, usually small, but rarely, almost as large as a nut.

To the catalogue of the organic remains occurring in Canada, I beg to premise a few summary observations on the limestone which furnishes them.

Their relation to the subjacent rocks and uniform similarity in structure and contents, mineral as well as organic, seem to indicate that the beds of limestone extending with few or no interruptions from Cape Tourment, below Quebec, to near the Falls of St. Mary, are the effects of a contemporaneous deposition; and further, that they are the representatives of the mountain or carboniferous limestone of England.

I make these statements with extreme diffidence; being, in some degree, aware of the difficulties of the discussion, of the existence of contradictory facts, few but weighty, and of the defective state of our information respecting the vast calcareous formations of North America.

The universality of its debris, crowded with the appropriate fossils, on the north shore of Lake Superior, argues a continuation of this rock from Lake Huron; but it has not yet been discovered in situ. I also anticipate that further research will assign the same date to the limestones of Malbay, Anticosta, and Gaspe, on the east; and on the north-west to those of the Lakes Winnepeg, of the Woods, Bourbon, Cedar, La Crosse, and Beaver, and of the Rivers Mississippi, Saskatchawine, Red River, Brochet and Voleurs; all, excepting Voleurs, (if I recollect aright) discharging into Hudson's Bay.

The horizontal limestone of the Canadas first mentioned is placed on the northern limits of the Basin, occupying the valley of the Mississippi, and the western parts of the state of New-York; and rests upon the primitive and transition ridge which separates the waters of the St. Lawrence from those of Hudson's Bay. From the mouth of the St. Lawrence, upwards, these more ancient rocks border the river closely. They form its north bank as far westward as Cape Tourment, and receding there, leave a stripe a few miles broad up to Montreal, when retreating to the Falls of the Chat, on the Ottawa, they allow to the horizontal limestone an interval sixty miles broad between themselves and the river St. Lawrence, which, at the outlet of Lake Ontario, they again approach and cross, by a spur sixty miles in breadth, extending, mingled with occasional terraces of sandstone and limestone, from Kingston to Brockville.

A line drawn W. N. W. from Kingston to Penctanguishene on the north-east coast of Lake Huron, and cutting the north shore of Lake Simcoe will trace the junction of the horizontal calcareous rocks with the inclined formations. No conchiferous limestone occurs on the northern shores of Lakes Huron and Superior; but it ranges within from three to six miles of that of Lake Huron, and thence is continuous, southward over the peninsula included by Lakes Erie, Ontario, Simcoe and Huron, although buried under deep alluvion; and over Ohio, Michigan, &c. to the Gulf of Mexico.

The secondary limestone of the St. Lawrence and its lakes, is of various colors, chiefly dark and pale blue and brown, the latter being sometimes green, and at others passing into a straw yellow, while the former graduates into black. Its texture is granular, varying in fineness from coarse to extremely compact, and then having a faint lustre. The fracture is conchoidal, although, in certain states, obscurely. It is always horizontal, except very rarely and in minute portions, as at Jacques Cartier, L. C. and at Point Henry, U. C. It is divided into layers which are usually one or two feet thick, but frequently also ten or fifteen feet. It is quite common for the same stratum to subdivide differently in contiguous places. Perpendicular cleavages every where show themselves, separating sets of layers into rhombic or squared masses. The floor and roof of each layer is extremely rough, and coated with a thin black glaze, perhaps of clay, which scales off; red clay is frequently interposed in this manner, as is common in mountain limestone. The limestone is usually most massive in the upper portions, the lower being slaty, and even shaly, black, comparatively free from organic remains, and sometimes altogether so. The upper strata are also often so crowded with sparry casts of fossils, as to become quite crystalline. Where these are more or less chertzy, the compact or granular cement is washed away by rains or currents, leaving the casts in high relief. In this form, the limestone of Lake Huron, &c. can scarcely be distinguished from that of Dudley, in Staffordshire. In all its modifications, it is occasionally fetid, from the presence of bitumen or sulphur. The limestone now described, abuts on one of the older rocks directly, or with the interposition of another horizontal stratum; and by far the most commonly on gneiss, which I have strong grounds for believing to be of the same age and general characters throughout the whole of the districts under consideration. It is incumbent directly on gneiss in the bed of the river St. Anne, near its upper Falls, in the seigniory of St. Feriole, L. C.; at Montmorenci, not far from the " the natural steps;" but only seen in time of low water; at and near Point Henry, close to Kingston, U. C.; and in many places on the north coast of Lake Huron. In the last named locality it rests directly, in several instances, on a beautiful snow-white transition quartz, which occupies the main shore in steep hills, four hundred and five hundred feet high, from near the French River to the River Le Serpent, (70—80 miles.) The immediately subjacent rock, at La Cloche, and on the isles north of the Manitoulines, in the same lake, is sometimes a highly inclined greenstone. Near Montreal, it overlies, directly, crystalline trap, containing augite, zeolite, mica, feldspar, &c.

But ordinarily, a sandstone, grey wacke, or a conglomerate of quartzose, or calcareous materials is interposed; also, in horizontal layers. It is to be remarked, (en passant,) that much the greater part of the grey wacke of Lower Canada does not belong to this deposition; but is conformable to the mica-slate, gneiss, &c. ranging along the north shore of the St. Lawrence, between Quebec and the river Saguenay.

Often these intervening strata derive their constituents from the enclosing rocks, as is finely seen in the outlet of Lake Ontario, on Mr. Law's farm, three miles below Kingston, where the inclined rock is milky quartz, subordinate to gneiss. Here the nodules are milky quartz, very large, usually with blunted angles, intermixed with fragments of the schorl so abundant in the gneiss, and imbedded in green and grey pulverulent calcareous matter, which gradually becomes compact, upwards, and free from nodules. It is also exemplified on the west side of the river Montmorenci, especially below the bridge, near the falls, where the nodules are of gneiss, sometimes one or more feet in diameter; the cement being calcareous and powdery. In Lake Huron, the same fact occurs on an extensive scale with the crystalline snow white quartz rock before alluded to.

In numerous and widely prevailing examples, this stratum receives its materials from distant sources, which are not to be traced, or only with a certain degree of probability. Frequently the cement is wanting, or is argillaceous. The sandstone, which is beneath the limestone from near Kingston, U. C. to St. Anne's, twenty-six miles north-west of Montreal, (one hundred and seventy-four miles,) is white, but with ferruginous spots and clouds, hard, fine-grained, without cement, and contains thick layers of large and small nodules of crystalline quartz, disposed in horizontal lines. It forms cliffs an hundred feet high in the Lake of the Thousand Islands, which rest on the very small grained gneiss (often a granite,) which abounds so in the north and north-east, and passes largely and frequently into primitive white quartz rock; thus disclosing a possible source of the sandstone and quartz nodules. Where clay is the cement 'an argillaceous sandstone or gray wacke is furnished. The former of these I have never seen in contact with the inclined rocks. It occurs very distinctly in the chasm of Niagara, the lower strata of which, (and particularly those on which Queenston stands,) are almost ferruginous clay. The nearest primitive is on the north shore of Lake Simcoe, ninety miles off. From the nature of the organic remains, and other contents of the limestones covering this sandstone, I am inclined to believe the latter to be the old red; which is often thus intermixed with argillaceous matters. At Dunkirk, on the south side of Lake Erie, Mr. Hulbert has bored through these rocks to the depth of 682 feet, (117 feet below the surface of the Atlantic,) and without meeting with salt. The above observations apply to the fine sections in the bed of the Genesee river; but I have not sufficiently examined the fossils in the limestone of that locality. Its sandstone has large but indistinct casts of what I suppose to be encrinites; but which may be vegetable; but in either case resembling the old red sandstone. It may be added that it is on the same level with, and not very far from the sandstone of the vicinity of Kingston; but similarity in level, taken by itself, is not an unerring test of similarity in age. In one part of a district or lake, granite, gneiss, &c. may attain a given elevation, and be there covered with gray wacke only; while in another and not very distant place these rocks may not rise to within some thousand feet of that height; and be buried under all the succeeding strata up to the Crag above the London Clay.

The sandstone of Lake Huron, the Falls of St. Mary and Lake Superior is parti-coloured, ferruginous, arenaceous, or consisting of very small quartz nodules. It is usually soft; but often very hard, and imperfectly crystalline. At La Cloche and elsewhere in Lake Huron, and in Lake George it most probably rests on transition quartz and transition greenstone. I have seen it within a few yards of both, but was unable from accidental causes to detect them in actual contact. In Lake Superior, near Gros Cap it abuts on gneiss, and greenstone.

The gray wacke above noticed, underlies the limestone from Montmorenci to Cape Tourment, a distance of twenty miles, in horizontal layers, varying from fine granular slaty, (used for grindstones.) to a coarse conglomerate of quartz pebbles It is surrounded by the older rocks, except on the south west.

A conglomerate wholly calcareous occurs in situ near the foot of the Long Sault of the River Ottawa, and at the Coteau du lac, three miles below Lake St. Francis, composed of angular and rolled masses, sometimes very large, of fine granular limestone, light brown and blue, imbedded in a dark brown paste. A similar rock occurs with the limestone about Poughkeepsie in the state of New-York, and at Aubiginy opposite Quebec interleaved with clay-slate and gray wacke, highly inclined, and having a south-west direction.

Having now sketched the mineral and geological characters of this limestone, I proceed to notice its contents. Its minerals, although not belonging exclusively to mountain limestone, still abound therein to a remarkable degree. Yellow blende exists in three localities, remote from each other. Galena and iron pyrites are universal, although not in large quantities. Fibrous and foliated sulphate of strontian are scattered profusely over all the lakes and water communications. To these are to be added fibrous arragonite, fluor, numerous and often splendid varieties of calc. spar, quartz crystals, and bitumen. Coal has been found on the Flint River, a branch of the River Saguina, Lake Huron, in some quantities, and in a district little elevated, I believe, above the contiguous lake. It gives a good light, and white ashes.

Chertz, which is always a prominent substance in mountain limestone, is in large quantities in that of Lakes Erie, (north-east end,) Huron, Superior, and of the Woods, in layers, straight or contorted. in masses, and forming fossil casts.

The plentiful occurrence of gypsum, and muriate of soda, is a chief objection to the associating of this limestone with the mountain or carboniferous of England. Gypsum only occurs in large quantities on the north of the lakes, along the river Ouse, Lake Erie, and on the St. Martin Islands, near Michilimackinac; whose limestone cliffs can scarcely be classed with the English rock in question. They are a confused aggregate of brecciated and vesicular masses, mixed up here and there, with fragments of white calcareous strata, and broken flints of a blue color. They contain few or no organic remains.

The muriate of soda occurs only on the north shore of Lake Ontario,—not on the north of the other great lakes. I have not visited the springs affording it; but the one near the Quintè Portage is almost on the same level with, and adjacent to, limestone similar to the carboniferous, in character and contents. I have to confess that my information respecting the saline formations of the United States, is slender and inexact. It is to be desired, that Dr. Van Rensselaer would add to his late very valuable treatise a minute investigation of the geological peculiarities of the muriatiferous rocks of the State of New-York. I am aware of the presence of oolite and fossil echini, in their neighborhood. My observations, in every part of this paper, refer only to the Canadas.

This limestone is particularly rich in the number, novelty and beauty of its organic remains. In addition to many which are unknown elsewhere, it abounds throughout its vast extent, with those fossils which are supposed to characterize the carboniferous limestone; and the analogies which are most important are also the most numerous. Gaspè, in longitude 64° opposite to Newfoundland, the Lake of the Woods, and all the intermediate calcareous regions, afford the same genera and very often, the same species. The following enumeration of these substances is brief, from the majority of them having been described at length with the assistance of forty-five engraved figures, in the sixth volume, part the second, of the transactions of the Geological Society of London. Some of them I shall omit, not having in my possession a copy of the work. I have only by me at present a few notes and the sketches in Indian Ink which I usually make soon after the discovery of a fossil.

No impressions of fish nor of vegetables have hitherto been discovered in the Canadas.

*Trilobite.*—This family is universal, astonishingly numerous, and very diversified in its forms. It is always in fragments; but which, however, not unfrequently, are the greater part of the fossil, and with the remainder close by.

I have not seen the genus Calymena of Brongniart on the north side of the St. Lawrence. The genus asaphus is the most general and the most perfect. The A. caudatus and laticaudatus are met with in most situations (rolled on north shore of Lake Superior, Rainy River, Lake of the Woods, &c.) Many of this genus differ from those of the above author, in the number of articulations: an asaph from Gaspè, in my collection, given me by my friend Mr. Buchanan of Montreal, has fifteen, instead of from eight to twelve articulations, the extremes allowed to this genus: the end of the cauda in this specimen is bent backwards. Others are distinguished by a double grooved edging round the abdomen. (Lake Erie.) Many asaphi from Montreal, Lakes Simcoe and Ontario have a smooth coat of limestone, granular or sparry, which conceals the abdominal joints and lobes and exhibits only the relieved outline of the cast; but in a few, their structure is still discernible; as is well exemplified in a superb specimen in the possession of Dr. James of Albany; in which, in fact, the greater part of this covering has disappeared. The largest American asaph which I have seen is that of Dr. James'. I have the greater part of one from Gaspè three inches long by three and a quarter at the broadest part. They are nearly of this size at Montreal, much smaller at lake Simcoe, and although often of the common size (one to one and a half inch in diameter,) in the Lake of the Woods, are almost microscopic, both there and in the Bay of Quintè, Lake Ontario. They occupy indiscriminately limestone of every colour, but are most numerous in the brown crystalline. They are composed of the limestone in which they happen to be imbèdded.

Dr. Mitchell, of New York, has an asaph from Anticosta, in the Gulf of St. Lawrence.

The calcareous rocks of the north shore of Lakes Huron and Simcoe, besides the asaph, are full, in patches of the debris of very large trilobites;—but too small to allow of the determination of the genus. I have, however, met with some fragments, which I believe to be the pointed lateral prolongations of the "bouclier" of the ogygia genus. Brongniart has figured some imperfect trilobites which Mr. Charles Stokes, M. G. S. London, sent him from Llandeilo in Wales. These are in great abundance in Lake Champlain, (M. Leseur) around Montreal, at the falls of Montmorenci, throughout Lake Ontario, and in one instance in Lake Simcoe In these places likewise they are mutilated; but are in a larger and better defined form, than those of Wales.

I beg to refer to three figures of large unknown trilobites, published last year in the Geological Transactions of London.

I have by me at present a fine but imperfect impression from the cast of an undescribed trilobite from the isles on the north shore of Lake Huron. It is a pretty exact oval, rather exceeding five inches in length, and two and an half in breadth. The total length appears to have been six inches. It is not clear which end represents the "bouclier;" except we judge from the position of the articulations, which are eleven in number, each one fifth of an inch broad, the upper one being an inch and a half from the summit of thesupposed bouclier. Of the three lobes, the middle one is much the largest, that on each side being only five eights of an inch broad, and being not quite so protuberant as the first mentioned lobe, which itself has a moderate and gradual convexity.

All parts of this remain are full of small transverse curved tracings, more or less parallel to each other.

*Ammonite.*—Casts of ammonites are plentiful at the east end of Drummond's Island; but are in less number on the isles of the north shore of Lake Huron. They occur in Lakes Simcoe and Ontario, abound in the brown limestone near Fort Wellington, U. C. at the head of Lake St. Francis, and at Montmorenci, L. C. Those are smooth, oval and spherical casts of granular limestone, and are about the same in size and general appearance. At the last place there is a very small kind (one half, to one and a half inches in diameter,) deeply striated, and invested with nacre or spathose substance.

*Orthoceratites.* These exist every where in immense quantities,—in all places, occosionally large:—in Lake

Huron, sometimes five feet long; but in the Lake of the Woods and Lake Simcoe little more than an inch in length. Besides several of the ordinary forms, eight kinds from Lake Huron, have been described in the Geol. Transactions of London, differing in the shape and position of the siphuncle, in the position of the chambers and their inequality of dimension in the same individual; and in external configurations, indicative of peculiar structure in the chambers. Major Delafield's collection contains a flattened orthoceratite from Lake Huron, seven inches long, nearly two inches broad at one end; and one inch and a quarter at the other. One face of the fossil presents the usual cellular divisions; but the reverse exhibits the appearances in the accompanying diagram. (See the plate at the end of this No.) At the larger end of this specimen, the siphuncle is of great magnitude; but at the smaller, it is not much more than a quarter of an inch in diameter. Its chambers are very unequal.

The isles on the north of Lake Huron possess a curious and complicated chambered shell which approaches nearest to an orthoceratite. There are at least three varieties.*

At the Portage of Notawasaga, on Lake Simcoe, I found two curved orthoceratites. The one now before me is two inches long by half an inch broad, and bent into a semicircle. It has thirty-four chambers in the lower two thirds of its length, those near the bottom being very small.

*Conularia.*—During a short search below the bridge, at the Falls of Montmorenci, I found three specimens of the rare organic remain, the conularia quadrisulcata; exclusively, I think, belonging to carboniferous limestone. I met with another at the portage of the bay of Quintê, in Lake Ontario, and a small fragment of this family, both at Montreal and on Lake Simcoe; but in neither case could I determine the species.

Among the univalves without chambers, I have only met with the euomphalus, trochus and turbo, in Lake Huron; but the second, only at Montreal, the trochus and turbo on the north shore of Lakes Ontario and Simcoe, and the last plentifully in the Lake of the Woods.

*Terebratulæ* abound every where, chiefly of two kinds:

* Geol. Trans. for 1823.

the bicarinata of Leseur, and the subrotunda. Those of Lake Simcoe are almost spherical, very small, and always invested with nacre. The bicarinatæ of Lake Erie are remarkable for their great size.

*Productæ.*—No locality of any extent is without productæ of various forms. In the Lake of the Woods, I have found them in deep straw yellow limestone, nearly two and an half inches long, with a remarkably broad base. In the same lake, they are also ovate; and in Lake Huron, and in the district of Gaspè. They are often of chertz.

I am not aware that the spirifer has yet been discovered in America.

*Encrinis.*—The encrinis, prominens, verrucosa, and levis. under different modifications, together with pentacrinital columns, are plentiful every where, but rarely with ramifications or stomach. The former has been found in the isles fronting Thunder Bay, on the south of Lake Huron by Lieutenant Bayfield, R. N. They abound at Montreal, as well as the stomachs or cups of the stag's horn encrinite, imbedded in shaly black limestone. I found there a beautiful and large example of the column and stomach of the encrinis moniliformis of Miller, in May, 1823. My friend Mr. Lee, late of the thirty-seventh regiment of British Infantry, met with, in the same place, what appears to M. Leseur and myself to be the lower part and base of the stomach of an encrinite, resembling the pear encrinite. I discovered another at Notawasaga, in Lake Simcoe.

*Caryophyllia* have been found in great numbers in the south of Lake Erie, by M. Leseur. I have seen them only in limestone very similar to that of Lake Erie, at the Little Detroit of La Cloche, at the east end of the great traverse of Forêt des Bois; where they are grouped with productæ, encrinites, orthoceratites, &c. and attached by a pedicle.

*Turbinolia.*—This species of madrepore, abounds in the Lake of the Woods, Rainy River and the great lakes, but is more rare at Montreal and about Quebec. It is of various sizes and shapes, common in the United States. In Lake Huron it often has extremely thick transverse rugæ, perhaps indicative of age. An individual from that lake is figured in the Geol. Transactions with tubular arms in the upper part of the fossil; a fact by no means uncommon there; but quite new.

*Astræa.*—The A. basaltiformis, (lithostrotron of Germany, and of Lloyd,) was presented to me by Major Delafield, and I believe from the limestone of the River Detroit. A new and elegant Astræa from Drummond's Island in Lake Huron is engraved in the transactions before referred to: and also another, very similar to the one represented in fig. 3, tab. 47, of Lamoureux, "Sur les Polypes Flexibles," &c. but the compartments of his are rounder and often pentagonal, while those of mine are irregular in the number and size of their sides. Vertical sections of this fossil frequently present interesting views of its mode of increase.

Cellular and chain Madrepores, Tubipa strues and ramosa, retepores, and flustra are in great abundance every where.

Nine varieties of a new genus of madrepores from the Manitoulines of Lake Huron have been described in the transactions frequently alluded to. They were first sent to Quebec, in 1818, by Mr. White the medical officer of the British Military station on Drummond's Island.

I was immediately struck with their singular form, which is that of a vertebral column, sometimes two feet long: and in the following summer I visited the spot. A general search for fossils then commenced, which has been attended by very gratifying results. Some remarkable facts respecting these remains were brought to light in May, 1823: but I am not yet prepared for their publication.

For a description, illustrated by drawings of several other new organic remains from Lake Huron, I beg to refer to the transactions of the London Geological Society.

The following shells are known only in the more recent formations. The delicate bivalve, the lingula (Crag, London Clay,) occurs in considerable numbers among the trilobites and orthoceratites of Lake Simcoe; and in well marked specimens. They are oval or sub-oval, and rather longer than half an inch. They are casts which frequently retain the original shell of a glossy hair brown colour.

Mr. Say, of Philadelphia, (to whom I am under many obligations,) pronounced with great hesitation, on account of accidental defects or the concealment of the hinge upon what he supposed to be the clypeaceous univalve, calyptræa, (crag above London clay,) from Lake Superior, a cerithium (London clay,) from Lake Simcoe, an unio (cornbrash &c.) a mytilus, (coral rag, &c.) both from the north-east coast of Lake Huron; gryphæa, (lias,) from Lakes superior and Simcoe,—arca, (lias,) Lake Simcoe, and Sanguinolaria. River Humber. L. Ontario.

Note.—The explosion described by Dr. Bigsby in the preceding article p. 75 seems analagous to the natural fires mentioned by Prof. Dewey. p. 55. An intelligent farmer of Dover, Dutchess Co. N. Y. informed me that within the last 25 years he had several times seen a flame, many yards in height, issuing for some hours from the side of a mountain of mica-slate near his residence. The vegetables around were burned; and a strong sulphureous smell continued several days at the place. Many neighbours have witnessed this occurrence, which among the more superstitious has produced no little alarm. This occurrence has, in every instance, been noticed in the spring of the year, after a thaw, which favours the suggestion of Prof. Dewey that the inflammable gas is generated by the action of water with a metallic sulphuret. Possibly Prof. Dewey alludes to this particular place. Sulphuret of iron is found here; and I observed also a whitish efflorescence composed of acicular crystals of a salt, apparently aluminous, in cavities of the rocks. C. H.

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## ART. III. *Notice of new localities of Sahlite—Augite—Ceylanite, &c.*—(*Read before the* NEWBURGH LYCEUM, Feb. 11, 1824.

Last November, the Rev. I. Johnston, Baron Rederer and myself, visited, on a new geological excursion, a place called Greenwood Furnace, in Munroe, and about 18 or 20 miles south of this place. About a half mile from the furnace, and near a small stream which moves the machinery of the works, we found large rocks of a very beautiful green coccolite and sahlite. The former varied in the size of its grains from that of a small shot to that of a filbert—they being uniformly of a laminated and highly crystalline structure, and easily submitting to mechanical division. On separating the grains, they generally presented faces of crystals, more or less irregular, and indented, except on the faces of the lamina, which were uniformly plane. The appearance of the mass was much as we might suppose it would be, if it had been formed by shaking violently together soft crystals of various sizes, and then suffering the mass to harden. The laminæ were highly translucent, and this joined to the richness of their colour, and the splendent lustre of their surfaces, many of which are from three to five eighths of an inch in diameter, make it one of the most beautiful specimens of that mineral, which I have seen. The sahlite and coccolite pass into each other, and are manifestly the same mineral, differing only in form, the former being quite compact, and having very large laminæ. It may be observed in confirmation of this, that on the granulated masses are found occasionally small clusters of perfect crystals about a line in diameter and exhibiting the primitive form.

In examining a small excavation which had been made in searching for iron ore, we found crystals of green augite which merit more particular notice. The excavation was in the bank of a ravine through which ran the stream spoken of above. The roof and sides of the pit were principally composed of green augite rock, having natural fissures, so that the fragments which were of irregular shape and size, could be easily separated with a pickaxe. The soil was strongly impregnated with oxide of iron, and probably, carbonate of lime. The crystals were generally found on the edges and surfaces of these fragments, but not always, for many specimens were found, in which the crystals were imbedded in a mass of carbonate of lime, or protruded from it. On breaking some of these masses, the limestone was found to be full of them. The general appearance indicated that the carb. lime had formed round the crystals. The crystals so found were usually of a deeper green than those found on the augite rock, apparently from having been defended from the oxide of iron which covered the latter, and occasionally adhering so closely as to demand the use of a hard instrument for its removal, though usually yielding to water and a brush.

A vein of green mica about one foot in breadth and several feet in depth passed through the rocks. It was mostly in six sided tables, sometimes in triangular pyramids, varying considerably in size, though commonly about half the size of the hand, and half and three fourths of an inch thick. On the borders of this vein were found nearly all the crystals. They are evidently augite, or rather I think that variety of it called sahlite, being universally composed of laminæ parallel to the base, the thickness of which can be easily seen by the naked eye on the surface of the crystal. When first taken from the earth, they broke with great ease, and the greatest care could not prevent many from being broken into short crystals, the laminæ exhibiting a smooth green surface of extraordinary beauty. On exposure they soon hardened, and when perfectly dry they became entirely firm. They can yet be divided however with facility not only parallel to the base but to the sides of the primitive prism. They are all eight sided prisms, but sometimes the truncations on the edges of the primitive are so slight, that without close inspection they appear to be truly four sided, and occasionally from one truncation being very deep, they look like triangular prisms, but both these instances occur relatively in few instances. None of them are tabular. Their summits consist of from four to eight faces, varying in magnitude, though most commonly the faces on two contiguous sides of the primitive prism are much larger than the others, and not unfrequently a face arising from the truncated edge between the two above mentioned sides, equals and even far exceeds the two adjoining ones. The angles and edges are defined with unusual precision, being as sharp and smooth as those of quartz. The surfaces are smooth and have a brilliant lustre. They exhibit no longitudinal striæ; but frequently parallel to the base and corresponding to the laminæ are deep depressions resembling a flight of steps, as if the laminæ had been slipped a little. Their size varies from that of extreme minuteness, to that of five or six inches in circumference. Their length may be said to vary in general from three fourths of an inch to three inches; but some are both longer and larger. I have one which is nearly *six* inches long, and *ten inches* in circumference with a very flat summit of four faces, one of them covering nearly the whole end of the crystal. This crystal is somewhat flattened. Baron Lederer, has one which, though but three inches long, is fourteen inches in circumference. It is a fragment without a summit, and was probably a good deal longer before it was dug out; but it was broken before discovered. These two. and one other nearly the size of the latter were found by Mr. E. C. Benedict a few feet from the place where the clusters were, and apparently were not attached to any rock. It was not uncommon to find, on breaking the larger crystals, small lumps of oxide of iron and specks of mica within them, and in some cases six sided crystals of mica enter the sides of the augite crystals. Of the number of these no estimation can be formed. There are thousands about the size of the finger and myriads of those which are smaller. The positions of the clusters are very variable. As has been remarked, some are on the corners, some on the edges, and some on the surfaces of the fragments. Others lie in nests like geodes within the surface, and others fill the sides and bottom of deep channels, passing quite round the mass to which they adhere, and in some cases they cover it so thickly in little groups as to render it difficult to handle the specimens without breaking off small ones. In the cavities just spoken of, frequently lie lumps of carb. lime fastened in by crystals which enter them in various directions. The crystals are grouped together in numberless fantastic modes, intersecting, lying on and passing through each other at all angles, usually without producing any alteration in their respective forms. When, however, one passes across the truncated edge of another, an alteration in the depth of the truncation is often the consequence. From a similar cause, and sometimes without any apparent one, a very different and singular appearance is exhibited—*reentering angles*. These appear sometimes instead of a truncation and sometimes in the middle of one. In both these instances the faces containing the reentering angle are parallel to the sides of the primitive parallelopiped. Occasionally such an angle very obtuse, is produced by a truncation's passing only part of the way across the edge, when of course the angle is contained by one face of the primitive and the face forming the partial truncation. It is not often that more than one of these angles is found on a crystal; occasionally two, which are generally on opposite edges of the primitive, though I have found one or two where they occurred on adjacent ones. A perfect notion of all these cases will be conveyed by sections parallel to the base. See figures, (1.) (2.) (3.) (4.) (5.) See plate II. Crystals of the form indicated by fig. 2, occur more frequently than the others. It has eleven faces. Fig. 3, shows one with fourteen. The terminations of these crystals are like those which are eight sided, and from an inspection of the laminæ which are distinctly visible, they seem to be single crystals. I am aware that writers on crystallography do not admit the existence of reentering angles in single crystals: but I must own my inability to detect any signs of those, which I speak of being double.

There are also some instances of peculiarity in the forms of summits, which it may be worth while to notice. I can think of no better way to give a just notion of that to which I refer than the following. Suppose a person to be forming a crystal by placing laminæ of the proper form upon each other, till he had commenced forming the summit by laminæ of smaller dimensions; but after the summit was partially formed, should determine to carry the crystal higher in a form similar to the lower part, and after having done so for perhaps half an inch, should then finish with a summit. In some cases the appearance is as if this process had been repeated the second time before the last summit was formed. The partial summits are sometimes like the ultimate ones, sometimes unlike. It is impossible however, within the limits of this paper to notice all the interesting appearances exhibited on these crystals. Of themselves they might form a copious volume for the crystallographer to study.

About four miles from Greenwood in the direction of Fort Montgomery, I found a rich locality of the ceylanite, or black spinelle. It was accompanied by brucite, both lying in carb. lime. The ceylanite was mostly in octaedrons, occasionally truncated, sometimes in hermitrope crystals and rhomboids. The crystals were very small, rarely larger than a pigeon shot, and most of them much smaller, but quite perfect. Some were larger, but imperfect. They were so thick and in such numbers as to form large black stripes several inches in breadth, and feet in length, in the limestone. The latter formed ledges of considerable extent. I believe that Dr. Mead, of Philadelphia, found the ceylanite in a similar connexion last summer at Forest of Dean, some miles distant from the locality to which I refer. The person who guided me through the wood, brought me afterwards from the vicinity of the furnace, some specimens containing larger crystals; but very defective. I did not visit the locality myself.

# BOTANY.

Art. IV.—*Caricography; (continued from Vol.* VII. p. 278.) *Communicated to the Lyceum of Nat. Hist. of the Berkshire Medical Institution.*

12. Carex *curta.* Gooden.
Muh. Pursh, and Pers.
Schk. tab. C. fig. 13.

C. *canescens,* L. Flor. Suec. secundum Wahl. and Agardh.

"C. *canescens:* spiculis basi masculis sub-approximatis quinis, squamis subæquantibus, capsulis subrotundo-ovatis acutiusculis convexo-subconvexiusculis subobtus-angulis ore bidentato." Wahl. No. 49.

*β.* spiculis superioribus aggregatis, capsulis patentibus acutis convexo-planiusculis subacutangulis." Wahl.

Culm 16—24 inches high, triangular and scabrous at the upper part—leaves subradical, narrow, carinate, nearly the length of the culm—spikelets 4—6, sub-cylindric, alternate, remotish; stamens chiefly at the base of the upper spikelet, and a bristleform scabrous bract commonly at the base of the lowest spikelet—fruit ovate obtuse, sometimes ovate and sub-acuminate, sub-scabrous, slightly two-toothed, convex on the upper and nearly flat on the lower side—scale ovate, white, with a green keel, almost hyaline, varying from two thirds to the full length of the fruit and the longer scales more acute. The whole plant is sometimes of a green colour, and at others, especially when it grows in very wet places, of a pale ash-colour; and when mature, easily distinguished by its silvery spikelets. Flowers in May—found in wet places about woods in cespitose clusters. Stigmas 2.

This is a variable species, and the several descriptions differ in a slight degree from each other. Gooden. supposed that his C. *curta* differed from C. *canescens,* L. Both species, however, are considered the same by Wahl. and Agardh. If Linnæus applied his name to different plants, it seems that the plants now called C. *canescens* on the continent is the C. *curta* of Goodenough. The writer in Rees' Cyc. considers the two as different species, and describes them under these two names, though he admits their great similarity and the great resemblance of Loesel's fig. of C. *curta* to both. He points out no *essential* difference between them, though he mentions their different general appearance to the eye. The two plants found in this section of the country are said to agree with C. curta from different parts of Europe, and though their general appearance is different, they answer to one description in all their essential characters. The difference in the aggregation of the upper spikelets appears in both plants, and the slight difference in the scales and fruit is found on the same plant in both varieties. The lighter coloured variety corresponds to the popular description of C. canescens by Agardh, and to the C. curta in Rees' Cyc. and Pers. Yet all these authors, except Rees' Cyc. consider with Willd. both plants to be one species. The description would be simplified by the following character of one variety, viz. *mature spikelets silvery white.*

13. C. *scoparia.* Schk.
Muh. Pursh. Eaton and Pers.
Schk. tab. Xxx. fig. 175.
C. *leporina?* Mx.

Spiculis alternis ovatis sessilibus superne fœmineis quinis, infima bracteata, bractea decidua; capsula lanceolata nervosa glabra erecta, squama lanceolata acuminata longior.

Culm 18—24 inches high, leafy, and scabrous above; leaves linear, narrow, shorter than the culm; spikelets 5—10, generally 5—7, approximate, sometimes very much aggregated into a club-form head, the lowest with a leafy bract sometimes longer than the culm and deciduous, and the three lower spikes often with short bracts also; fruit lanceolate, slightly ovate at the base, about 9. nerved, margined, scabrous on the upper half, and two toothed, slightly tawney and whitish on the edges, a little longer than the lanceolate acuminate tawney scale. Stigmas 2.

Flowers in May—grows in moist and wet situations, and is readily distinguished in July by its tawney spikelets. From C. *straminea*, it differs materially in the shape of its fruit and the general appearance of the spikelets.

This species is very accurately figured in Schk. but it is not easily distinguished from its allied species by any description, except that given by Muh. That it is related to C. *ovalis or leporina* is remarked by Muh. and indeed it was formerly considered by him as the same species and thus named, as I learn from the Rev. Mr. Schweinitz. It is however very different from C. ovalis or leporina in the shape of its fruit and scale and spikelets. Pursh asks whether C. *viridula*, Mx. may not be C. scoparia. This cannot be, as C. viridula appears to have about three spikelets and is very nearly related to C. *scirpoides*, Schk. It is far more probable that the plant described by Mx. as C. leporina, L. is the same as C. scoparia. For, although Mx. states that the plant is destitute of bracts, this is often the appearance of C. scoparia, as its bracts are deciduous. An additional reason is that the C. leporina of Wahl. and Agardh has a sub-leafy bract under the lowest spikelet. It is remarked also by Mx. that the spikelets are greenish or yellowish, a character particularly to be observed in C. scoparia, as well as the locality assigned by Mx. viz. from Carolina to Canada.

14. C. *lagopodioides*. Schk.
Muh. Pursh. Pers. and Eaton.
Schk.tab. Yyy. fig. 177.
C. *tribuloides*, Wahl. secundum Muh.
C. *Richardi*, Mx.

C. tribuloides, spiculis basi masculis confertis numerosis, squamis sub-parvis, capsulis ovali-oblongis subconvexiusculo-planis acuminatis patentibus membranaceo-marginatis ore bidentato. Wahl. No. 34.

Culm scabrous above, three sided, leafy, often exceeding two feet in height; leaves sheathing at the base, longer than the culm, linear-lanceolate; spikelets 8—20, cylindric-ovate, approximate, sometimes much aggregated into a head; a large bract under the lowest spikelet, often longer than the culm, deciduous; fruit erect, lanceolate, nerved, slightly margined, bicuspidate, distinctly scabrous or ciliate-serrate on the margin; scale ovate-lanceolate, a little more than half the length of the fruit with a green keel. The whole plant has a faint green colour. Flowers in May—found in wet places. Stigmas 2.

This species is related to C. ovalis and C. scoparia. From both, however, it is readily distinguished by the preceding characters. The authors, except Muh. have given too few characters to distinguish it very easily from its related species. By Schk. it is finely figured, and is clearly a very distinct species.

15. C. *festucacea.* Schk.
Muh. Pursh, Eaton and Pers.
Schk. tab. Www, fig. 173.

Spiculis sessilibus alternis, ovatis approximatis 5—8, apice fœmineis, bracteatis; capsulis subrotundo-ovatis rostratis alatis striatis bidentatis margine ciliato-serratis, squama ovato-lanceolata nuncronata majoribus.

Culm 15—30 inches high, triangular, leafy, glabrous; leaves sheathing, linear, shorter than the culm; spikelets rather near, cylindric-ovate and at length globose, with small bracts; fruit ovate, or roundish ovate, beaked, diverging compressed, ciliate-serrate; pistillate scale three-fourths the length of the fruit, green on the keel, mucronate. The mucronate point is short and often disappears in the mature state of the fruit. Stigmas 2.

Flowers in May—grows in cultivated fields and drier meadows.

This species is nearly allied to C. straminea; but may readily be distinguished from it by its shorter, more round, and less widely winged fruit, and by its scale, which is ovate-lanceolate and mucronate. The scale of C. straminea is lanceolate or oblong-lanceolate, and its fruit less diverging than that of this species. From C. scoparia and C. lagopodioides it is readily distinguished by the characters already given.

16. C. *scirpoides.* Schk.
Muh. Ph. Eaton, and Pers.
Schk. tab. Zzz. fig. 180.
C. *triceps.* *Mx.*

Spicis quaternis sessilibus ovatis obtusis inferne masculis, infima bracteata; fructibus ovatis cordatis compressis rostratis margine scabris, squama ovata acuta longioribus.*

*This, as well as several of our well known species, is not described by Wahl. or in Rees' Cyc. In the latter, the popular descriptions are generally excellent; but the article was written before the work of Schk. was completed, and the references to the figs. of Schk. are acknowledged to be taken from the work of Wahl.

Culm 6—12 inches high, scabrous above, leafy towards the base; leaves linear, shorter below, upper ones long as the culm, glaucous and scabrous; spikelets 3—5, alternate, the lowest supported by a scabrous bract longer than the spikelet; stamens generally at the base of the upper spikelet alone, and decurrent; fruit sometimes rather broad ovate, often distinctly cordate at the base and terminating in a short bifid scabrous beak, sometimes ovate-lanceolate or with a longer beak; staminate scale ovate obtuse; pistillate scale ovate, shortly acute, sometimes quite obtuse in maturity, yellowish white with a green keel, and about half the length of the fruit. The fruit is diverging and often nearly horizontal when mature. The spikelets before maturity much resemble those of some species of scirpus,—whence the specific name. Stigmas 2.

In wet places in woods it is often very small, and very difficult to be ascertained, when it is in flower. Flowers in May,—found in wet situations.

This species greatly resembles C. *stellulata,* Schreb. as figured by Schk. tab. C. fig. 14, and Muh. asks whether it is *sufficiently distinct* from it. By Schk. and others, they are considered different species. The capsules of C. *stellulata,* are not cordate at the base, are nearly entire at the beak, acuminate, and more diverging. C. scirpoides is very distinct from other American species, unless it be C. *viridula,* Mx. which, it is hoped, will ere long be better known.

17. C. *Tenera.* (Mihi.)

Spicis sub-quinis obovatis remotiusculis alternis sessilibus inferne attenuatis masculisque, infima bracteata; fructibus ovatis compressis rostratis subalatis nervosis ciliato-serratis, squama oblongo-lanceolata majoribus.

Culm 15—30 inches high, slender, somewhat 5-sided, leafy towards the base, with a slender flexuous rachis; spikelets 3—5, somewhat clubform and lengthened below, pistillate at the apex, of a brownish colour, distant from each other about their length, the whole nodding; pistillate scale about two thirds the length of the fruit and tawney; leaves linear-lanceolate, shorter below, and much shorter than the culm. In maturity the plant is sub-procumbent. The whole plant is light green except the spikelets, which are of a yellowish brown colour like those of

C. scoparia. Flowers in May and June—grows in moist meadows. Stigmas, 2.

From C. scoparia, this species is clearly distinct. It much resembles C. festucacea, but differs in the number, position, form and colour of the spikelets. Though about as tall a plant as C. festucacea, it is much smaller in all its parts, and its fruit is much less diverging. It belongs in the same division in Ph. and Eaton with the preceding species.

18. C. *formosa*. (Mihi.)

Spicis oblongis crassis secundis quaternis distantibus exserte pedunculatis nutatibus, suprema inferne mascula; fructibus oblongis triquetris subinflatis utrinque acutiusculis ore subintegro vel bilobo, squama ovata acuta duplo majoribus.

Culm 12--18 inches high, triangular, leafy; leaves sheathing, shorter below, linear-lanceolate, dark brown at the root, and shorter than the culm; spikes four oblong, thick, somewhat 3-sided, on slender long recurved peduncles which are longer than the sheaths; bracts long, leafy, with sheaths less than half the length of the peduncles; leaves and sheaths pubescent or slightly pilose; fruit distinctly 3-sided, somewhat acute at both ends, inflated in the middle, glabrous, yellowish, nerved, close-set, with an open, nearly entire or slightly two-lobed orifice; stigmas three; staminate scale oblong obtusish; pistillate scale ovate, acute or slightly awned, white on the edges and green on the keel, about half the length of the fruit. The colour of the plant is yellowish green. Flowers in May—found at Stockbridge in wet upland meadows, and growing in great abundance with C. *flava*.

This species is closely allied to C. *miclichoferi*, Schk. tab. Mmm. fig. 198. It differs, however, in the androgynous and upper pistillate spike, and its fruit is not sub-hispid, is more acute, and has a more entire orifice. It has a nearer resemblance to the following species named by the Rev. L. D. de Schweinitz; his description however I have not seen.

19. C. *gracillima*. Schw.

Spicis longis gracilibus distantibus sub-laxifloris quaternis exserte pedunculatis, suprema inferne mascula, omnibus bracteatis; fructibus oblongis triquetris obtusis ore obliquo et sub-bilobo, squama oblonga obtusa breve aristata majoribus.

Culm 15--24 inches high, reddish at base, leafy and sub-procumbent; leaves linear lanceolate, shorter below, sheathing; upper leaves and bracts long as the culm; spikes filiform, slender, often two inches long, pendulous, rather loose flowered, with filiform and delicate peduncles projecting considerably from pretty long sheaths; the highest spike has sometimes very few pistillate flowers and is occasionally entirely staminate; fruit 3-sided, oblong, obtuse, slightly nerved, glabrous, with a sub-oblique and two-lobed membranous orifice; stigmas three; staminate scale oblong, obtuse, white with a green keel; pistillate scale oblong or sub-ob-ovate, obtuse, with a short awn, white on the edges, and green on the keel, and about half the length of the fruit. The whole plant is glabrous and light green.

Flowers in May—grows in moist meadows—common. This plant is clearly distinct from the preceding species, and there is no figure corresponding to it in Schk.

The two preceding new species belong in the same section with C. virescens in Ph.—the caption of the section being corrected as mentioned, Vol. VII, p. 274. It was thus corrected in the Manual of Botany, 3d Ed.

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## PHYSICS, CHEMISTRY, MECHANICS AND MATHEMATICS.

Art. V.—*Letter from* Robt. Hare, *M. D. Professor of Chemistry in the University of Pennsylvania, to* B. Silliman, *Professor of Chemistry in Yale College, on some improved forms of the Galvanic Deflagrator; on the superiority of its deflagrating power; also an account of an improved Single Leaf Electrometer; of the combustion of Iron by a jet of Sulphur, in vapour; and of an easy mode of imitating native Chalybeate Waters.*—Reprinted with corrections and additions, from Silliman's Journal, No. 1. Vol. VII.

After I had discovered that the deflagrating power of a series of galvanic pairs was surprisingly increased, by their simultaneous exposure, after due repose, to the acid, various modes suggested themselves of accomplishing this object. In the apparatus which I sent you, the coils, being all suspended to two beams, could be lowered into troughs containing the acid. In another apparatus, of which I afterwards gave you an account, with an engraving for your Journal, the troughs containing the acid, were made to rise, so that all the plates might be immersed at once. A better mode has since occurred to me. Two troughs are joined lengthwise, edge to edge, so that when the sides of the one are vertical, those of the other must be horizontal. Hence, by a partial revolution of the two troughs, thus united, upon pivots which support them at the ends, any fluid which may be in one trough, must flow into the other, and reversing the motion must flow back again. The Galvanic Series being placed in one of the troughs the acid in the other, by a movement such as above described, the plates may all be instantaneously subjected to the acid, or relieved from it. The pivots are made of iron, coated with brass or copper, as less liable to oxidizement. A metallic communication is made between the coating of the pivots, and the galvanic series within. In order to produce a connexion between one recipient of this description, and another, it is only necessary to allow a pivot of each trough to revolve on pieces of sheet copper, severally soldered to the different ends of a rod of metal. To connect with the termination of the series, the leaden rods, (to which are soldered the vices, or spring forceps, for holding the substances to be exposed to the deflagrating power,) one end of each of the lead rods, is soldered to a piece of sheet copper. The pieces of copper, thus soldered to the lead rods, are then to be duly placed under the pivots, which are of course to be connected with the terminations of the series. The last mentioned connexion is conveniently made by means of straps of copper, severally soldered to the pivots, and the poles of the series, and screwed together by a hand-vice.

*Fig. 1. pl 5. represents an apparatus consisting of two troughs, each ten feet long, constructed in the manner which I have described. Each trough is designed to contain 150 galvanic pairs. The galvanic series in the upper

* For the plate see Vol. VII, No. 2, of this Journal.

trough is situated as when not subjected to the acid. In the representation of the lower trough, the galvanic series is omitted, in order that the interior may be better understood. The series belonging to this trough, may be observed below it, in three boxes, each containing 50 pairs, fig. 2. In placing these boxes in the trough, some space is left between them and that side of the trough on which the acid enters, so that instead of flowing over them, it may run down outside, and rise up within them.

The pairs of the series consist of copper cases, about 7 inches long, by 3 inches wide, and half an inch thick; each containing a plate of zinc, equidistant from its sides, and prevented from touching it by grooved strips of wood. Each plate of zinc is soldered to the next case of copper, on one side. This may be understood from the diagram, fig 3. It must be observed, that the copper cases are open only at the bottom and top. They are separated from each other by very thin veneers of wood.

Fig. 4. represents a smaller trough, differing from the others only in length. This I made, with a view to some experiments on the comparative power of the galvanic pairs of the form of copper cases, with zinc plates, above described, and those made on Cruickshank's plan, or of the form used by Sir H. Davy, in the porcelain troughs.

Fig 5. represents a box, containing 100 Cruickshank plates, (each consisting of a plate of zinc, and copper, soldered face to face,) and slid into grooves, at a quarter of an inch distance from each other; all the copper surfaces being in one direction, and all the zinc surfaces in the other. In this case the zinc plates are exposed only on one side. The sum of the surfaces on which the acid can act, is therefore the same as in a deflagrator of 50 pairs, in which each zinc plate is assailable on both sides. It ought to be understood, that the box containing the 100 Cruichshank plates is open at bottom, and is of such dimensions as to occupy the place of a box, containing 50 pairs of the deflagrator, receiving the acid in its interstices from below. in the same manner, by a partial revolution of the trough, fig. 4.

Fig. 6. represents a box, containing 200 Cruickshank plates. This differs from the common Cruickshank trough, only, in having the interstices as narrow as those between

the copper and zinc surfaces of the deflagrator pairs, represented by fig. 2. and in the mode in which the acid is thrown off, or on, the whole series, which does not differ, materially, from that described in the instance of fig. 1.

On contrasting the series of 50, (fig. 4.) with Cruickshank's plates in the box, (fig. 5.) the deflagrating power of the latter was found comparatively feeble; and even when compared with the Cruickshank trough, (fig. 6.) in igniting metals, or carbon, the 50 pairs (fig. 4.) were found greatly superior. The shock from the Cruickshank trough was more severe. You must recollect, that in former experiments, I found that galvanic plates, with their edges exposed as they are in the porcelain troughs, used by Sir Humphrey Davy, were almost inefficient, when used without insulation, as are the pairs of the deflagrator. This demonstrates, that an unaccountable difference is producible in galvanic apparatus, by changes of form or position.

Being accustomed to associate the idea of the zinc pole, in a Voltaic series, with the end terminated by zinc, and the copper pole, with the end terminated by copper, I was surprised to find that, in decomposing water, the oxygen was attracted by the wire connected with the copper end of my deflagrator, while the hydrogen went to the wire connected with the zinc end. Subsequently, however, it occurred to me, that, in the deflagrator the zinc pole is terminated by copper, the copper pole by zinc; and hence the apparent anomaly, that oxygen appears to be attracted by copper, and hydrogen to be attracted by zinc.

The projection from the carbon exposed between the poles, takes place at the negative pole of the pile, and not at the positive pole, as you have alleged; and thus your observation, that the current of igneous matter is from the copper to the zinc, may be reconciled with the Franklinian theory.

The observations, which are the subject of this communication, combined with those which you have made, of the incapacity of the deflagrator, and Voltaic series in the usual form, to act, when in combination with each other; must justify us, in considering the former, as a galvanic instrument, having great and peculiar powers.

Since the above was written, I have tried my series of 300 pairs: The projectile power, and the shock, were proportionally great, but the deflagrating power was not increased in proportion. The light was so intense, that falling upon some adjacent buildings, it had the appearance of sunshine. Having had another series of 300 pairs made for Dr. Macnevin of New-York, on trying it, I connected it with mine, both collaterally, and consecutively, so as to make in the one case a series of six hundred,—in the other a series, half that in number, but equal in extent of surfaces. The shock of the two, consecutively, was apparently doubly as severe, as the shock produced by one; but the other phenomena seemed to me nearly equally brilliant, in either way.

The white globules which you noticed, were formed copiously on the ignited plumbago, especially in vacuo. I have not had leisure to test them, being arduously occupied, in my course of Lectures, and in some efforts to improve the means of experimental illustration.

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*Account of an Electrometer, with a single leaf, by which the electricity excited by the touch of heterogeneous metals, is rendered obvious, after a single contact.*

Fig. 7. represents an Electrometer, with a single leaf suspended from a disk of zinc, six inches in diameter, which constitutes the top of the instrument. Opposite to this single leaf, is a ball, supported on a wire, which may be made to approach the leaf; or recede from it, by means of a screw. Above the instrument, is seen a disk of copper, with a glass handle.* The electricity produced by the contact of copper and zinc, is rendered sensible in the following manner. Place the disk of copper on the disk of zinc, (which forms the canopy of the Electrometer:) take the micrometer screw in one hand, touch the copper disk with the other, and then lift this disk from the zinc. As soon as the separation is effected, the gold leaf will strike the ball usually, if the one be not more than $\frac{5}{100}$ of an inch, apart from the

* For the experiment with this electrometer a metallic handle would answer. Its being of glass enabled me to compare the indication, thus obtained, with that obtained by a condenser.

other.* Ten contacts of the same disks of copper and zinc will be found necessary to produce a sensible divergency in the leaves of the Condensing Electrometer. That the phenomenon arises from the dissimilarity of the metals, is easily shown, by repeating the experiment with a zinc disk, in lieu of a disk of copper. The separation of the homogeneous disks will not be found to produce any contact between the leaf and ball. I believe no mode has been heretofore contrived, by which the electrical excitement resulting from the contact of heterogeneous metals, may be detected by an Electroscope, without the aid of a condenser. It is probable, that the sensibility of this instrument, is dependent on that property of electricity, which causes any surcharge of it, which may be created in a conducting surface, to seek an exit at the most projecting termination, or point, connected with the surface. This disposition is no doubt rendered greater, by the proximity of the ball, which increases the capacity of the gold leaf to receive the surcharge, in the same manner, as the uninsulated disk of a condenser influences the electrical capacity of the insulated disk, in its neighbourhood. It must not be expected, that the phenomenon above described can be produced in weather unfavourable to electricity. Under favourable circumstances, I have produced it, by means of a smaller Electrometer, of which the disks are only $2\frac{1}{2}$ inches in diameter.†

The construction, as respects the leaf, and the ball, regulated by the micrometer screw, remaining the same; the cap of the condensing electrometer, and its disks, may be substituted for the zinc disk.

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## *On the Combustion of Iron, by a jet of Sulphur in Vapour.*

If a gun barrel be heated red hot, at the but end, and a piece of sulphur be thrown into it; on closing the mouth with a cork, or blowing into it, a jet of ignited sulphurous vapour will proceed from the touch-hole. Exposed to

* I have seen it strike at nearly double this distance.

† I think I have seen an effect from a disk only an inch in diameter, or from a zinc disk, having a copper socket to its handle.

this, a bunch of iron wire will burn, as if ignited in oxygen gas, and will fall down in the form of fused globules in the state of proto-sulphuret. Hydrate of potash, exposed to the jet, fuses into a sulphuret of a fine red color.

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### *An easy mode of impregnating Water with Iron.*

If a few pieces of silver coin be alternated with pieces of sheet iron, on placing the pile in water, it soon acquires a chalybeate taste, and a yellowish hue, and in 24 hours, flocks of oxide of iron appear. Hence by replenishing with water, a vessel, in which such a pile is placed, after each draught, we may have a competent substitute for a chalybeate spring.

Clean copper plates, alternating with iron, would answer; or a clean copper wire entwined on an iron rod; but as the copper when oxidated yields an oxide, it is safer to employ silver.

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## Art. VI.—*Analyses of the Chrysoberyls from Haddam and Brazil.* By Henry Seybert.* *Read 5th March*, 1824.

In the summer of 1823, I visited Haddam, in the state of Connecticut. Among the various substances there collected, was the Chrysoberyl, a mineral much esteemed on account of its rarity. It occurs disseminated in a coarse grained granite, in which the predominant ingredient is a white feldspar, which Professor Berzelius regards as *albite*, perfectly resembling that of Finbo. In the same granite this celebrated chemist observed the *columbite*.† It is also associated with greyish quartz, manganesian garnet of a fine blood red color, and a yellow granular substance, which some mineralogists supposed to be a

* This paper will appear in a volume of the transactions of the American Philosophical Society, now in the course of publication at Philadelphia. In the mean time it has been, by permission, transmitted by the author, for insertion in this Journal.

† Essai de' l' Emploi du Chalumeau, p. 243.

variety of the cymophane; but from its inferior hardness and general chemical composition, I recognized it to be common beryl.

For the earliest chemical information concerning the chrysoberyl, we are indebted to Professor Klaproth. He published his analysis of it in 1795,* and gave the following constituents of it, viz. alumina, 71.50; lime, 6.; oxide of iron, 1.50; silica, 18.; loss, 3. Berzelius presented us with a formula founded on this composition;† but from his experiments with the blowpipe he was led to conclude that it contained no lime, and that it was a subsilicate of alumina.‡ In this he was apparently confirmed by Professor Thomson,§ who quotes Klaproth's analysis, and states that he examined the mineral some years ago, but having accidentally lost his results, he was unable to publish them. He observes, however, that the only constituents he found were alumina, silica, and oxide of iron. When I was about to prepare the communication which I have now the honor to lay before the Society, a more recent analysis of the chrysoberyl of Brazil, by M. Augustus Arfwedson, was observed, by me, in Tilloch's Philosophical Magazine.|| He confirmed the results of Professor Thomson and considered the chemical composition of this substance to be—silica, 18.73; and alumina, 81.43, with a trace of oxide of iron.

The cymophane, from Haddam, was sent to M. Hauy by the late Dr. Bruce, in 1810, to have his opinion concerning its nature.** Previous to that period, the mineralogists in the United States supposed it to be *corundum*. The late celebrated crystallographer observes, "La cymophane des Etats Unis a d' abord eté prisè pour une varieté de corindon. Effectivement elle se rapproche de ce

* Beitrage, vol. i. p. 97.

† Systeme de Mineralogie, p. 219,—C4S+18A4S.

‡ Essai de' l' Emploi du Chalumeau, p. 325.

§ Thomson's Chemistry, vol. iii. p. 213.

|| No. for November, 1823, p. 357.

** Annales du Museum d' Histoire Naturelle, tome xviii. p. 57.

mineral par sa dureté, par sa pesanteur specifique, et même par le resultat de son Analyse, qui a donné environ 72 parties d' alumine sur 100, avec 18 de silice, et 6 de chaux."* I was anxious to examine the cymophane found at Haddam, especially as M. Hauy does not name the author of the analysis he quotes. The specimen used for my experiments was of a pale green color. It did not present any of the chatoyant appearance so remarkable in the variety from Brazil, and some specimens from Saratoga in New-York, where it was lately discovered by Dr. Steel. Its specific gravity, by two trials, was 3.508 and 3.597. It is not magnetic, and before the blowpipe it is infusible. For a further description of the physical characters of this mineral, I refer to Hauy and Cleaveland.

Three grammes of the mineral were examined under the impression that Professor Klaproth's analysis was accurately made. It was decomposed in the usual manner with four parts of caustic potash, and subsequently treated with diluted muriatic acid ; but the solution was imperfect. The insoluble matter was collected on a filter, and it amounted to 25 or 30 per 100. It was repeatedly acted on in the same way, and each time it diminished in quantity, until the fourth experiment. It then weighed about fifteen-hundredths, and thereafter resisted all further efforts to render it soluble by these means. This residue was then boiled in concentrated sulphuric and muriatic acids, but neither of them dissolved more than one-third of it. These solutions were tested by different re-agents, and greatly to my surprise, the addition of subcarbonate of ammonia occasioned a floculent precipitate, which entirely re-dissolved in an excess of the alkaline subcarbonate. I immediately suspected the presence of *Glucina*, but was much at a loss to explain its insolubility, until I observed Berzelius's analysis of the *Euclase*,† in which he met with a compound of glucina and oxide of tin that obstinately resisted acids. He also met with refractory combinations of this earth and

* Traité de Mineralogie, 2me Edition, vol. ii. p. 309.

† Nouveau Systeme de Mineralogie, p. 269.

the oxides of manganese and cerium. I next endeavoured to dissolve the compound by the acid sulphate of potash; but this method did not succeed. I was not more successful with the nitric and nitromuriatic acids; nor could it be dissolved by means of boric acid. Berzelius having discovered columbium in the gangue of the cymophane from Haddam, the insoluble residue was tested for the oxide of that metal, but all my attempts were fruitless. At length, I supposed, that as barytes could be brought into contact with this substance more conveniently than potash at a high temperature, it might decompose it. With this view, a portion of the insoluble matter was exposed to a strong heat, during one hour with six parts of nitrate of barytes in a platina crucible. The calcined mass was boiled in nitric acid. In this way nearly two-thirds of the matter that could not be entirely attacked in any other way, were dissolved. The same treatment was repeated, until nearly the whole of it was taken up, which happened after the fourth calcination. It was then no further acted on.

After making numerous experiments on the matter that resisted nitrate of barytes and nitric acid, I ascertained, that it was not acted on by alkalies nor acids when used separately, but after having been previously calcined with caustic potash, it readily dissolved in muriatic acid, yielding a solution of a pale yellow colour, which gave a reddish precipitate with an infusion of galls, a deep green precipitate with the hydrosulphate of potash, and a white precipitate with alkalies. Hence it was oxide of titanium.

After the barytes was separated with sulphuric acid, the nitric solutions were united, and treated with an excess of subcarbonate of ammonia. An abundant precipitate ensued, which entirely re-dissolved in the excess of subcarbonate. By ebullition it was again precipitated, and when calcined, it was in the form of a light white powder, possessing all the properties that characterise *Glucina*. With the sulphuric and muriatic acids it formed very sweet astringent deliquescent salts. By caustic potash it was precipitated from its solutions, and the precipitate re-dissolved in the excess of the alkali. Klaproth and Arfwedson, in their analyses of the Chrysoberyl from Brazil, considered the insoluble matter remaining after they had treated the mineral with potash and muriatic acid, to be *silica*. This will explain why their results differ so essentially from mine.

After having thus satisfied myself of the composition of the residue above mentioned, I resumed my preliminary experiments, and proceeded to examine the muriatic solution obtained from the treatment of the mineral with potash and muriatic acid. From this solution some silica was separated. A portion of the liquid was treated with caustic ammonia, and then tested for *lime* with oxalate of potash, but none of it could be detected. To the remaining liquor a considerable excess of subcarbonate of ammonia was added, and the precipitated matter was digested twenty-four hours. It was then separated by filtration, and the fluid was boiled till all the ammonia was expelled. No glucina was thus precipitated. Hence we conclude, that the very small portion of titanium above mentioned, rendered the whole of the glucina so refractory. The alumina precipitated by the subcarbonate of ammonia was mixed with a small quantity of oxide of iron. It was soluble in caustic potash, and with this alkali and sulphuric acid it gave regular octædral crystals of alum. The liquor, when tested with phosphate of soda and ammonia, was found to contain *no Magnesia*.

After the preliminary experiments, I commenced the following

ANALYSIS OF THE CHRYSOBERYL FROM HADDAM.

*A*. Five grammes of the mineral, reduced to small fragments in an iron mortar, were carefully pulverized in one of agate, from which it acquired the additional weight of 0.13 grammes. The 5.13 grammes were then exposed to a red heat, and thereby suffered a diminution of 0.40 per 100.

*B*. The calcined mineral (*A*) was heated, during one hour, in the silver crucible, with caustic potash, and the product was treated with diluted muriatic acid ; the solution was of a lemon yellow colour. There remained a white insoluble residue, which after calcination weighed 1.47 grammes. It was repeatedly calcined with caustic potash, and treated with diluted muriatic acid, with the following results :

| | | |
|---|---|---|
| After the 2d experiment, it weighed | 0.97 grammes. | |
| 3d | 0.89 | |
| 4th | 0.85 | |

By the fifth treatment it was not diminished, and then presented itself in the form of a light white powder, resembling pure silica in appearance.

*C.* The residue (*B*) was repeatedly strongly calcined with six parts of nitrate of barytes, and subsequently boiled with nitric acid.

| | |
|---|---|
| After the 1st treatment, there remained | 0.43 grammes. |
| 2d | 0.15 |
| 3d | 0.06 |

And by the 4th operation only 0.01 gramme was dissolved.

The remaining 0.05 grammes were essayed in the manner related in the preliminary experiments, and thus proved to be oxide of titanium. Hence we have 1. per 100 of that oxide.

*D.* The nitric solutions were united and evaporated to dryness, to expel the excess of the acid. The saline mass was dissolved in water, and after the barytes was separated with sulphuric acid, an excess of subcarbonate of ammonia was added to the solution. An abundant precipitate appeared, which entirely re-dissolved. The *Glucina* was precipitated by ebullition. After edulcoration and calcination, it weighed 0.79 grammes, or 15.80 per 100.

*E.* The several muriatic solutions (*B*) were united and evaporated to a dry mass, which was treated with muriatic acid, and there remained 0.33 grammes of silica, from which deduct 0.13 grammes acquired from the agate mortar ; and there will be 0.20 grammes, or 4. per 100 as a constituent of the mineral.

*F.* After the silica was separated from the liquid (*E*,) the alumina and oxide of iron, were precipitated by means of a great excess of subcarbonate of ammonia. After twenty-four hours, the liquor was separated from the yellowish precipitate, and was boiled, but no *glucina* was precipitated from it. The matter precipitated by the subcarbonate of ammonia consisted of 3.68 grammes of alumina, or 73.60 per 100., and 0.19 grammes of peroxide of iron, which, on account of the colour of the mineral, must be estimated as protoxide. The 0.19 grammes of peroxide are equivalent to 0.169 of protoxide, or 3.38 per 100.

THE CONSTITUENTS OF THIS CHRYSOBERYL THEREFORE ARE

(*Per* 100 *parts*)

| | | |
|---|---|---|
| *A.* | Moisture | 0.40 |
| *C.* | Oxide of titanium | 1.00 |
| *D.* | Glucina | 15.80 |
| *E.* | Silica | 4.00 |
| *F.* | Alumina | 73.60 |
| *F.* | Protoxide of iron | 3.38 |
| | | 98.18 |
| | | 100.00 |
| | Loss | 1.82 |

As the preceding results differed so essentially from the analyses of the chrysoberyl from Brazil by Klaproth and Arfwedson, I determined to examine a specimen from that locality. 1.5 grammes were analysed, in the manner above mentioned, and the following results were obtained :—

(*Per* 100 *parts*)

| | |
|---|---|
| Water | 0.666 |
| Oxide of titanium | 2.666 |
| Glucina | 16.000 |
| Silica | 5.999 |
| Alumina | 68.666 |
| Protoxide of iron | 4.733 |
| | 98.730 |
| | 100.000 |
| Loss | 1.270 |

In estimating these constituents according to the electro-chemical theory, I believe that the oxide of titanium, notwithstanding its important agency in the analytical experiments, must be regarded as an accidental ingredient, as well as the oxide of iron, which in some measure may have been derived from the iron mortar. As the cymophane of Brazil appears to be constituted more conformably to the hypothesis of chemical proportions than that of Haddam, the following calculation may be made, founded on its composition, which gives for the essential constituents of Chrysoberyl,

(*Per* 100 *parts*)

| | | | |
|---|---|---|---|
| Silica | 6·61 | containing Oxygen | 3.32 |
| Alumina | 75.75 | | 35.38 |
| Glucina | 17.64 | | 5.49 |

and very nearly corresponds with the following mineralogical formula, $A^4S+2GA^4$.

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Art. VII.—*Method of preserving the color of the purple cabbage. Extract of a letter to the Editor, from George T. Bowen.*

You are aware that the infusion of the common red cabbage is one of the best tests which we possess of the presence of acids and alkalies. In the variety of the colors which are produced in it by the addition of these substances, the cabbage liquor is superior to litmus, for it is not only like litmus reddened by acids, but is also unlike that substance turned green by the alkalies. The great objection to the cabbage liquor as a test is its liability to spoil, and I have never seen in the chemical books any method proposed of preserving it for use. The red liquor which is produced by the addition of an acid to the infusion, may be kept for a long time uninjured; in order to use it, however, it is necessary to restore its blue color by means of an alkali; and the delicacy of the test is in this manner impaired. I find that this test may be prepared so as not only to keep for many months, but also so as to retain its original color and delicacy.

When the leaves of the cabbage are digested in warm alcohol, the coloring matter is entirely dissolved, and we obtain a tincture of a reddish color, but which, on exposure to the air, becomes blue. After having distilled off a portion of the alcohol, the remainder should be evaporated, at a very gentle heat, until there results a mass of the consistence of a thick syrup. The extract obtained in this manner, when put up in closely stopped bottles, may be preserved for years. In order to use it, it is only necessary to add a small portion of it to water, in which it is readily soluble, when the addition of an acid or an alkali will produce its peculiar effect. When we wish to employ this test to discover small quantities of carbonic acid it is necessary to render it slightly green by the addition of a diluted alkali. The carbonic acid will then restore the blue color, by saturating the alkali. Test papers may also be prepared by means of the alcoholic tincture of the cabbage, which, when rendered green by immersion in a diluted alkaline solution, may be used in all those cases in which litmus papers are commonly employed.

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## Art. VIII. *Description and Analysis of the Sillimanite, a new mineral.* By George T. Bowen, of Providence.

Read before the Academy of Natural Sciences, of Philadelphia, on the 6th of April, 1824.

### *Introductory Remarks.*

On receiving the following article, I was impressed with the opinion, that it could not, with propriety, appear in this Journal, and immediately wrote the author to that effect. He replied, that it would have already appeared in the Journal of the Academy of Natural Sciences of Philadelphia before the publication of the present number of this Journal; (as it was originally communicated to the Academy, it was their property,) and he urgently requested me to consent to its *republication* here. Had the name, *originally* proposed for it, *at New-Haven*, or *any* *other* than the one which it now bears, been given to it, I could have had no objection to its appearance in this Journal, and as the present name was bestowed, entirely with out my privity, and was already placed beyond my control, before I was informed of the design, I have reluctantly yielded to Mr. Bowen's request, supposing that a refusal under such circumstances, would bear less the appearance of a proper feeling, than of an over scrupulous delicacy.

B. S.

*Y. C. May*, 1824.

The mineral which is the subject of the following observations, was discovered in the town of Saybrook, Connecticut, during the summer of the year 1817, at which time several specimens were brought from that locality, and deposited in the cabinet of Yale College, by Dr. McClellan of Philadelphia.

At the time of its discovery, some doubts existed as to the true nature of this substance; several specimens, however, having been shewn to the different mineralogists of this country, they pronounced it to be Anthophyllite, and it is mentioned as Anthophyllite in the last edition of Professor Cleaveland's Mineralogy. A number of specimens of this substance, have also, at different times, been sent to the mineralogists of Europe, who have expressed the same opinion respecting it.

I first became acquainted with this mineral during the winter of the year 1821, while engaged in the laboratory of Professor Silliman, and at his request, I then commenced an examination of it. I was, however, under the necessity of leaving New Haven before the analysis was completed, and have never had an opportunity, until lately, of resuming the subject.

It is proper that I should here mention, that about the time when the examination of this substance was commenced, a descripition of its external characters was drawn up by Dr. T. D. Porter of New-Haven, who suspected it to be a new mineral, but as its external aspect was observed to correspond very nearly with that of the anthophyllite, and as Dr. Porter's description was not accompanied by an analysis, there still remained a doubt as to its true nature. Hence the description was not published.

Having thus given a brief history of this mineral, I shall now proceed to state the results of its examination, and shall then offer my reasons for considering it a new species.

## *Description.*

The color of this mineral is dark gray, passing into clove brown.

It occurs crystallized in rhomboidal prisms, whose angles are about 106° 30′ and 73° 70′; the inclination of the base to the axis of the prism being 113°. It has but one cleavage which is parallel to the longer diagonal of the prism. The sides and angles of the crystals are frequently rounded.

Its hardness is greater than that of quartz; even the topaz may be scratched by some of the specimens. It is translucent on the edges, and in small fragments; is brittle and may easily be reduced to powder.

Its fracture in the direction of the longer diagonal is lamellar, and displays a brilliant lustre; the cross fracture is uneven and splintery.

It does not become electric either by heat or friction, nor does it give any indications of magnetism even when tested by the method proposed by M. Haüy.

Its specific gravity is 3.410.

Before the blow pipe it is infusible per se, and also when heated with borax.

The nitric, muriatic and sulphuric acids do not act on its powder, even when digested upon it with the assistance of heat.

This mineral occurs in a vein of a quartz, penetrating gneiss in the town of Saybrook, Connecticut, where, I am informed, it is found in considerable quantities.

## ANALYSIS.

*A.* Three grammes of the mineral reduced to an impalpable powder were exposed, during half an hour, to a red heat, in a platina crucible. The colour of the powder was not altered by ignition, after which it weighed 2.985 grammes. The loss of moisture by a calcination was, therefore, .015 grammes, or 0.50 per 100.

*B.* The calcined mineral was then treated with three times its weight of caustic potash, and the mixture exposed to a red heat, during one hour, in a silver crucible. The contents of the crucible after exposure to heat, were of a light brown colour. The fused mass was treated with muriatic acid in excess, and the fluid evaporated to dryness. Water acidulated with muriatic acid was then added, and the whole thrown upon a filter. The silex separated in this manner when washed and calcined amounted to 1.293 grammes, or 43 per cent.

*C.* The muriatic solution (B) was then decomposed at a boiling heat, by sub-carbonate of ammonia, and the precipitate which was produced, having been well washed, was treated repeatedly with caustic potash, in order to separate the alumine. This alkaline fluid was supersaturated with muriatic acid, and then treated with sub-carbonate of ammonia in excess. The alumine which was precipitated, amounted when washed and calcined to 1.626 grammes, or 54.310 per cent.

*D.* That portion of the mineral which remained after the action of the potash, was of a brown color. It was dissolved in muriatic acid, the excess of acid neutralized by potash and hydro-sulphuret of potash then added, which caused a black precipitate. This precipitate after being heated to expel the sulphur, was treated with a little nitric acid and calcined. It weighed 0.62 grammes or 2 per cent, and was pure peroxide of iron.

*E.* The liquor (D) from which the iron had been precipitated by an hydrosulphuret, was then tested with oxalate of ammonia, and with phosphate of soda and ammonia, but gave no indications of the presence of either lime or magnesia.

The result of this analysis gives as the constituents of this mineral, *Per* 100 *Parts.*

| | | | | |
|---|---|---|---|---|
| *A.* Water, | 00.510 | containing oxygen, | | |
| *B.* Silica, | 43.000 | " | " | 21.629 |
| *C.* Alumine, | 54.210 | " | " | 25.315 |
| *D.* Peroxide of Iron, | 02.000 | | | |
| | 99.720 | | | |
| | 100.000 | | | |
| | .280 Loss. | | | |

In order to verify the above results this analysis was varied as follows, viz. After having ascertained the loss by calcination, and separated the silex in the usual manner, the solution in muriatic acid was saturated with potash, and the alumine and iron then precipitated by hydro-sulphuret of potash. These two substances were afterwards separated by the action of caustic potash. The solution to which the hydro-sulphuret had been added, was then tested, and was thus found to contain neither lime nor magnesia. Three analyses which were made of this mineral, coincide almost exactly in their results, and give, as a mean, its composition as follows.

*Per* 100 *Parts.*

| | | | | |
|---|---|---|---|---|
| Water, | 00.510 | containing oxygen, | | |
| Silica, | 42.666 | " | " | 21.460 |
| Alumine, | 54.111 | " | " | 25.270 |
| Oxide of Iron, | 01.999 | " | " | |
| | 99.286 | | | |
| | 100.000 | | | |
| | .714 Loss. | | | |

It is therefore a silicate of alumine, with an accidental portion of oxide of iron, and its mineralogical formula will be CS.

The mineral which this substance most strongly resembles in *external characters*, is the anthophyllite. There is however, a difference in the aspect of the two minerals, and the results of the above mentioned analyses, prove them to be totally distinct.* Nepheline is the only mineral to which the subject of this paper is allied in *chemical composition*, but nepheline is much softer, is more fusible, and crystallizes differently, having for its primitive form a six sided prism, while the primitive form of the mineral in question is a rhomboidal prism.

From the preceding experiments, therefore, the substance which I have analyzed, must be considered as a new species in mineralogy, and I propose for it the name of Sillimanite, in honour of Professor Silliman, of Yale College.

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## Art. IX.—*Analysis of a Silicious Hydrate of Copper, from New-Jersey, with a notice of the discovery of two localities of Spodumene in the United States.* By George T. Bowen.

[Read before the Academy of Natural Sciences of Philadelphia, March 2d, 1824, from whose Journal it is copied.]

### 1. *Of the Ore of Copper.*

This mineral is found at Somerville, New-Jersey, in a copper mine belonging to Mr. I. Camaans. It occurs as an incrustation on the ferruginous copper ore of that mine, and is accompanied by native copper, green malachite, the crystallized red oxide of copper, and by native silver. It has been supposed by many mineralogists to be a phosphate; the following experiments, however, prove that it contains no phosphoric acid.

Its colour is bluish-green; colour of its powder light blue. It is massive and opaque; its fracture is conchoidal and dull. It is brittle, and is easily scratched by the knife. Its specific gravity is 2.159. Alone, before the

*In order to ascertain the true composition of the anthophyllite, I analyzed a specimen of that mineral from Norway, and found my results to coincide, as to its constituent parts, with the analyses which are generally quoted in mineralogical books.

blowpipe, it becomes black, but is infusible; with borax it fuses into a glass of a bright green colour, and when heated with sub-carbonate of soda, yields globules of metallic copper. When treated with nitric acid, it is partly dissolved without effervescence, and affords a solution of a blue colour.

*Analysis.*

*A.* Two grammes of the mineral, after being carefully separated from the accompanying carbonate of copper, were reduced to an impalpable powder, and exposed during half an hour to a red heat in a platina crucible. The powder after ignition was of a black colour, and weighed 1.660 grammes. The loss, by calcination, was, therefore, 0.340 grammes in two grammes, or 17 per 100.

*B.* The calcined mineral was then fused with three times its weight of crystallized carbonate of potash, and the fused mass, which was of a black colour, was treated with muriatic acid in excess, and the solution evaporated to dryness; acidulated water was then added, and the whole thrown upon a filter. The silex separated in this manner, when washed and calcined, amounted to 0.745 grammes, or 37.250 per 100.

*C.* To the solution in muriatic acid, caustic potash was added in excess, and the fluid boiled. The precipitate which was formed after being washed and calcined, weighed 0.903 grammes, and on examination proved to be pure peroxide of copper. These 0.903 grammes in 2 grammes are equal to 45.175 per 100.

*D.* In order to ascertain whether this mineral contained phosphoric acid, I dissolved a portion of it in nitric acid, decomposed the nitric solution by means of caustic potash, and treated the alkaline fluid with acetic acid in excess. The acetous solution, when tested by nitrate of lead, gave no indications of phosphoric acid.

The constituents of this mineral, according to this analysis, are, per 100 parts,

| | | | | |
|---|---|---|---|---|
| *A.* Water, | 17.000 | containing oxygen | | 15.119 |
| *B.* Silica, | 37.250 | " | " | 18.736 |
| *C.* Peroxide of copper, | 45.175 | " | " | 9.011 |
| | 99.425 | | | |
| | 100.000 | | | |
| | .575 *loss.* | | | |

It is therefore a bisilicate of copper with water, and its mineralogical formula will be $CS^2 + Aq$.

## 2. *Of the Spodumene.**

In the month of November of the last year, Mr. Nuttall brought to Philadelphia several minerals from Massachusetts, among which was one which from its external characters he suspected to be spodumene. On examining it chemically, I determined it to be that mineral, having obtained from it a portion of the new alkali, lithia. The specimen submitted to examination was of a white colour; it was of a lamellar structure, of a pearly lustre, was brittle, scratched glass, and was fusible before the blow-pipe. It yielded readily to mechanical division, and afforded a rhomboidal prism whose angles were 100° 80′. In order to obtain the lithia from this mineral, a portion of it which had been previously pulverised was fused with an equal weight of caustic potash, and the fused mass dissolved in diluted muriatic acid. The muriatic solution was then evaporated to dryness, and the product digested for some time in warm alcohol. The alcohol on evaporation afforded a white deliquescent salt of an acrid taste. That it contained neither lime nor potash was proved by its solution affording no precipitate either with oxalate of ammonia or with muriate of platina, and that it was really the muriate of lithia was evident from its tinging the flame of alcohol of a deep crimson colour, and from its affording when added to a concentrated solution of carbonate of soda, an abundant

* The notice of the Spodumene was forwarded in February last, but came too late for publication in the last number of the Journal. An account of it has since been published in the Journal of the Academy of Natural Sciences of Philadelphia.

precipitate of the carbonate of lithia. This mineral was discovered by Mr. Nuttall, during the last summer, in the town of Sterling, Massachusetts, on a farm belonging to Mr. Putnam.

A short time after having examined the above mentioned mineral, I discovered several specimens of the spodumene among a small collection of minerals from the vicinity of Conway, Mass. The specimens from this last mentioned locality are of a light green color, and bear a strong resemblance to the spodumene of Sweden. I had procured a quantity of lithia from this mineral, and had so far proceeded in a regular analysis, as to have obtained 65.3 per cent of silex, and 24.5 of alumine, when an accident prevented me from proceeding with the analysis. But as the result obtained corresponded very nearly with the published analysis of spodumene, it was not thought necessary to repeat the examination.

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ART. X.—*Remarks on the theory of the construction of the Thermometer,* by REV. J. ADAMS, *Professor of Mathematics and Natural Philosophy in Brown University, Providence, Rhode Island.*

It is highly important, that the theory of the construction of an instrument, so extensively useful as the thermometer, should be well settled and well understood. It is used often in physics and constantly in chemistry; and to it we are indebted for the greatest part of our information on the interesting subject of heat. The astronomer consults it in his observations, in all cases, where refraction is an element. By it, we determine the mean temperature of the earth, and of the different climates upon its surface. Any effort therefore, towards establishing a correct theory of the construction of this instrument, it is believed, will be viewed by the public, with candour and indulgence.

It is well known, that the greatest part of physical inquirers regard caloric as a material substance, to which they attribute several properties analagous to those which other material substances possess; such as elasticity, the power of entering into combination with other substances, &c. These properties they attribute to it on the ground of analogy;

for as they can neither see, nor touch, nor weigh caloric, they are obliged to strip it, at least as far as our senses are concerned, of all the most apparent properties by which we are assured of the existence of matter; such as extension, impenetrability, and gravity. This opinion, is supported by considerable evidence, though perhaps not sufficient to give entire satisfaction.

Other philosophers, refer the phenomena of heat to a vibratory motion of the particles of matter, varying in velocity with the perceived intensity of the heat. In fluids and gases, the particles are conceived to have a motion round their own axes. Temperature, therefore, with them, will increase with the velocity of the vibrations, and increase of capacity will be produced by the motion being performed in greater space. The loss of temperature, during the change of solids into liquids and gases, will depend upon loss of vibratory motion, in consequence of the acquired rotary motion.* The most distinguished advocate of this hypothesis, of late years, is Sir H. Davy. A detailed account of his views may be found in his "Elements of Chemistry." Since, in the exact sciences, the opinion of no man is better than the reasons which he gives for it; with perfect respect for the talents of this illustrious chemist, and with the greatest admiration of his splendid discoveries, it is probable, that his hypothesis will never be extensively received. Indeed, the idea, that all the facts with which we are acquainted respecting heat, can be made to depend on *motion* of any kind, is perhaps scarcely less than inconceivable. It is difficult, to understand, how this hypothesis can be plausibly supported. A highly ingenious and convincing argument against it, of the nature of a *reductio ad absurdum*, has been constructed by Dr. Hare, and will doubtless be recollected by the readers of this journal.†

Another class of philosophers, attaching themselves to neither of these hypotheses, limit themselves to admitting the facts common to both, and consider the term caloric, as the name of a cause whose nature is not known any further than, that it gives us the sensation of heat, and produces peculiar effects upon the substances around us.

* Brande, Manual of Chem. 1. 248.

† Vol. IV, 142.

The investigations connected with the hypothesis, that caloric is a material substance, appear to have given rise somewhat extensively among writers, to what, it is believed will be considered, upon examination, an erroneous view of the construction of the thermometer. What is intended by this communication, may best be accomplished, by first making quotations from several writers, and by afterwards making such remarks upon them, as the occasion renders necessary.

Dr. Henry says, "the experiments of De Luc have shown, that the ratio of expansion does not *strictly* keep pace with the actual increments of temperature; and that the amount of the expansion increases with the temperature. Thus if a given quantity of mercury, in being heated from 32° to 122°, the first half of the scale, be expanded 14 parts, in being raised from 122° to 212°, the higher half, it will be expanded 15 parts."

"From the inquiries of Mr. Dalton," continues the same writer, it "appears to follow, that the irregularity of the expansion of mercury is considerably greater than has been stated by De Luc."

Again, "making due correction for this circumstance," that is, the expansion of the glass in the thermometer, "Mr. Dalton has been led to conclude from his experiments, that notwithstanding the apparent diversities of expansion in different fluids, they all actually expand according to the same law; viz. that the quantity of expansion is as the square of the temperature from their respective freezing points, or from their point of greatest density. If then a thermometer be constructed, with degrees corresponding to this law, they will be found to differ very considerably from those of the common mercurial theremometer, in which the space between freezing and boiling is divided into 180 equal parts. In the appendix, will be found a table showing the correspondence between the old scale, and the new one constructed on Mr. Dalton's principle.*

Dr. Gorham says, Chem. I. 74, "the thermometer as commonly constructed with equal divisions, is not to be considered as perfectly correct in its indications of temperature. Liquids not only differ in their expansibilities, but

*Chemistry, Vol. 1. Chap. III. Sect. II.

the expansion of the same liquid is not uniform for the increase of heat. Mr. Dalton having found that the dilatations of water are nearly as the squares of the temperatures reckoning from 32°, or the maximum of condensation, infers that the law is equally applicable to all other homogeneous liquids; and he conceives the slight deviation from this law observed in water, arises from the unequal expansions in the mercury of the thermometer. If an instrument of this kind be so constructed as to accord with the unequal dilatations, the degrees will be smaller between 32° and 122°, than between 122° and 212°.

Dr. Ure says, "if the body selected for indicating, by its increase of bulk, the increase of heat, suffered equal expansions by equal increments of the calorific power, then the instrument would be perfect, and we should have a just thermometer or pyrometer. But it is very doubtful whether any substance, solid, liquid or aeriform, preserves this equable relation between its increase of volume and increase of heat."

Again, "I think it indeed highly probable, that every species of matter, both solid and liquid, follows an increasing rate in its enlargement by caloric. Each portion that enters into a body, must weaken the antagonist force, cohesion, and must therefore render more efficacious the operation of the next portion that is introduced. Let 1000 represent the cohesive attraction at the commencement, then, after receiving one increment of caloric, it will become 1000—1=999. Since the next unit of that divellent agent will have to combat only this diminished cohesive force, it will produce an effect greater than the first, in the proportion of 1000 to 999, and so on in continued progression. That the increasing ratio is, however, greatly less than Mr. Dalton maintains, may, I think, be clearly demonstrated."

Dr. Ure also says, that "by means of two admirable micrometer microscopes of Mr. Troughton's construction, attached to a peculiar pyrometer, I found, that between the temperatures of melting ice, and the 540° Fahr. the apparent elongations of rods of fine copper and iron, corresponded *pari passu* with the indications of two mercurial thermometers of singular nicety, made by Mr. Crighton of Glasgow, one of which cost three guineas, and the other two, and they were compared with a very fine one of Mr. Troughton's. I consider the above results and others contained in that same paper, as decisive against Mr. Dalton's hypothetical graduation of thermometers."*

The same writer† defines a "thermometer to be an instrument for measuring heat, founded on the principle, that the expansions of matter are proportional to the augmentations of temperature. With regard to aeriform bodies, this principle is probably well founded; and hence our common thermometers may be rendered just, by reducing their indications to those of an air thermometer. Solids, and still more liquids, expand unequally, by equal increments of heat, or intervals of temperature."

Messrs. Dulong and Petit remark, "that Mr. Dalton, considering this question from a point of view much more elevated, has endeavoured to establish general laws applicable to the measurement of all temperatures. These laws, it must be acknowledged, form an imposing whole by their regularity and simplicity. Unfortunately, this skilful philosopher proceeded with too much rapidity to generalize his very ingenious notions, but which depended on uncertain data. The consequence is, that there is scarcely one of his assertions but what is contradicted by the result of the researches, which we are now going to make known."

"Again, the well known uniformity in the principal physical properties of all the gases, and particularly the perfect identity in the laws of their dilatation, render it very probable, that in this class of bodies, the disturbing causes to which I have adverted in my paper, have not the same influence as in solids and liquids; and that consequently the changes in volume produced by the action of heat upon air and gases, are more immediately dependent upon the force which produces them. It is therefore very probable that the greatest number of the phenomena relating to heat will present themselves under a more simple form, if we measure the temperatures by an air thermometer.‡"

"It seems probable" says Sir H. Davy, "that the capacity (for heat) of solids and fluids is increased by expansion

* Ure's Dict. Art. Caloric.

† Art. Thermometer.

‡ Quoted by Dr. Ure, Dict. Art. Caloric.

and diminished by condensation, and if this is the case, the additions of equal quantities of heat will give smaller increments of temperature at high than at low degrees, which must to a certain extent render the thermometer inaccurate in higher degrees, though probably only to a very small extent, of little importance as to all practical purposes; and this cause of inaccuracy appears to be counteracted by another, that fluids seem to be more expansible by heat in proportion as their temperature is higher.*"

Many other similar quotations might be made from the most distinguished late writers, were it deemed necessary. It is not my design to examine separately those which have been produced. The wide discordance of the results must be seen upon the slightest inspection. It is also sufficiently apparent, that there has been much loose experimenting, hasty generalization, and erroneous reasoning, as well as a great departure from the cautious spirit of the Baconian philosophy on this subject. "Aliquando dormitat bonus Homerus." If the thermometer is to be graduated according to any of the preceding conclusions, whose results shall be preferred? But it is believed, it will appear from the following remarks upon the preceding quotations, that the construction of the thermometer has no connection with hypothetical considerations, but that it is founded upon facts unquestionable in their nature, and ascertained without difficulty.

First, then, the thermometer viewed as the measurer of temperature, is, like other standards of measurement, an instrument of a conventional nature; its construction always has been, and must be founded upon facts, and must in no degree be connected with hypothetical considerations. A different number of facts have, it is true, since the invention of the thermometer, at different periods, been used in its construction; but still they were always facts and not hypotheses. By temperature here is meant, the energy, intensity or degree of action of the unknown cause, caloric; and by differences of temperature, different degrees of energy in the action of this cause. The thermometer in its indications, gives merely *differences of temperature.*

* Elements, p. 51.

A mercurial thermometer, in the present improved state of that instrument, must be constructed according to the following facts. 1st. The tube in which the mercury is to range between its extreme points, must be divided into portions of equal capacity; since the bore of no tube is equal in all its parts. Such a division may be most conveniently made by means of an instrument invented by M. Gay Lussac.* 2d. It must be as free as possible from air and vapours, by being hermetically seated under the most favourable circumstances. It is not designed here to enter into the details of the practical construction of the thermometer. 3d. When it is wished to render the instrument very sensible, the bulb should be cylindrical or conical; otherwise, the bulb may be spherical. 4th. There must be at least two fixed points; viz. that of *melting ice*, (not freezing water) and that of boiling water. 5th. The water used in determining the fixed points, must be distilled, and must be boiled in a metallic vessel.† 6th. The boiling point for water must be determined, when the barometer, after being reduced to the level of the sea, and to the temperature of melting ice, stands at the height of thirty inches. If, after the reductions above mentioned are made, the barometer is not at thirty inches, the boiling point must be determined by making an allowance at the rate of 1° Fah. for a difference of 0.589 of an inch of barometric pressure.*

It admits of mathematical demonstration, that thermometers constructed with the conditions above specified, are strictly comparable with each other.

It is said above, that the thermometer viewed as a measurer of temperature, is, like other standards of measurement, an instrument of a conventional nature. The length of the English yard, was adjusted by the length of the arm of king Henry I. and the original metallic rod is preserved

* Bict, Traité de Physique, Tom. I. 46—8.

† Bict, I. 43.

* The expansion and contraction of the glass in thermometers, is at least theoretically speaking, a cause of error in their results. But as this cause of error is common to all thermometers, and affects them all in *very nearly* the same degree, and is itself small; its practical effect will be scarcely discernible. It would not be difficult, were it of any use in practice, to give a formula for the correction of this error.

in the exchequer. This rod has, since this adjustment, been universally agreed upon as the standard of the measurement of lengths in England, and every other country where the English measures have been used, and all other linear measures have been adjusted in reference to it. The French, after examining all the standards of linear measure furnished by nature, agreed upon the $\frac{40}{1000000}$ part of the length of the meridian, as *their standard*, and this, by the name of *metre*, forms the basis of their regular and beautiful metrical system. The dollar, containing 371.25 grains of pure silver, and 44.75 grains of copper, is agreed upon in the United States, as the standard to which all other coins, as well as all monies of account, are to be referred. *The general agreement* to consider these as standards of measure of their own kind, is what constitutes them such standards. The case is the same with the thermometer. Until the late attempts to introduce hypothetical considerations into its construction, the dilatation of mercury was universally agreed upon as the standard for measuring the different degrees of energy of caloric, i. e. as the standard for measuring temperature. The whole dilatation between the determinate points, is divided into a convenient number of equal parts; (80, 100 and 180 are the principal numbers which have been used,) and the scale which results from this graduation is *conventionally used* to measure all temperatures between its extreme points. It is with as much reason, that the thermometric scale is equally divided into 180, or any other number of equal parts, as that the yard is divided into 3, 36, &c. equal parts. Even if the hypothesis were, beyond question, true, that caloric is a material substance, and that the introduction of ten parts of a given quantity of it into the mercury of the thermometer should expand it from 32° to 122°, while nine parts should be sufficient to expand it from 122° to 212°; still the circumstance ought not to affect the graduation; because the thermometer is designed to measure the energy of the action of caloric, and not the quantity of it introduced or disengaged. It is one thing to measure the quantity of caloric received into a body, or removed from it, and another to measure the intensity of its action. These by no means necessarily correspond with each other.

Again, wherever in the prceding quotations, a new graduation of the thermometer is suggested, the proposed graduation is not founded upon facts, but upon hypothesis. In the present state of our information, it is an *hypothesis*, and has not been proved to be a fact, that caloric is a material substance. When Dr. Ure says, "that solids and still more liquids expand unequally by equal increments of heat;" the idea of its being a material substance and of its producing a mechanical effect is introduced. The same hypothesis is involved in the reasonings of all the writers which have been cited except the last: but in some, it is much more dexterously *kept out of sight, by cautious language*, than in others. Dr Ure thinks in one passage, that with regard to aeriform bodies, the expansions give just indications of temperature; while in another, he is very doubtful, whether any substance solid, liquid or *aeriform*, can by the graduation, afford a true measure of temperature. His words have not been used, but his meaning has been given. When Dr. Ure says, that he considers an air thermometer as a just measure of temperature, he should have recollected, "that between the limits of freezing (melting ice) and boiling water, a mercurial and air thermometer did not present any sensible discordance."* This is the result of M. Gay Lussac, whose accuracy as an experimenter, has perhaps never been exceeded. The same relation, which M. Gay Lussac has shewn to exist between the mercurial and air thermometer, the experiments of Messrs. Lavoisier and Laplace, have proved to belong equally to the mercurial thermometer and most of the solid metals. "Les expériences de M. M. Lavoisseur et Laplace, sur la dilatation des corps solides, nous ont appris qu' entre les tennes de la glace fondante et de l'eau bouillante, la dilatation des metaux solides est sensiblement proportionnelle à celle du mercure. La meme proportionnalité subsiste encore dans ces limites entre les dilatations du mercure et celles des gasees. Ce resultat important a èté parfaitement établi par les expériences que M. Gay Lussac a faites dans ce dessein sur la dilatation des gaz.† These

* Dict. art. Caloric.

† Biot, Traité de physique, &c. I. 182.

results lead to the conclusion, that air, mercury, and the solid metals, generally, may be employed without danger of error as thermometric substances. Dr. Ure himself says, that rods of pure copper and iron corresponded in their dilatations pari passu with two of the best mercurial thermometers, through the extended range between melting ice, and 540°, Fahrenheit. He also admits that a mercurial, adjusted by an air thermometer, gives correct indications of temperature. And as the expansion of air, mercury, &c all keep pace without any sensible discordance, thermometers constructed with them, will all be strictly comparable with each other.

In selecting substances for constructing thermometers, four appear to be sufficient in every case for which the instrument can be wished. These are air, alcohol, mercury, and a combination of platinum and copper. The state of the first will remain unchanged, as far as we know, through any range of temperature, but the practical management of it, except within the limits of a moderate range, is so difficult, that it will probably never be entensively employed. The second substance is best adapted for the measurement of temperatures below the point of the congelation of mercury. The third is extremely well fitted for common use, since among other advantages, it remains unchanged in form, through a very long range of temperature.

In trigonometrical surveying, the base for a series of triangles, must be measured with the greatest possible accuracy, and to do this, the temperature must be constantly known. For the French surveys, the celebrated Borda prepared a platinum rod, of twelve feet in length for the measuring rod, to which was fastened at one end a rod of copper, a little shorter than itself, which could slide freely upon the plantinum. The platinum rod near the moveable end of the copper bar, was accurately graduated into aliquot parts of its length, and the moveable copper end, was provided with a vernier and microscope, to assist in reading. When the temperature of this compound instrument varies, the rods are unequally expanded, and the graduation previously adjusted by the points of melting ice and boiling water, gives the temperature of the instrument.*

* Biot, Traite de physique, I. 163.

This arrangement seems preferable to the glass rods used in the great English trigonometrical surveys.

*Brown University. March 20th* 1824.

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Art. XI.—*Remarks on several papers published in former volumes of this Journal. (Communicated by the Author to the Editor.)*

1. *Remarks on the "New Algebraical Series," given by* Professor Wallace, *in page* 278 *of this Journal for the month of February*, 1824.

These series can hardly be called *new*, since they are nothing more than the usual expansion of the binominal quantity $1-kz$ to the negative fractional power $-\frac{a}{k}$ or $-\frac{b}{k}$ etc. and nearly the whole theory of the functions he has named $fa, fb$, etc is to be found in the *Complement des Elemens d' Algebre* of La Croix, [Page 161, Edit. 4.] where it is stated that the method was first published by Euler in the XIX, Vol. of the "*Novi Commentarii Academiae Scientiarum Imperialis Peteopolitanæ*" about fifty years since.

Mr. Wallace supposes,

$$fa=1+a.\frac{z}{1}+a(a+k).\ \frac{z^2}{1.2}+a(a+k)\ (a+2k).\ \frac{z^3}{1.2.3}+$$

&c. and as the series in the second number of this equation is equal to $(1-kz)^{-\frac{a}{k}}$ expanded into a series by the binominal theorem, if we for brevity: put $F=(1-kz)^{-\frac{1}{k}}$ it will become equal to $F^a$, whence

$$fa=F^a$$

Therefore the function $fa$ is equivalent to the power $a$ of the quantity F; and in like manner $fb=F^b$; $f(a+b)=F^{a+b}$, and as $F^a\times F^b=F^{a+b}$, it follows that $fa\times fb=f(a+b)$, which is the fundamental theorem of Mr. Wallace, found by the actual multiplication of the series corresponding to those functions. In like manner his formulas II, III, IV, become respectively,

$$(F^a)^m = F^{ma} \qquad \text{(II.)}$$

$$\frac{F^a}{F^b} = F^{a-b} \qquad \text{(III.)}$$

$$\sqrt[m]{F^a} = F^{\frac{a}{m}} \qquad \text{(IV.)}$$

which are the usual formulas for the powers, quotients and roots of quantities.

The symbols used by La Croix, are almost identical with those of Mr. Wallace, using $m$, $n$, $p$, &c. instead of $a$, $b$, $c$, &c. Thus La Croix's equation corresponding to (I.) of Mr. Wallace, given above is

$$f(m) \times f(n) = f(m+n.)$$

B.

*Boston, April* 16, 1824.

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2. *Remarks on the paper "On the Precession of the Equinoxes" published in page* 323 *of the Journal for February* 1824.

That the subject of the Precession of the Equinoxes had not been sufficiently examined by the author of that paper is evident from his suggestion, that if the precession was produced by the attraction of the equatorial ring, or spheroidal part of the earth, it might arise "from a diminution of the angle of the equator and ecliptic," when it is well known that the whole motion is merely a change of direction in the line of intersection of the Equator and Ecliptic, or as he calls it (in page 324.) "the line of the Equatorial Nodes." He also says, "that it is difficult if *not impossible* to see any method in which a regular and successive variation of the the line of the nodes should be effected." And in speaking of the parallel case of the revolution of the nodes of the lunar orbit, he goes so far as to assert that he can see no rational method of accounting for it, except the *eccentricity of the* (*moon's*) *orbit*, and that "if the Earth was in the centre of the Moon's orbit, there would be a motion of the nodes backwards and forwards *but no revolution.*" Now there is no foundation for this assertion, since it has been proved by several writers on the lunar theory, that the excentricity of the orbit has but little effect in the motion of the Moon's nodes, and the time of their revolution would be nearly the same, even if the moon's orbit were to become a perfect circle, as may easily be perceived from what is proved in Lib. 3. Prop. 30—33. of Newton's *Principia.* Moreover the method he has proposed, to account for the Precession, is liable to the objection, that it would cause an apparent relative motion among the fixed stars, by which they would appear to approach to, or recede from, each other, or otherwise vary their apparent places in the heavens; but the Precession produces no such effect, it leaves the relative positions of the fixed stars *wholly unchanged*, but alters the point of the ecliptic, or rather the circle of latitude from which the longitudes are counted, giving to that circle a small annual motion; it being more convenient to begin the computation of the longitude upon the ecliptic, from the *moveable* line of intersection of the equator and ecliptic, than from any *fixed* point, which in fact could not easily be obtained, since all the *fixed* stars, as they are usually called, are supposed to have a proper motion; and it is highly probable that the solar system partakes of a similar motion. Other objections might be made, but what has already been said, will suffice to point out the chief defects of this theory.

*Boston, April* 16, 1824. B.

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3. *Remarks on the paper on the Maxima and Minima of functions of two variable quantities, published in Vol.* 5, *of this Journal, by the late* PROFESSOR FISHER.

By means of a particular theorem, Professor Fisher has solved a number of problems relative to the maxima and minima of functions of two variable quantities, with much ease and elegance; but it will appear, upon examination, that all these problems depend on functions usually called *homogeneous*, and by the substitutions generally made for the reduction of such functions, we may obtain the same solutions, by a more general method, *embracing a much greater number of cases*, using merely the common forms of substitution and reduction of algebraic quantities, without the intervention of any new geometrical principle or theorem.

The problems treated of by Professor Fisher are of this kind. $u$ and $v$ are supposed to be functions of the variable quantities $x$ and $y$, and so dependant on each other, that $u$ is to be a *maximum* or *minimum* when $v$ is a given quantity. The most natural way to solve such problems, is to find the value of one of the unknown quantities, as for example, $y$, in terms of $x$, by means of the given quantity $v$. Substituting this in the function $u$, it becomes a function of the *other* variable quantity $x$ (independent of $y$;) and its differential being taken relative to $x$ and put $=o$, will give the maximum or minimum of $u$, according to well known principles. The same result would be obtained, if we find $x$ from $v$ in terms of $y$, and substitute it in $u$, by which means it will become a function of the single variable quantity $y$, (independant of $x$) whose differential relative to $y$ put $=$o, will also give the maximum or minimum of $u$. As either of these methods will answer, it will be in our power to use that which leads to the most simple results; but sometimes the function $v$ is of so complicated a form, that it is difficult to determine the value of $x$ or $y$, and some analytical artifice must be used to obtain the required solution. One of these artifices consists in the introduction of a new variable quantity $t$ instead of $x$ or $y$. Thus if the function $u$ is a homogeneous expression in $x$ and $y$ of the order $m$, or such *that the sum of the exponents of* $x$ *and* $y$ *in every term of* $u$ *is exactly equal to* $m$, we may, by the substitution of $y=xt$ reduce it to the form $u=x^m$. T′, T′ being a function of $t$ exclusive of $x,y$, and the same substitution of $y=xt$ in $v$, supposed to be a homogeneous function of $x$. $y$. of the order $n$, would reduce it to $v=x^n$. T″, T″ being another function of $t$ independent of $x$. $y$. Now the value of $x$ found from this last expression and substituted in $u$, will give $\frac{u}{v^{\frac{m}{n}}}=\frac{T'}{T''^{\frac{m}{n}}}$, the second member of this equation being a function of $t$ alone; and, if for simplicity we put

$$T=\frac{T'}{T''^{\frac{m}{n}}}\left(=\frac{u}{v^{\frac{m}{n}}}\right)$$

it will become $T=\frac{u}{v^{\frac{m}{n}}}$. Taking now the differential of this equation, the second member will vanish, when $u$ is a maximum or minimum, because then $du=o$, and ($v$ being constant) $dv=o$, and the differential becomes $d\,T=o$, therefore the maximum or minimum of $u$ will be obtained by putting the differential of T equal to nothing.

It will sometimes be more simple to put $x=yt$ (instead of $y=xt$) and then we shall have $u=y^m\,T'$, $v=y^n.\ T''$ (T′ and T″ being in general different from the values above found) hence, we get as above

$$T=\frac{T'}{T''^{\frac{m}{n}}}\left(=\frac{u}{v^{\frac{m}{n}}}\right)$$

and the maximum or minimum is found, as before, by putting $du=o$, $dv=o$ which gives $dT=o$.

It may so happen that the proposed problems, without any reduction, appear under the form $u=x^m.\ T'$, $v=x^n.\ T''$; T′, T″, being functions of $y$ alone without $x$. In this case no reduction will be necessary, because we have immediately $\frac{u}{v^{\frac{m}{n}}}=\frac{T'}{T''^{\frac{m}{n}}}=T$, whose differential gives $dT=o$, when $u$ is a maximum or minimum. The same thing takes place, if $u=y^m\,T'$; $v=y^n.\ T''$; T′, T″, being functions of $x$ alone, because they give $\frac{u}{v^{\frac{m}{n}}}=\frac{T'}{T''^{\frac{m}{n}}}=T$, and the maximum or minimum of $u$ is found, as before, by putting $dT=o$.

We may observe that generally when $dT=o$, we shall also have $d.\ T^p=o$, therefore instead of T, we may take any power $p$ of T, positive or negative; we may also neglect any constant factor $a$ by which T is multiplied, since $d.\ aT=o$, gives $a.\ dT=o$, whence $dT=o$.

All the problems actually solved by professor Fisher, depend on homogeneous functions and can therefore be solved by the method just mentioned, putting $dT=o$; as we shall show by solving a few of his problems.

*Problem* 1. Suppose $u=\pi y\sqrt{yy+xx}$, $v=\frac{1}{3}\pi\,y^2x$, $\pi=3,14159$, and let it be required to find the value of $u$ when a maximum, for a *given* value of $v$.

The substitution of $x=yt$, gives $u=\pi.\ y^2.\ \sqrt{1+tt}$; $v=\frac{1}{3}\pi.\ y^3.\ t$. Comparing with the above forms $u=y^m.\ T'$, $v=y^n.\ T''$, we get $m=2$ $n=3$, $T'=\pi\sqrt{1+tt}$, $T''=\frac{1}{3}\pi t$, and if we neglect the constant factors in $T=\frac{T'}{T''^{\frac{m}{n}}}$, it becomes

$T=\frac{\sqrt{1+tt}}{t^{\frac{2}{3}}}$ whence $T^2=t^{-\frac{4}{3}}+t^{\frac{2}{3}}$, whose differential put $=o$ gives $t=\sqrt{2}$, whence $x=yt=y\sqrt{2}$.

*Problem* 2. Given $u=\frac{1}{3}\pi y^2 x$ to be a maximum, when $v=\pi y\,(\sqrt{yy+xx}+y)$ is constant.

Putting $x=yt$, we get $u=\frac{1}{3}\,\pi.\,y^3.\,t$, $v=\pi y^2\,(\sqrt{1+tt}+1)$ whence $m=3$, $n=2$, and, (neglecting the constant factors) $T'=t$; $T''=\sqrt{1+tt}+1$, $T=\frac{t}{(\sqrt{1+tt}+1)^{\frac{3}{2}}}$ or $T^{-\frac{2}{3}}=\sqrt{t^{-\frac{4}{3}}+t^{\frac{2}{3}}}+t^{-\frac{2}{3}}$ whose differential put$=o$ and reduced, gives for the maximum of $u$, $t=2\sqrt{2}$, whence $x=y.\,2\sqrt{2}$.

*Problem* 8. Suppose $u=\frac{1}{2}\pi p x^2$, $v=\frac{1}{6}\frac{\pi}{p}\left\{(p^2+4px)^{\frac{3}{2}}-p^3\right\}$, $p$ being the parameter of a parabola, whose equaquation is $px=yy$ ($p$ being called $a$ by Professor Fisher.) Then $v$ being given it is required to find $u$ a maximum.

Putting $x=pt$, we get $u=\frac{\pi}{2}.\,p^3.\,t^2$, $v=\frac{1}{6}.\,\pi.\,p^3.\left\{(1+4t)^{\frac{3}{2}}-1\right\}$, [$p$ taking the place of the unknown quantity $x$ or $y$ in the forms treated of above.] Hence $m=3$, $n=2$, and neglecting the constant factors $T'=t^2$; $T''=(1+4t)^{\frac{3}{2}}-1$, whence $T=\frac{T'}{T''^{\frac{m}{n}}}=\frac{t^2}{\left\{(1+4t)^{\frac{3}{2}}-1\right\}^{\frac{3}{2}}}$, whence $T^{-\frac{2}{3}}=t^{-\frac{4}{3}}(1+4t)^{\frac{3}{2}}-t^{-\frac{4}{3}}$, whose differential put $=o$, and reduced gives $4tt-15t+12=o$ whence $t=\frac{8}{5+\sqrt{\frac{11}{3}}}$, and

$$x=pt=\frac{8p}{5+\sqrt{\frac{11}{3}}}.$$

The solution of this problem by any usual method seems to have been considered as quite tedious by Professor Fisher, in page 88 Vol. V. of the Journal.

*Problem* 14. Suppose $u=2x$ sin. $y$ to be a maximum when $v=x^2.\,y$ is a given quantity.

Here the quantities require no previous preparation. For by putting $m=1$. $n=2$, $T'=2\sin y$, $T''=y$, we get

$T=\frac{u}{v^{\frac{1}{2}}}=\frac{2\sin.y}{y^{\frac{1}{2}}}=2y^{-\frac{1}{2}}.$ sin. $y$, whose differential, put $=o$ gives, $2\,y=$tang. $y$.

*Problem* 11. In a Catenarian curve, in which $a$ is the parameter, $x$ the absciss, $y$ the ordinate, and $z$ the arch; we have $d=\frac{z^2-x^2}{2x}$; $y=a.$ hyp. log. $\frac{z+x}{z-x}$, and the area included by the arch and the horizontal line joining its extremities $u=2(a+x)\,y-2az$. If we suppose this to be a maximum when $z$ is given or $v=z$, we shall have, by putting $x=zt$; $a=z.\frac{1-tt}{2t}$; $2\ (a+x)=z.\frac{1+tt}{t}$; $u=z^2.$ $\left\{\frac{1-t^4}{2t^2}\text{ hyp. log.}\frac{1+t}{1-t}+\frac{tt-1}{t}\right\}$, and $v=z$, hence $m=2$, $n=1$. $T\left(=\frac{u}{v^2}\right)=\frac{1-t^4}{2t^2}.$ hyp. log. $\frac{1+t}{1-t}+\frac{tt-1}{t}$, whose differential put $=o$ & reduced gives hyp. log. $\frac{1+t}{1-t}=\frac{2t(1+tt,)}{1+t^4}$ whence we may find $t$ and then $x$, $a$, $z$. This may be reduced to the same form as Professor Fisher's solution, by putting $s=\frac{1+tt}{2t}$, which gives log. $\frac{s+1}{s-1}=$ log. $\left(\frac{1+t}{1-t}\right)^2=$ $2$ log. $\left(\frac{1+t}{1-t}\right)$, and the preceding expression may be put under the form $\frac{2s^2-1}{s}$ hyp. log. $\frac{s+1}{s-1}=4$, as in his solution.

We shall add the following problem, not embraced in Professor Fisher's rules.

*Problem.* Suppose $u=x^3+axy$ and $v=x^4y$, $a$ being a given numerical coefficient, and let it be required to find the value of $u$ a maximum, when $v$ is a constant quantity.

The value of $u$ is not homogeneus in $x$, $y$, but it may be made so by substituting $Y^2$ for $y$ and then proceeding as above, or we may at once put $y=x^2t$, by which means we get $u=x^3(1+at)$, $v=x^6t$, whence $m=3$, $n=6$, and $T=\frac{u}{v^{\frac{1}{2}}}=\frac{1+at}{t^{\frac{1}{2}}}=t^{-\frac{1}{2}}+at^{\frac{1}{2}}$, whose differential put $=o$ gives $t=\frac{1}{a}$, whence $y=x^2t=\frac{x^2}{a}$, or $x=\sqrt{ay}$.

I have solved this problem as an example of the general method, but it is very evident that a simple solution might be obtained by substituting $y=\frac{v}{x^4}$ in $u$, by which it becomes $u=x^3+av\,.\,x^{-3}$, whose differential putting $du=o$, $dv=o$, gives $x=\sqrt{ay}$. But this simplicity could not be obtained if $v$ had been of a more complicated form, as, for example, if $u=x^3+axy$, as above, and $v=x^8y^2+3x^2y^5$. This does not come under Professor Fisher's form, but the substitution of $y=x^2t$ makes $u=x^3\ (1+at)$, $v=x^{12}(t^2+3t^5)$, whence $m=3$, $n=12$, $\frac{m}{n}=\frac{1}{4}$, $T=\frac{u}{v^{\frac{1}{4}}}=\frac{1+at}{(t^2+3t^5)^{\frac{1}{4}}}$, whose differential put $=o$, would give $t$, and thence $x$, $y$.

Various substitutions may be made besides those we have used; as for example, $y=x^pt$, $y^p=x^2t$, $y=x^pt+cx^2t$, &c. And if by any of these, or other similar substitutions, we can reduce $u$ and $v$ to the forms $u=U.\,T'$, $v=V\,.\,T''$, U and V being functions of *one* of the unknown quantities, (as for example $x$) and $T'$, $T''$ functions of $t$, we may from the last, $V=\frac{v}{T''}$, find $x$ equal to a function of $\frac{v}{T''}$. Substituting this in U, we get $u$ equal to a function of $\frac{v}{T''}$ and $t$, or of $v$ and $t$. Taking the differential, putting $du=o$ and $dv=o$, we obtain the value of $t$, and by this means, in many cases, we may solve the problems, in a very simple manner. It is unnecessary to enter into any greater detail, what we have said will explain the principles of the method. B.

*Boston, April* 18, 1824.

### *Remark by the Editor.*

The above papers, originally intended for the Boston Journal of Philosophy and the Arts—have been through the candour of the Editors of that Journal, and with the consent of the author, transmitted for insertion in this work.

## Art. XII.—*On the Precession of the Equinoxes.*

To the Editor of the American Journal of Science.

Sir,

In No. 2. Vol. VII, of the Journal of Science, you published an article upon the Precession of the Equinoxes. The writer of that article mentioned some objections to the common theory upon that subject which he considered insuperable. He also suggested the idea that our system revolves about a "distant centre" in what he calls the "Orbis Mundorum," and that the Precession of the Equinoxes is owing to the advance of the system in this orbit, while the earth revolves in the Ecliptic. I refer the reader to that article, for further particulars. I beg permission to say a few words relative to the writer's objections to the old theory, and also to mention some objections that arise in my mind to his "recently discovered" theory.

1. He says "that different astronomers with equal confidence, form different conclusions relative to the size and shape" of the Equatorial ring, "and until these are positively known, no rational or conclusive demonstration can be made of the nature and power of its attraction." It has been satisfactorily proved by the Trigonometrical Surveys, and by the vibration of the pendulum that the Equatorial diameter of the earth, exceeds the Polar at least thirty-four miles, and consequently it is proved that a protuberant ring of matter surrounds the earth seventeen miles in thickness extending north and south of the equator, until it gradually becomes nothing

On the supposition that the mean density of the ring equals the mean density of the earth, (considered as a sphere surrounded by this ring,) Newton proved that the quantity of matter in the earth : quantity of matter in the ring : : 529000 : 461. He also calculated that the momentum of the ring spread out in its natural place, is equal to the momentum of a ring of moons surrounding the equator, containing $\frac{2}{5}$ of the same quantity of matter. It has likewise been calculated that the influence of the sun upon the equatorial ring to turn it about its centre is equal to the influence it would exert upon a ring of moons placed at the equator, containing $\frac{1}{5}$ of its quantity of matter. (*Vince's Astron. Vol. 2. p.* 114—15, *and old Encyclop. Art. Precession.*) With these agree the calculations of Frisius, Bradley, D'Alembert and Euler. But it is said that these things are not "positively known." If they are not, it is true that conclusions drawn from these data correspond with fact, which I consider a strong argument in their favor.

2. It is said that "the case is not exactly parallel with that of the Lunar motions," for the ring *surrounds* the equator, and the centre of the equator "and the centre of the ring is the centre of the attraction," and consequently "all the effect the sun can have in consequence of the ring arises merely from the different distances" of its perihelion and aphelion. Perhaps the case is not exactly parallel with that of the Lunar motions. But their *analogy* is such that one may fitly be used to illustrate the other. If the writer means by "centre of attraction," the centre of gravity in relation to the sun, then I say that the centre of attraction and the centre of the ring, (meaning the the centre of matter in the ring) cannot coincide. For the different distances of the perihelion and aphelion of the ring, which the writer considers *too small* to produce any effect, will manifestly prevent such a coincidence. In fig. 1 Plate II. Let PRP be the earth, RR' a ring of matter about the equator. C the centre of revolution which I call also the centre of matter in the protuberant ring, and S the sun. Then if C be the centre of gravity towards the sun. the momentum of the half of the ring RC=R'C, the other half. But the momentum is equal to the quantity of matter multiplied into the velocity. In this case the quantities of matter are by supposition equal. The momenta of the parts of the ring will vary then as their velocities i. e. as the attraction of the sun upon the parts R and R'. Now the attraction of the sun diminishes as the square of the distance increases. Its attraction then upon R : its attraction upon R' : : $1\frac{1}{1000}$ : 1 nearly. Wherefore C the centre of motion cannot be the centre of gravity of the ring towards the sun. It must be at some point between R and C; say D. Wherefore it is evident that the greater attraction for R the part of the equatorial ring nearest the sun will have the same effect upon the motion of the earth as though the earth was a sphere with a

solitary moon continually situated on the side nearest the sun.

It therefore appears that the sun may have *some* effect upon the equatorial ring arising "*merely* from the different distances" of its perihelion and aphelion. I shall now proceed to mention how great an effect it has been calculated to have. Newton proved that the sun's attraction should bring the equator sooner to the ecliptic so as to produce a mean precession in the equinoxes of 9″. 07‴ only, for he assumed as true that the motion of the nodes of a rigid ring of moons is just equal to the motion of the nodes of a solitary moon. Frisius demonstrated that *the motion of the nodes of a rigid ring of moons must be double that of a solitary moon.* Consequently taking Newton's data he proved that the sun alone might cause a precession of 18¼″. Vince shows that the sun acting upon the equatorial ring may cause a precession of 21″. 6‴. The European astronomers all agree that the sun alone may cause an annual precession from 18″ to 21″. The *mean* annnal precession of the equinoxes is 50¼″. It is calculated that the moon alone will produce a mean annual precession of about 30″. The action of the moon upon the equatorial ring is not so uniform as that of the sun, because its orbit is inclined to the equator 10° more at one time than at another. If the precession is caused by the joint action of the sun and moon it should be variable. Facts prove that it does vary according to the inclination of the moon's orbit, and according to its place in the orbit. The moon when in the most favorable situation will produce a precession of 35″ nearly. The annual precession should vary, in order to agree with calculations, from about 45″ to 55″. This agrees with fact. This calculation makes the influence of the sun about one half as great as that of the moon. This is as we should expect, for in producing tides the sun exerts very near one half as much influence as the moon.

3. It is said that "the precession of the equinoxes if caused by the equatorial ring must arise" "from a diminution of the angle of the equator with the ecliptic, or from a change in the direction of the line of the equatorial nodes." The writer goes on to state that we have *no evidence* of such a regular diminution of the angle, and immediately after says that the nutation of the earth's poles is produced by the diminution of

the ecliptic angle caused principally by the moon's attraction. Now I ask if the diminution of the angle to produce the nutation of the poles will not necessarily produce a precession of the equinoxe ? Further, he says, it cannot arise from a diminution of the ecliptic angle, for that would produce a sensible effect upon the seasons. It would diminish the angle but a few seconds, and consequently would have about as much effect upon the seasons, at any given place, as a person would experience by moving N. or S. 5 miles. Dr. Bradley, Vince and some others have calculated what the diminution of the angle should be, and find that the calculations agree with fact.

What is meant by saying, that the precession of the equinoxes "must arise"—"from a change in the direction of the line of the nodes," I am not able to tell.

Since calculations have been made relative to the power of the attraction of the sun and moon upon the equatorial ring, and since the calculated effects of the same correspond so precisely with facts, I must say that I am not able to see the validity of the writers objections to the old theory.

I think there are some insuperable objections to the *new theory*, two of which I will mention.

1. The diameter of the "orbis mundorum," must be of very great length. The system must perform a revolution in 25920 years. If the orbit be circular the system must move *uniformly*, and consequently the annual precession of the equinoxes must be *uniform*. But if the "orbis mundorum" be an ellipse, then the system either moves with an accelerated or retarded velocity. Now the precession of the equinoxes is in fact quite *irregular*. How then I ask can this irregular precession be produced by the regular motion of the system about a distant centre.

2. The attraction of the "distant centre" must be immensely great, and probably would affect the motion of the earth in the ecliptic nearly as much as the sun affects the motion of the moon revolving about the earth. While the earth is passing from that part of the ecliptic the most remote from the "distant centre" to the part nearest, its motion would be accelerated, and in passing through the other half of the ecliptic retarded. To find accurately then the apparent place of the sun in the ecliptic for any given

time, an equation must be found shewing how much the motion of the earth is affected by the attraction of the "distant centre." But the apparent place of the sun is found without any such equation. It must be true then that the system does not move in any "orbis mundorum."

E. D.

*Williams College, March*, 1824.

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## Art. XIII.—*Account of a new Air Pump, in a letter to the Editor from Joseph H. Patten.*

*Newport, R. I. Jan. 14th*, 1824.

Dear Sir,

I enclose for your inspection, the draught of a pneumatic pump, which I think, will in a considerable measure obviate the defects of those in common use. The construction is so simple that it will require but a small share of skill, or ingenuity to put it together, and it will be less liable to get out of repair than the pumps now in use. The valves which in other machines are a great source of difficulty, may be made larger and stronger, and the apertures, of course, will be more accurately closed, without at all affecting the degree of exhaustion. The vapour arising from the oil necessarily used in all pneumatic instruments, is in this completely excluded from the receiver, and the vacuum in the *exhauster* being torricellian, that in the receiver will approach as near to it, as the elasticity of the air will permit. The glass parts of the instruments can be obtained from any glass house, and the barrel, (which would be more elegant of glass) can be made at any steam engine or gun manufactory, and a clock maker will be competent to construct the brass work The subjoined sketch, although not drawn by an adept in the art, will, I hope, give you an idea of it. It represents a vertical section of a *table* pump, supposed to be divided directly through the centre, with one half of the wood work, to which it is attached.

It is a number of months since I first thought of it; I then had one constructed with a barrel of *sheet brass* and the plate of the pump of tinned iron; it was very coarsely done, and the exhauster was filled with *linseed oil*, but notwithstanding its roughness, it far exceeded my expectations. I have never yet been able to get an iron barrel, as it cannot be procured here, and numerous avocations have prevented its being obtained elsewhere.

Figs. 1st and 2d correspond in their lettering.

In fig 1st. (see plate II.) AB, CD, EF, represent a vertical section of the instrument, G is a barrel of cast iron or glass, screwed firmly to the table EF, in it is the solid piston H moved by the rack work I. K is a glass globe resting upon the table CD, of a little less capacity than the barrel G with which it communicates by the glass tubes L and M firmly cemented into the peice N and into the bottom of the barrel G. To the top of the globe K is cemented the thick cap O, through which are made two apertures, into one of which is screwed the stop-cock P communicating with the plate of the pump R; over the other aperture rests the valve S opening nto the atmosphere, (the construction is seen in fig. 2d.) In the globe K is a stiff wire ascending into the cock P a short distance, and on it is screwed the valve T; the other end descends into the tube L, and to it is attached the wooden or cork ball U. We will now suppose the piston H withdrawn, and the barrel G filled with quicksilver; the tubes L and M being open will be filled to the height of the dotted line. Put the piston carefully in so that no air shall be between it and the mercury. As the piston descends, the mercury rises, and when it reaches the ball U it floats it, and by means of the wire forces the valve T against the aperture that communicates with the receiver R, and as the mercury continues to rise, the air driven before it has no way of escaping but through the valve S. The piston is now at the bottom of the barrel, and the globe is full of mercury,—if the piston be now drawn up, a vacuum would be formed in the *barrel*, but the mercury in the globe *must* descend as it is above the level of the piston the whole height T, and the vacuum in the globe K would be Torricellian were there not a communication between it and the receiver R. When the mercury again ascends into the globe, it expels every particle of air provided the mercury rises into the aperture at S; and to ensure this the cap O is formed into a rim so as always to supply the contraction or waste, and it is admitted towards the end of the exhaustion by raising the valve S with the finger. The air is admitted through a hole *a* in the cock P, a section is shewn fig. 3d. The cap O should be strong and if brass should be coated with the cement used in attaching it to the glass, (that used for nautical machines is best,) the gage may be attached to the cap, or enclosed in the receiver.

The stiff wire, with the valve T and the ball U, may be entirely removed; and for it may be substituted a glass tube open at both ends cemented into the cock P, and reaching almost to the bottom of the globe. The mercury, when it rises to the lower end of this tube, cuts off the communication with the receiver. This will perhaps be the simplest and best plan. It may be made a double pump by connecting the cap O with the barrel G, as on the dotted line *b*—one valve opening in and one out. The weight of the mercury will be no objection as the machine is small—the diameter of the globe about 4 inches, the height of the barrel about 8, and the whole height to the plate R, 15 or 20 inches.

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Art. XIII.—*A brief account of some Electro-magnetic and Galvanic Experiments.* By Robert Hare, M. D. Professor of Chemistry in the University of Pennsylvania.

Seven hundred feet of copper wire, nearly as thick as a knitting needle, were made to encircle the columns of the Lectnre Room. One end of the wire was connected with one end of a large calorimotor—the other, terminated in a cup of mercury—into this, a wire proceeding from the other pole of the calorimotor was introduced. Under these circumstances, a magnetic needle placed near the middle of the circuit, was powerfully affected—and when the circuit was first interrupted, and then re-established by removing the wire from the cup, and introducing it again, the influence appeared to reach the needle as quickly as if the circuit had not exceeded seven inches in extent. The needle being allowed to become stationary in the meridian, while the circuit was interrupted, and the end of the wire being then returned into the mercury, the deviation of the needle, and the contact of the wire with the metal, appeared perfectly simultaneous.

A wire was made to circulate with great rapidity, by means of two wheels about which it passed like a band. The wheels being metallic, and severally connected with the different poles of a colorimotor, it was found that the motion neither accelerated nor retarded the galvanic influence—and it made no difference whether the needle was placed near the portion of the wire which moved from the positive pole to the negative, or the portion which moved in the opposite direction.

If a jet of mercury, in communication with one pole of a very large calorimotor, is made to fall on the poles of a horseshoe magnet communicating with the other, the metallic stream will be curved outwards or inwards, accordingly as one or the other side of the magnet may be exposed to the jet—or as the pole communicating with the mercury may be positive or negative. When the jet of mercury is made to fall just within the interstice formed by a series of horseshoe magnets, mounted together in the usual way, the stream will be bent in the direction of the interstice, and inwards or outwards, accordingly as the sides of the magnet, or the communication with the galvanic poles, may be exchanged. This result is analogous to those obtained by Messrs. Barlow and Marsh, with wires, or wheels.

It is well known that a galvanic pair, which will, on immersion in an acid, intensely ignite a wire, connecting the zinc and copper surfaces, will cease to do so after the acid has acted on the pair for some moments—and that ignition cannot be reproduced by the same apparatus, without a temporary removal from the exciting fluid.

I have ascertained that this recovery of igniting power does not take place—if, during the removal from the acid, the galvanic surfaces be surrounded either by hydrogen gas, nitric oxide gas, or carbonic acid gas. When surrounded by chlorine, or by oxygen gas, the surfaces regain their igniting power, in nearly the same time as when exposed to the air.

The magnetic needle is, nevertheless, much more powerfully affected by the galvanic circuit, when the plates have been allowed repose, whether it take place in the air or in any of the gases above mentioned.

I have not yet had time, agreeably to my intention, to examine the effect of other gases, or of a vacuum.

ART. XIV.—*Remarks upon Prof. Vanuxem's paper on fused charcoal, published in Vol.* IV. p. 371, *of the Journal of the Acad. of Nat. Sci. at Philadelphia.*

PROF. VANUXEM has examined, chemically, a portion of matter obtained from charcoal, by Dr. Macneven, by the use of Dr. Hare's Deflagrator, and finds it composed, (as to a little more than one half,) of iron and silex. Its weight was only 0.385 of a grain or less than four tenths of a grain, and on even this small portion there was a loss of nearly one half.

Mr. Vanuxem has not done me the honour to mention me, or my experiments, but as no other person (within my knowledge) has published any thing on the fusion of charcoal, I am obliged, however reluctantly, to appropriate his remarks, and to consider them as intended to invalidate some part of the results which I have published.

The substance upon which Mr. Vanuxem operated, is, evidently, from his description of its properties, a different thing, in most respects, from the greater part of the fused masses which I obtained, and if he will take the trouble attentively to peruse my several papers, in the fifth and sixth volumes of this Journal, he will observe that there was much variety in the products, and that I was myself not unaware, that earthy, alkaline, or other foreign matter might have contributed to, at least, some of the results.

I am not disposed to question, that the silex and iron, obtained by Professor Vanuxem, existed in the matter transmitted by Prof. Macneven, but, when this matter is acted upon by so powerful an agent as hot nitric acid, and there is found to be so serious a loss as 1.05 out of 2.50 we are surprised that no means were taken, to collect the *gaseous* products, and to ascertain whether carbonic acid was not formed? No means to consume and waste the carbon, could be better devised, than those employed by Mr. Vanuxem. If we contrast the *negative* fact that he obtained no evidence of the existence of carbon, when it is obvious that in the way in which he proceeded, it was impossible he should discover it, even if it existed in large proportion—if we contrast this procedure, with the *positive* result, obtained by myself, when

I consumed, the fused carbon in pure oxigen gas, by means of the solar focus, and obtained a decided product of carbonic acid, it will probably not be thought extraordinary if I regard Mr. Vanuxem's couclusion as premature, and not fully justified, even by his own statement, in regard to the particular specimen which he examined.

It is very possible that some of the globules obtained in my experiments, may have consisted *in part* of foreign matter, although the proportion of such matter in charcoal prepared in the manner in which mine was, is extremely small; and it will be recollected that Messrs. Allen and Pepys, in their famous experiments on the combustion of carbon, considered such charcoal, as so nearly pure, that little or no allowance was necessary to be made for any foreign matter in estimating the quantity of oxygen, requisite for the combustion, and the quantity of carbonic acid actually produced. In my experiments on the fusion of charcoal, nearly the whole of that part of it, which was exposed to the action of the voltaic current, was rapidly converted, into melted matter, and there was so little waste of the charcoal point, that it was impossible to doubt, (nor have I *now* the smallest doubt,) that the carbon underwent a true fusion.

I will not now advert to the many novel and interesting phenomena, (at least as they appeared to me,) which attended these experiments; but it would be very easy to state many circumstances, which are entirely irreconcileable with the supposition that there was no fusion of any thing except foreign matter.

As I have been unexpectedly called upon to make these remarks, I must be allowed to add, that at the time my experiments were performed, and the reports of them drawn up, my health was so rapidly declining, that it was with the utmost difficulty I finished my experiments, by operating, (at last) only for a few minutes, at a time, and by employing others, to put upon paper what I had observed. My labour was at last left unfinished, and many things omitted which I intended to perform. I have never been able to enter the laboratory since, for the purpose of resuming these or any other labours. This is the sole reason, why I have not prosecuted the subject, and investigated the numerous branches of enquiry, which were suggested by results and phenomena so unexpected; particularly, I have been very anxious to examine, by the obvious and decisive means which chemistry affords, *all* the varieties of melted matter which I obtained, and I have been desirous that my experiments should be repeated *in their full extent* by others; of course, I can have no objection to a fair examination of any part of the subject, and I am glad to see Prof Vanuxem or any other man of science engaged in the inquiry. His results are in point, as to the particular specimen, which he examined, except that he omitted the precautions necessary to ascertain whether carbon was present. I must be allowed to say however, that the conclusions he has drawn, and the opinions he has expressed, appear to me too broad, for the basis upon which they are erected. and although he had succeeded in proving that the specimen, which he examined contained no fused carbon, it by no means follows that other specimens might not have consisted principally or wholly of this substance, and it would have seemed to me *on every ground*, more desirable, to have made more extended and varied experiments, and to have foreborne to decide, from the examination of *one* very minute portion, that a conclusion founded on hundreds of experiments, was erroneous.

My own opinion is, that among the fused substances which I obtained, some were composed principally of foreign matter, and others of carbon in a state of as great purity, as it could be afforded by the substance under examination. nor shall I consider these opinions as disproved, until a course of experiments, *as extensive as my own*, is instituted and all the varieties of melted matter rigorously examined.

In the present state of my health, it is impossible to say when I shall be able to resume the inquiry.

B. SILLIMAN.

## MISCELLANEOUS.

Art. XV.—*Notice and Review of the* "Reliquiae Diluvianae; *or Observations on the Organic Remains contained in Caves, Fissures, and Diluvial Gravel, and on other Geological Phenomena, attesting the action of an Universal Deluge.* By the Rev. William Buckland, B. D., F. R. S., F. L. S., Member of the Geol. Soc. London, Hon. Memb. Amer. Geol. Soc. &c. &c., and Professor of Mineralogy and Geology in the University of Oxford. Quarto, pp. 303—27 plates. London, 1823.

A few years ago, the editor of a journal of science, who should admit into his pages an analysis of a new work on the geological evidences of the deluge, would have run some hazard of losing his reputation as a lover of demonstration and strict inductive philosophy. And even at this day, the above title page may possibly excite some jealousy and alarm, in here and there, a mathematical mind, lest Newton and Bacon are about to be abandoned, and they are to be mounted on the Alborak* of Burnet, or Whiston, or Hutchinson. But we can assure such persons that these fears are entirely groundless; and, although a considerable part of the argument of this book is derived from such unpromising topics as bones and caverns, we think that the author has succeeded in drawing from them both the most convincing conclusions, and the most interesting and entertaining descriptions.

The friends of revelation may also be anxious to know the bearing this book has upon the Mosaic history; and we can assure them likewise, and we do it with pleasure, that we have never met with a work on natural history merely, which corroborates that narrative so much as this.

It is unfortunate for geology, that during the dark ages of the science, so many and such ridiculous speculations should have been mingled with it. A prejudice has thus been excited against the science, which remains to this day; and very many men of ability and learning in other sciences, who are ignorant of the details of modern geology, associate with the very name of the sci-

* The horse on which Mahomet performed his celebrated night journey to heaven.

ence, the ideas of hypothesis and extravagance. Yet the wanderings of their predecessors, "damned to everlasting fame," serve as beacons to warn modern geologists of their danger; and the fate of these theorists does exert a salutary influence upon them. We do not fear to hazard the assertion, that as a body, no class of philosophers are more cautious of mere hypothesis, than the respectable geologists of the present day. To amass facts, is the object they pursue with unremitted ardor. We appeal to the transactions of the European geological societies, to the public scientific journals, and to such works as those of MacCullock, Conybeare, Phillips, Greenough, Cuvier, Brongniart, and Maclure, in proof of these declarations.

It is important, however, since all men are prone to indulge in wild hypotheses, that the extravagancies of former theorists be frequently held up before them, and by referring to former speculations upon the deluge, we think it will exhibit to greater advantage the cautious spirit, and severe inductive logic, of the treatise we have undertaken to examine.

The name of Burnet is "familiar as household words," on this subject. And the mere title page of his book, written more than a century ago, is enough to show us how mistaken he was in regard to the nature and extent of geological knowledge—"The sacred theory of the earth, containing an account of the original of the earth, and of all the general changes which it hath already undergone, or is to undergo till the consummation of all things." He tells us that the primitive earth was no more than a spherical rind or crust, perfectly smooth, destitute of mountains and seas, which, being heated by the sun, became dry and full of chinks, and by the expansive force of the enclosed vapour, the crust burst asunder and fell down into the deep, and caused the waters to overflow and drown the inhabitants.

Dr. Plot, in 1677, having taken it for granted that the Noachian deluge was the cause of all the organic remains found in the earth, and perceiving this to be totally inadequate to produce such effects, extricated himself from the dilemma, by saying that "the great question now so much controverted in the world is, whether the stones we find in the form of shell fish, be *lapides sui generis* naturally produced by *some extraordinary plastic virtue*, latent in the earth, in quarries where they are found; or whether they rather owe their form and figure to the shells of the fishes they represent:" and he gravely sustains, by numerous reasons, the former of these opinions.

M. Bourguet maintained that the original earth was formed at once, and afterwards gradually softened, and at length suddenly dissolved—producing we suppose the deluge—and through the agency of fire, it then began to be consumed, and that it is now like a bomb shell with its match on fire, and ere long will be blown up with a dreadful explosion.

Robinson, a clergyman of the English established church, gave, in 1694, an anatomical description of the earth, in which he undertook to prove "that matter at first consisted of innumerable particles, of divers figures, and different qualities, running a reel in dark confusion till the world, by the infusion of a vital spirit, became a *great animal*, having skin, flesh, blood, &c." In the eighth chapter of his "Anatomy of the Earth," he treats of "the belly of the earth." He thinks it undeniably certain, that the centre of the earth contains a vast cavity of a multangular figure, "filled up with a crude and indigested matter, endued with several different and contrary qualities, which are in a continued struggle and contention among themselves." When the airy particles prevail, they break through the crust or skin of the earth in hurricanes; when the fiery particles triumph, volcanic eruptions and earthquakes are the consequence; and these are sometimes so violent that "the very ribs of the earth" are broken; "and these convulsions are as natural to the earth," he says, "as fevers, agues, and other distempers are to the bodies of other animals."

Authors, in all ages, have found no difficulty in establishing the position, that the central parts of the earth contain water enough to produce the deluge. The difficulty has been, how to raise it from the centre, so as to drown the surface.* Ray had recourse to a shifting of the earth's centre, whereby the water was drawn after it, and overwhelmed the dry ground by successive inundation. Dr. Hook, however, supposes the earth was compressed into a prolate spheroid, just as a lemon is squeez-

* See some suggestion to elucidate this subject, in the notice of Hayden's Geological Essays, Vol. III. p. 52, &c. of this Journal.—Ed.

ed in the hand for extracting the juice. This would deluge the depressed zone; but how the elongated or elevated extremities were inundated, he does not inform us.

Dr. Woodward supposes, that during the deluge, all the most solid bodies, as stones, metals, minerals and fossils, were totally dissolved and finally subsided again and formed rocks; the water encompassing the whole. Afterwards an agent, seated within the earth, broke up these strata, forming mountains and vallies. continents, islands, and seas. He does not tell us what Moses meant by the mountains, above which the waters of the deluge rose fifteen cubits.

From the days of the Lydian Xanthus to Granville Penn, great use has been made of earthquakes and subterranean fires, in accounting for the phenomena of the crust of the globe; and it has been a favorite opinion, entertained even by some of the most respectable naturalists of the present day, that the sea and land changed places during the last diluvial catastrophe that happened to the globe. But we think Professor Buckland, as will shortly be seen, has forever put this question at rest, and proved that no such change has taken place.

Hutchinson, the founder of a sort of visionary school, was the disciple of Woodward; but he virulently attacked the hypotheses of his master. He maintained the hurtful opinion that the fundamental principles of natural philosophy are to be found in the sacred scriptures; and asserted this, and all his other opinions, with disgusting dogmatism and self sufficiency. Newton he attempted to ridicule, and accuses him of an intention to destroy religion. He made, however, some valuable observations upon diluvial action, and promoted geological inquiry, by directing his disciples to an examination of the structure of the earth.

Catcott was one of these disciples, and his work on the deluge is probably the best of that school. He has treated the subject of diluvial currents with great ability. But he was seduced by the extravagances of hypothesis, and inserted in his work a plate exhibiting "the internal structure of the terraqueous globe, from the center to the circumference," and with great seriousness, advises his readers to make themselves well acquainted with this, as rendering plain and clear the philosophical explanations of the flood. In explaining this plate, he remarks "that the opinion of the ancients concerning the earth's resembling an egg, has great propriety in it; for the center nucleus, by its innermost situation and shape, may well represent the yolk; the abyss of water, which surrounds it, and is in a middle position, may stand for *the clear fluid of the white;* the crust of the earth (allowing only for its breaks and cracks,) by its roundness, hardness, uppermost situation, and little inequalities on its surface, is justly analogous to the shell."

The celebrated theory of Whiston, that imputes the deluge to the shock or attraction of a comet, has had as many supporters, as any other; and a late able geological writer, after sweeping away every other hypothesis, suffers this to remain as perhaps better than none.

Very different from these wild freaks of imagination, are the writings of modern geologists. Even when they propose hypotheses, it is with the premonition that they are of little importance, and not entitled to much confidence.

The recent "Comparative Estimate of the Mineral and Mosaical Geologies," by Granville Penn, Esq. we feel obliged reluctantly to notice, as an exception to this remark. We know nothing of this gentleman, except what we learn from this book; and this exhibits him in the character of a good scholar, who is well versed in philology, and who has read most of the modern treatises on geology: but really we do not fear to hazard the assertion, that he has not seen much of rocks in their native beds. Yet he has made a vehement attack upon modern geology. He assumes in the first place, that the mineral and Mosaical geologies are directly opposed to each other, and absolutely irreconcileable; so that if the one be true, the other is false. He then endeavors to extract the "root or fundamental principle" of the mineral geology, which root, he conceives to be the hypothesis of a primitive chaotic ocean, containing in solution the materials of which the solid parts of the globe were formed by a gradual process of precipitation and crystallization. He next puts forth his mightiest efforts, to prove that such a supposition is directly opposed to the philosophy of Bacon and Newton; who, by the way, lived in an age when almost nothing was known of geology.* In this discussion, he brings forward not a single fact in proof of his position, and notices but few of the facts which geologists adduce to support the contrary; but relies on abstract reasoning. He objects against "maintaining a constant skirmish with cavillers and sophists, whose policy it is to challenge a perpetual warfare on the road, that it might not be travelled to the end." These cavillers and sophists are none other than certain stubborn facts, and really we do believe they would have stopped Mr. Penn, had he not taken an airy route above them. Whether the course he has adopted, (to say nothing of the facts which geology discloses in opposition to his peculiar views,) be preferable to one recently recommended in this country, viz. to "*deny the facts*,"† we shall not undertake to determine.

Mr. Penn seems to have become possessed with the idea that geologists are banded together against revealed religion; and he even tells us, "it is manifest, that the mineral geology, considered as a science, can do as well without God, (though in a question concerning the origin of the earth,) as Lucretius did." We know not but Mr. Penn may have met with infidel or atheistical geologists. But we can assure him, that there are very many among them, both in Europe and this country, who do not merely give their assent to the truth of revelation, but whose whole hope rests upon it; whose attachment to it is stronger than death, and who count it their chief glory and happiness, to defend and enforce its glorious truths:—men, who rejoice to see in every rock formation the marks of a creating and upholding God; and are they to be counted atheists, because they happen to differ from Mr. Penn in regard to the mode in which creating energy was exerted? We sincerely protest against any such efforts to divorce science from religion. What "God hath joined together, let no man put asunder."

Although Mr. Penn appears to have studied geological writers attentively, we are persuaded he does not fully understand them in regard to the original creation and subsequent arrangement of rock strata. He quotes from Ba-

* And not much more of Chemistry. Ed.

† See Evangelical Witness, March 1824, p. 374.

con a passage, as if in opposition to geology, wherein it is stated, that " there is nothing in the History of the Creation, to invalidate the fact, that the mass of the earth was created—*confusa*—confusedly or undistinguishably, in one moment of time ; but that six days were assigned for disposing and adjusting it :—so that the matter itself seems to have been, as it were, a work off hand ; but the introduction of its form, bears the style of a law or a decree." Now we believe this is in perfect accordance with the views of most geologists. They suppose that all the materials of the globe were brought into existence in a moment, by "the creative fiat of Almighty God," and that six days were employed in the arrangement of this mass, which some denominate chaotic : and because some understand these six days to be longer than six literal days, are they, therefore, to be considered atheists or even infidels ?

But what if Mr. Penn has succeeded in tearing away what he assumes as the root of mineral geology ? We do believe that he has mistaken a mere branch for a root : or if it be a root, it is not the main one. Its loss will not injure the trunk at all. Geologists of the present day do not feel much alarmed for their science, though the root of Werner's and Hutton's hypotheses be eradicated, so long as the root of *geology* remains : so long as the leading facts, in regard to the relative position, disruption, inclination and imbedded fossils of rocks, remain untouched. We think, indeed, that any one who will examine rocks, not merely in books, but in their native beds, will inevitably conclude that they must once have been in a state of fluidity. But he might reject such a supposition and still not be an outcast from the science, nor forfeit the communion of the brotherhood.

Alarmed as this writer is, when geologists demand time for the formation of the primitive rocks, he is not afraid to allow the period from the creation to the deluge for the deposition of the secondary rocks. Much as he cries out against hypothesis, he contends that the earth was originally a perfect sphere, covered over with water, and that its shell was broken up, or grooved, " by the violent action of mechanical agencies," so as to form the sea and the dry land ; and that, at the deluge, these hollows were elevated and the continents sunk, by the operation of earthquakes and other violent agencies. This supposition, that the sea and land changed places at the deluge, has long been a favorite opinion of naturalists, even of those as eminent and recent as Cuvier; and it forms the key stone of Mr. Penn's system. But it happens, that the discovery of some brok en hyæna's bones an a cave at Kirkdale by Professor Buckland, completely refutes this notion, and proves that the antediluvian continents were the same as our present continents. M. Cuvier has had the candor, since the publication of Mr. Buckland's book, to acknowledge the incorrectness of his opinion. (Ossemens fossiles, 2d Edit. vol. 4, pp 224-486.) Mr. Penn has had—(we think our readers, when they shall learn the facts, will call it) *the obstinacy*—to persist in his opinion, and to publish a "Supplement" of criticisms on the Kirkdale evidence. But *more* of this hereafter.

Mr. Penn contends for the most exact adherence to the letter of the scripture. Yet he does not hesitate, to answer his own purposes, to adopt that very questionable rule of interpretation advanced by Rosenmuller, that "Moses speaks according to *optical*, not *physical* truth." He maintains too, that the sun and moon were created on the first *demiurgic* day, although Moses expressly declares they were created on the fourth. He believes too, and attempts to prove, that only a part of the various species of animals on earth, were saved in the ark, in direct contradiction to the declaration of Moses, that God commanded Noah "*of every living thing of all flesh, two of every sort, shalt thou bring into the ark.*" We state these things, not because we have any serious objection to such views, but merely to show, that this writer, when occasion demands, can use as great liberties with the language of scripture as other men.

But we will detain our readers no longer from the work of Professor Buckland.

The object of this work, as the title page evinces, is to exhibit all the important geological evidences of the last grand diluvial catastrophe to which our planet has been subject:—or, as it has been recently stated in a foreign Review, to give us the "geology of the deluge." (Ed. Rev. Oct. 1823.) Much error has existed on this subject, because writers on the deluge have resorted to the secondary and tertiary rocks, in search of evidence. But it is now proved, beyond all reasonable doubt, that the various fossils imbedded in the regular strata of the earth, could not have been lodged there by the deluge: "the phenomena in question (as a late European writer observes,) being now universally regarded as of antediluvial production." We must, therefore, look for proofs of the Noachian deluge in those loose deposites of loam and gravel, confusedly mingled together, and spread over every country on the globe; which mantle is appropriately denominated *diluvium*, and must carefully be distinguished from *alluvium*, which is the result of causes, now in operation. It is in this diluvium, that the principal geological evidences of the deluge occur. The present work exhibits in two parts and an appendix, three general divisions of the argument. The proofs of the deluge are:

1. The phenomena of caves and fissures in rocks.
2. The beds of diluvium spread over every part of the earth and containing the bones of animals.
3. The excavation of vallies by diluvial action.

The first class of proofs occupies the largest portion of Prof. Buckland's work, and is chiefly original. As the cave at Kirkdale, in Yorkshire, was first discovered and explored, and is most fertile in curious facts, we shall not hesitate to give its history, somewhat in detail, although this has already been done more or less in various periodical works, but we apprehend that these interesting facts are still unknown to many of our American readers. It is well known to geologists, that the compact limestone districts of England, Ireland, Carniola, and the United States, are remarkable for the number and extent of the caverns and fissures which they contain. No less than twenty-eight of these, and as many fissures, are enumerated in England; and the cave at Kirkdale adds another to the number. This was not known to exist, till the summer of 1821, when it was discovered by working a large quarry along the slope of a hill. The original entrance of the cave was extremely small, and was closed by rubbish. Its length is not far from 245 feet, varying much in diameter, but never exceeding seven feet in breadth and fourteen in height. The roof was covered with pendent stalactites, and the floor partially with an incrustation of stalagmite. Upon this.

lay a coat of soft mud, or loam, " covering entirely its whole bottom, to the average depth of about a foot, and concealing the subjacent rock, or actual floor of the cavern." This mud is an argillaceous and slightly micaceous loam, composed of such particles as would easily be suspended in water, and is mixed with much calcareous matter. Above this mud, was a second crust, or plate of stalagmite, shooting over its surface, like ice upon water, or cream on a pan of milk. It did not extend, however, over the whole surface of the mud. In this mud, which contained no pebbles, and in the stalagmite beneath it, were found a large quantity of the bones of various animals, mixed confusedly together, and, almost without exception, broken into angular fragments and splinters of every size. They are in a high state of preservation, most of their original gelatine being preserved. Those, however, that lay at the bottom, and had probably been in the cave a long time previous to the introduction of the mud, were in various stages of decomposition. Not a fragment of the bones had the appearance of being worn by the action of water.

The genera of animals, identified in the Kirkdale cave, are twenty three : viz. the Hyaena, Tiger, Bear, Wolf, Fox, Weasel, Elephant, Rhinoceros, Hippopotamus, Horse, Ox, Deer, (3 species) Hare, Rabbit, Water-rat, Mouse, Raven, Pigeon, Lark, Duck and Partridge. Most of these belong to extinct species.

Professor Buckland's attention was drawn to this subject by observing, that some of the hyænas' bones, presented to him from this cave, were worn down in a very peculiar manner, very differently from the effect which would have been produced by water. He immediately conjectured that these bones came from a den of those animals, and that the wear and polish they exhibited, had been produced by the repeated tread of living hyænas over them; and if so, that this animal, confined at present to warm climates, must once have been an inhabitant of Yorkshire. Invited by such interesting motives he hastened to Kirkdale to examine the cave and not only did he find, in the local circumstances, abundant confirmation of this opinion, but also many striking evidences of the Noachian deluge. If we fail in giving an abstract of the facts and reasonings that led to these highly important results, we can assure our readers that they will find the chain complete in Professor Buckland's work.

As already observed, all the larger bones found in the Kirkdale cave are splintered, broken and gnawed, so "that there is no hope of obtaining materials for the construction of a single limb, and still less of an entire skeleton." The teeth and solid bones of the tarsus and carpus, however, are not usually fractured, and their number is twenty times greater than could have been supplied by the individuals whose bones are found in the cave. One collector alone obtained more than 300 canine teeth of the hyaena ; which must have belonged to 75 individuals ; and it is certain, that 200, or 300, of these animals, must have died in the cave. Let us hear the author's conclusions from such facts.

"It must already appear probable, from the facts above described, particularly from the comminuted state and apparently gnawed condition of the bones, that the cave at Kirkdale was, during a long succession of years, inhabited as a den by hyænas, and that they dragged into its recesses the other animal bodies, whose remains are mixed indiscriminately with their own : this conjecture is rendered almost certain by the discovery I made, of many small balls of the solid calcareous excrement of an animal that had fed on bones, resembling the substance known in the old Materia Medica by the name of *Album Graecum* : its external form is that of a sphere, irregularly compressed, as in the fæces of sheep, and varying from half an inch, to an inch and an half in diameter. It was at first sight recognised by the keeper of the Menagerie at Exeter Change, as resembling both in form and appearance, the fæces of the spotted or Cape hyaena, which he stated to be greedy of bones beyond all other beasts under his care." p. 19. This album græcum was analysed by Dr. Wollaston, and found to consist, as might be expected, of fæcal matter, derived from bones, of phosphate of lime, carbonate of lime and a small proportion of the of the triple phosphate of ammonia and magnesia. Since the publication of Mr. Buckland's work, the album græcum has been found at the cave in much greater quantities than was at first supposed. (Ed. Rev. Oct. 1823, p. 208.)

The hyænas' bones were as much fractured as those of other animals, and many of the splinters bore the marks of teeth of the size and form of those belonging to the hyæna. The teeth and bones of this animal were usually found to have belonged to individuals very old, or very young; while the bones and teeth of the other animals, did not indicate age, but appeared to have belonged to animals that perished in the vigour of life and by violence. These circumstances lead to the conclusion, that the hyænas not only dragged into the cave and devoured the bones of the other animals, but also occasionally made a prey of their young, to satisfy the cravings of hunger since the number of the teeth of the young hyænas, is much too great to be attributed to those individuals that might die by accident or disease.

These conclusions derive additional strength from the habits of living hyænas. There are but three species of this animal known to exist; and all of these differ from the fossil species. They belong to a genus, intermediate between the cat and the dog, and are greedy of putrid flesh and bones, often in hot climates following armies and digging up human bodies from the grave. They drag the carcases of all sorts of animals to their dens, and accumulate the broken fragments of the bones around their retreats.

The power of their jaws is enormous, and when they attack the dog, they "begin by biting off his leg at a single snap." They are extremely greedy of bones, and after Mr. Buckland's work was written, he by accident saw an experiment performed, that lends strong confirmation to his suppositions concerning the Kirkdale remains. Let it be given in his own words.

"Since this paper was first published, I have had an opportunity of seeing a Cape hyæna at Oxford, in the travelling collection of Mr. Wormbell, the keeper of which confirmed in every particular, the evidence given to Dr. Wollaston by the keeper at Exeter Change. I was enabled also to observe the animal's mode of proceeding in the destruction of bones: the shin bone of an ox being presented to this hyæna, he began to bite off with his molar teeth large fragments from its upper extremity, and swallowed them whole as fast as they were broken off. On his reaching the medullary cavity, the bone split into angular frag ments, many of which he caught up greedily and swallowed entire: he went on cracking it till he had extracted all the marrow, licking out the lowest portion of it with his tongue: this done, he left untouched the lower condyle, which contains no marrow and is very hard. The state and form of this residuary fragment are precisely like those of similar bones at Kirkdale: the marks of teeth on it are very few, as the bone usually gave off a splinter before the large conical teeth had forced a hole through it; these few, however, entirely resemble the impressions we find on the bones at Kirkdale; the small splinters also in form and size, and manner of fracture, are not distinguishable from the fossil ones. I preserved all the fragments and the gnawed portions of this bone, for the sake of comparison by the side of those I have from the antediluvian den in Yorkshire: there is absolutely no difference between them, except in point of age. The animal left untouched the solid bones of the tarsus and carpus, and such parts of the cylindrical bones, as we find untouched at Kirkdale, and devoured only the parts analogous to those which are there deficient. The keeper pursuing this experiment to its final result; presented me the next morning with a large quantity of album græcum, disposed in balls that agree entirely in size, shape, and substance with those that were found in the den at Kirkdale. I gave the animal successively three shin bones of a sheep; he snapped them asunder in a moment, dividing each into two parts only, which he swallowed entire, without the smallest mastication. On the keeper putting a spar of wood, two inches in diameter, into his den, he cracked it in pieces as if it had been touchwood, and in a minute the whole was reduced to a mass of splinters. The power of his jaws far exceeded any animal force of the kind I ever saw exerted, and reminded me of nothing so much as of a miner's crushing mill, or the scissors with which they cut off bars of iron and copper in the metal founderies." p. 37.

The plates accompanying Mr. Buckland's work exhibit the various fragments of bone mentioned above, as broken by the living hyæna and those found in the Kirkdale cave: and really, an inspection of them removes every doubt concerning the identity of the cause that produced them.

We have already spoken of the partial wearing away, and polishing of some of the bones in this antediluvian den. This appears on one side only, and therefore could not have been the result of the agency of water. The frequent tread and rubbing of the hyæna's upon them, is the only probable cause of this phenomenon. The author fortifies this position, by stating in a note, that he has "been informed by an officer in India, that passing by a tiger's den, in the absence of the tiger, he examined the interior and found in the middle of it a large portion of stone, on which the tiger reposed, to be worn smooth and polished by the friction of his body. The same thing may be seen on marble steps and altars, and even metallic statues in places of worship that are favorite objects of pilgrimage: they are often deeply worn and polished by the knees, and even lips of pilgrims, to a degree that, without experience of the fact, we could scarcely have anticipated." Travellers inform us, that a stone, similar to that mentioned above, occurs in a cave in Franconia, and that a bronze statue of St. Peter at Rome, has lost a part of the great toe in this manner.

The most abundant, perhaps, of all the bones in this cave, were those of the water rat. The cave is situated, at present, about eighty feet above a small stream, that falls into the vale of Pickering, and therefore above the highest floods. The nature of the adjacent country, however, induces our author to conclude, that the valley of Pickering, previous to the last great diluvian catastrophe, formed the bottom of a lake, and this den of hyænas being on the margin, its proprietors obtained from thence an occasional supply of ducks and water rats. In confirmation of the supposition that hyænas may, at least occasionally, eat water rats, Mr. Buckland, after quoting from Parry and Hearne the fact that the arctic bears and wolves feed on mice, enquires, "If bears eat mice, why should not hyænas eat rats?" After the gigantic animals upon which the hyæna sometimes fed, these diminutive ones might even prove a dainty.

Ruminating animals form the ordinary food of beasts of prey; accordingly we find their bones in great abundance in the Kirkdale den. As to the bones and teeth of the elephant, rhinoceros, hippopotamus, and birds, it is probable they were dragged thither by the hyænas, by piecemeal, from individual carcases, which they found in the adjacent country.

The evidence derived from all these facts, and others of minor importance, which we have not room to state, appears then to be direct and conclusive to prove that the Kirkdale cave was inhabited by successive generations of hyænas. No other supposition will stand the test of examination a moment. If it be said that the various animals entered this cavern spontaneously, to die there, or had fled thither to escape some approaching catastrophe, it may be replied, that the cave was not large enough to admit the larger animals, and no circumstances can be imagined that would collect together spontaneously, animals of so dissimilar habits as hyænas, tigers, bears, wolves, foxes, horses, oxen, deer, rabbits, weasles, water-rats, mice and birds. If it be supposed that these bones were drifted into the cavern by a flood, it remains to be shown how the larger animals could have entered, why the bones are so broken, and why there is such a disproportion between the number of teeth and the bones. We give the third supposition in the author's own words.

"The third and only remaining hypothesis that occurs to me is, that they were dragged in for food by the hyænas, who caught their prey in the immediate vicinity of their den; and as they could not have dragged it home from any very great distances, it follows, that the animals they fed on all lived and died not far from the spot where their remains are found."—p. 40.

"The accumulation of these bones, then, appears to have been a long process, going on during a succession of years, whilst all the animals in question were natives of this country. The general dispersion of bones of the same animals through the diluvian gravel of high latitudes, over a great part of the northern hemisphere, shows that the period in which they inhabited these regions, was that immediately preceding the formation of this gravel, and that they perished by the same waters which produced it. M. Cuvier has, moreover, ascertained, that the fossil elephant, rhinoceros, hippopotamus, and hyæna, belong to species now unknown; and as there is no evidence that they have, at any time, subsequent to the formation of diluvium, existed in these regions, we may conclude that the period at which the bones of these extinct species were introduced into the cave at Kirkdale, was antediluvian.—p. 41.

It has been a favorite hypothesis with many naturalists, that the remains of extinct genera and species of the larger animals, such as the mammoth and megatherium, were drifted by the waters of the deluge from the southern climates, where they lived; " but the facts developed in this charnel-house of the antediluvian forests of Yorkshire, demonstrate that there was a long succession of years in which the elephant, rhinoceros and hippopotamus had been the prey of the hyænas, which, like themselves, inhabited England in the period immediately preceding the formation of the diluvian gravel; and if they inhabited this country, it follows as a corollary, that they also inhabited all those other regions of the northern hemisphere, in which similar bones have been found, under precisely the same circumstances, not mineralized, but simply in the state of grave bones imbedded in loam, or clay, or gravel, over a great part of northern Europe, as well as North-America and Siberia. The catastrophe producing this gravel appears to have been the last event that has operated generally to modify the surface of the earth, and the few local and partial changes that have succeeded it, such as the formation of deltas, terraces, tufa, torrent-gravel and peat bogs, all conspire to show, that the period of their commencement was subsequent to that at which the diluvium was formed."—p. 42.

" It is in the highest degree curious to observe, that four of the genera of animals whose bones are thus widely diffused over the temperate, and even polar regions of the northern hemisphere, should at present exist only in tropical climates, and chiefly south of the equator; and that the only country in which the elephant, rhinoceros, hippopotamus and hyæna are now associated, is Southern Africa. In the immediate neighborhood of the Cape, they all live and die together, as they formerly did in Britain; whilst the hippopotamus is now confined exclusively to Africa, and the elephant, rhinoceros and hyæna are also diffused widely over the continent of Asia."

"To the question which here so naturally presents itself, as to what might have been the climate of the northern hemisphere, when peopled with genera of animals which are now confined to the warmer regions of the earth, it is not essential to the point before me, to find a solution; my object is to establish the fact, that the animals lived and died in the regions where their remains are now found, and were not drifted thither by the diluvian waters from other latitudes. The state of the climate in which these extinct species may have lived antecedently to the great inundation by which they were extirpated, is a distinct matter of enquiry, on which the highest authorities are by no means agreed. It is the opinion of Cuvier, on the one hand, that, as some of the fossil animals differ from existing species of the genera to which they belong, it is probable they had a constitution adapted to endure the rigours of a northern winter; and this opinion derives support from the Siberian elephant's carcass, discovered with all its flesh entire, in the ice of Tungusia, and its skin partially covered by long hair and wool; and from the hairy rhinoceros found in 1771, in the same country, in the frozen gravel of Vilhoui, having its flesh and skin still perfect, and of which the head and feet are now preserved at Petersburg, together with the skeleton of the elephant above alluded to, and a large quantity of its wool, to which Cuvier adds the further fact, that there are genera of existing animals, *e. g.* the fox tribe, which have species adapted to the extremes both of polar and tropical climates."

"On the other hand, it is contended that the abundant occurrence of fossil crocodiles and tortoises, and of vegetables and shells, (*e. g.* the nautilus,) nearly allied in structure and character to those which are now peculiar to hot climates, in the secondary strata, as well as in the diluvium of high north latitudes, renders it more probable that the climate was warm in which these plants and animals lived and died, than that a change of constitution and habit should have taken place in so many animal and vegetable genera, the existing members of which are rarely found except in the warmer regions of the present earth. To this argument, I would add a still greater objection, arising from the difficulty of maintaining such animals as those we are considering, amid the rigours of a polar winter; and this difficulty cannot be solved by supposing them to have migrated periodically, like the musk, ox and rein-deer of Melville Island; for in the case of crocodiles and tortoises, extensive emigration is almost impossible, and not less so to such an unwieldy animal as the hippopotamus, when out of water. It is equally difficult to imagine that they could have passed their winters in lakes or rivers frozen up with ice; and though the elephant and rhinoceros, if clothed in wool, may have fed themselves on branches of trees and brushwood, during the extreme severities of winter, still I see not how even these were to be obtained in the frozen regions of Siberia, which at present produce little more than moss and lichens, which, during a great part of the year, are buried under impenetrable ice and snow; yet it is in these regions of extreme cold, on the utmost verge of the now habitable world, that the bones of elephants are found occasionally crowded in heaps along the shores of the icy sea, from Archangel to Behring's Straits, forming whole islands composed of bones and mud, at the mouth of the Lena, and encased in icebergs, from which they are melted out by the solar heat of their short summer, along the coast of Tungusia, in sufficient numbers to form an important article of commerce."—pp. 44, 45, 46.

The chronological inferences deducible from the phenomena of the Kirkdale cavern, are briefly these: 1st. there was a period, apparently of no great length, during which this cavern existed in its present state, but was not inhabited by hyænas. During this period the stalagmite that covers a part of the floor beneath the mud, was deposited, which contains no bones. The second period was that in which the cave was inhabited by hyænas, and the stalactite and stalagmite were still forming. Accordingly, the bones are found imbedded in the stalagmite of this period, forming an osseous breccia. It might be expected, that the ingress and egress of these animals, in so low a cave, would strike off from the roof portions of the stalactites; and Mr. Buckland found among the breccia, stalactitic tubes, evidently thus broken from the roof. While this stalagmite containing the bones was forming, no mud was introduced; since it is entirely wanting in the breccia. The third period is that in which the mud was introduced, and the animals extirpated; viz. the period of the deluge. It must all have been deposited by a single inundation, since there is no alternation of the mud with the stalactite. Whether this was the Noachian deluge, we think would not be quite demonstrably proved, from the Kirkdale cavern alone; although rendered probable. But, as we shall see hereafter, there is a striking coincidence as respects this point, between this and numerous other caves which Mr. Buckland subsequently visited, forming altogether a body of proof too strong to be resisted. "The fourth period is that during which the stalagmite was deposited, which invests the upper surface of the mud."—This must have been the longest of the periods, since the quantity of stalagmite formed is much the greatest. No other process appears to have been going on at this time, except the formation of stalactitic and stalagmitic infiltrations; nor did any creatures enter the cavern, except perhaps a few mice, rats, weasels, rabbits and foxes.

Every one will see how exactly these periods correspond to the history of the world, as given in the scriptures, and handed down by tradition. The first and second period clearly point us to the antediluvian age of the world, the third, to the Noachian deluge, and the fourth, to the state of the world since that catastrophe. Nor does the Kirkdale cavern stand alone in furnishing this curious evidence; but the phenomena of many others speak the same language, as we shall see in pursuing our analysis of Mr. Buckland's work.

(To be continued.)

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## Art. XVI.—*Notice of the Print of Col. Trumbull's Picture of the Declaration of Independence.*

In the first volume of this Journal, p. 200, we noticed the picture of the Declaration of Independence, painted by Col. John Trumbull, by order of the Government of the United States. This picture, it is well known, is the first of a series of four, which have now been executed by the same distinguished artist, to adorn the walls of the Capitol, at Washington, and to instruct and gratify posterity, by a graphical exhibition of some of the grand events to which the American revolution gave birth.

Col. Trumbull—himself an actor, (in no inferior situation,) in the great scenes which terminated in the establishment of American independence, very early conceived the design of preserving the portraits of some of the most distinguished men of that period, and of transmitting them to posterity, (grouped in strict accordance with historic truth) in situations, in which they were real actors. With this view, he began to collect materials, while the events were still recent, and before death had removed many of the illustrious men, who had deliberated in the Senate, or contended in the field. In prosecution of his purpose, he travelled extensively both in his own country, and in Europe, to copy, from the life, the features of the individuals, who, while the struggle lasted, were united in council and in action, but whom the return of peace had finally separated, and blended with their families, or with the mass of society, in countries, remote from each other.

If we should not ultimately be gratified, by the entire completion of this great original design; and if all the portraits that were obtained, and all the interesting scenes in which it was intended to combine them, are not to be finally exhibited, still, the American people have much reason to congratulate themselves, that their government has secured for them, and for posterity, pictorial representations of four of the most momentous scenes of the revolution, and these (if only four were to be selected) are certainly chosen with great good judgment. It is scarcely necessary to say, that they are

The Declaration of Independence;

The surrender of Gen. Burgoyne and his army;

The surrender of Lord Cornwallis and his army; and

The resignation of Gen. Washington.

The first and the last are peaceful scenes,—the calm and dignified exhibition of assembled senators, at the commencement, and at the close of one of the grandest dramas, ever exhibited on this globe. The two middle scenes, corresponding with the progress of events, are those in which the splendors and the terrors of war are veiled by the glories of victory; and victors and vanquished blended, in the moment of triumph and of humiliation, exhibit nothing of hostile bearing, but the arms and the costume, which distinguished their respective nations. Perhaps, this is as near an approximation to the horrid realities of actual conflict, as the mild and peaceful genius of the present period will desire;—but, since such things *have been*,—since our soil was, often, deeply imbued with the most generous blood of its valiant sons;—since thousands have bled whose names perished with them, and hundreds more have died, whose individual deeds are registered in history, it is certainly very desirable, that every authentic vestige of their features, or of their actions, should be preserved, and that thus posterity should be made to realize the magnitude of the price which was paid, and of the efforts which were made, to secure the liberties of this country. We deem it, therefore, not presumptuous to indulge the hope, that the government and the country will secure, while it is in their power, all the materials, for historical pictures of the revolution, which Col. Trumbull's zeal and patriotism have accumulated; and that, while his life and faculties (mature in abundant experience and fame, without abatement of energy) are continued, these great works may be finished by *the only artist living*, who possesses the materials and the personal knowledge, combined with the talents and experience, which are necessary to the accomplishment of this great national work.

Should the government not continue to patronize the design, we cannot doubt, that the artist himself would hazard little in executing the remainder of the series on his own account—especially as the sister-art of engraving has, in this country, attained to a high degree of excellence. Our first historic painter has no reason to be dissatisfied with the copy which has been recently made, by Mr. Durand, of his great Picture of the Declaration of Independence. This print we contemplate with much satisfaction, both because it is, at once, a correct and spirited representation of the original, and because it is a specimen of the progress and state of the art of engraving in this country, which does us much honor, and encourages the fairest hopes for the future. As to the fidelity, both of the painter in copying, and of the engraver in preserving the portraits of the members of the congress, which declared the independence of these States, no testimony can be more decisive, or gratifying, than that of the illustrious friend of this country, and of Washington, the Marquis La Fayette—which, although it has gone the round of our public prints, is worthy to be preserved in a form more enduring, and is therefore inserted here; nor do we think it worth while to suppress those parts of the letter, which, although not relating immediately to the subject before us, have still a very important bearing on the interests and honor of this country.

*Extract of a Letter from the Marquis La Fayette to Col. John Trumbull.*

"Paris, Jan. 4, 1824.

"*My Dear Sir,*

Words cannot sufficiently express how happy you have made me by your most valuable, and no less welcome, present.* I received it in my usual family retirement at La Grange, and was delighted with many happy recollections it did produce, among which the pleasure of my friendly acquaintance with the painter had a very great share. I at once recognized all the portraits, and think you have been remarkably fortunate in hitting not only the features, but the manners and deportments of the principle characters. It is so much the case, that my children, who, George excepted, were very young when they had a peep at John Adams, pointed out the father, from their later acquaintance with the son. Hancock, Charles Thompson, Franklin, Roger Sherman, &c. &c. suddenly appeared to me in that grand act which has begun the era of rational freedom and self-government. I hailed the banner under which I enlisted in my youth, and shall die in old age; and I thanked the great artist, the good fellow-citizen and soldier, to whom I was obliged for so many lively, affectionate, and patriotic sensations.

It is to me also an inexpressible gratification to think your admirable pencil has fixed me on the grand central rotunda of the Capital of the United States, in a situation where I like myself seen, viz. in my American regimentals, under our republican Continental colors, at the head of my beloved, gallant, affectionate light infantry, at the

* A copy of Col. Trumbull's new print of the Declaration of Independence.

successful close of the Virginia campaign. I cannot promise you my actual features would do justice to your portrait at that time; but the heart is the same.

The account you give of the great Water Communication through those countries which I saw, for the great part, a wilderness, while I acted as Commander in the Northern Department, is truly enchanting. In those wonders of virtuous freedom, national sense, and unshackled industry, my mind seeks a refuge from too many disquiets and disappointments on this side of the Atlantic."

Mr. Durand has chosen to execute his work *in lines*—the mode of engraving adopted, as we believe, by all the distinguished artists of this age, when they put forth their powers on works of dignity and importance, calculated to challenge the admiration of future generations as well as of the present. We pretend not to critical skill, but may perhaps be allowed to remark, that Mr. Durand (who was advantageously known before as our best engraver of portraits) has produced a print, which delights the eye and the mind, at the hundredth inspection, and which will prove a pleasing and instructive substitute, in the case of those persons who have never seen, and may never be able to see the original picture. We are gratified to learn, that, although the sale of this print has, hitherto, been by no means so extensive as its merits deserve, still so many copies have been sold as to justify the design of engraving the other pictures.

The entire collection of these prints must form a very interesting exhibition in the family circles of the present day, and will be regarded by posterity as an invaluable treasure.

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## Art. XVII.—*Notice of an excursion among the White Mountains of New Hampshire, and to the summit of Mount Washington, in June*, 1823, *with miscellaneous remarks, by* James Pierce.

The White Mountains present the most elevated ground in the United States, and form a part of a primitive range, that diverges from the highlands separating New-England from Canada, and passes in a south-west direction through

New-Hampshire. Local names are given to different sections. The most interesting pass of this chain is by the Portland and Lancaster road. After travelling a considerable distance in a pine clad region, wild ranges of mountains are disclosed to the west, rising in amphitheatric order, crowned by numerous lofty peaks, and above all Mount Washington towers majestically, its summit being often enveloped by white fleecy clouds.

At the eastern base of these mountains, a wide and rich alluvial valley is observed, in which a considerable lake, and the pleasant village of Fryburgh are situated. For several miles the road winds through an extensive fertile plain, watered by the serpentine Saco. The course of this stream is marked by elms, many of them of uncommon altitude and beauty. Striking views are often presented of the White and Franconia Mountains. The valley gradually became more narrow as it penetrated the mountains, and was in dense shade, while the retiring sun illuminated the summits, and tinged the clouds resting on them with purple and gold. For thirty miles, the road winds among the mountains in a ravine which is in general narrow, rocky, and wood clad, but expands in a few places into rich flats under cultivation, and like the Alpine vales of Switzerland, environed by towering mountains.

The elevations bordering on the valley are in general clothed with trees of varied verdure, evergreens predominating near the summits, and in the cold shaded ravines. The prominent parts of the mountain's side are usually occupied by hard wood, principally birch—succeeding forests, overthrown by gales, and consumed by fires. Damp evergreen sheltered groves are unaffected by these sources of destruction.

Conspicuous beds and ledges of granite, gneiss, and sienite, extensively occupy the surface of mountains, recently swept by fire. Large boulders of sienite, detached from the summit ledges, rest in the valley. The road rises almost imperceptibly, accompanied by the Saco. Wrecks from the mineral and vegetable world, spread on its banks, evince the power of this stream in its spring floods—now shorn of its foam, it feebly murmured by, presenting few rapids, and no falls of consequence.

The mountain vallies are heavily timbered, with trees of annual verdure, mostly hard maple, beech, and birch. The soil is rich, well irrigated, and adapted for grazing, but is too stoney and cold for advantageous tillage. Only one occupied dwelling meets the eye in twenty miles. Many of the summits, adjacent to the ravine, are divested of trees, but a few towering peaks raise their evergreen banners to the skies.

As we approached the notch or narrowest pass, the lofty ridge to the right exhibited but little verdure; its steep or precipitous surface is covered with bare loose rocks, and elevated mural ledges, over which torrents in spring form beautiful cascades. The road in the vicinity of the notch is steep, and the river boisterous. We crossed a small stream, auxiliary to the Saco, which descends from a great elevation by a succession of falls.

The pass at the notch was originally occupied by the river, and practicable only for footmen. The present road was constructed by breaking down the adjacent clifts—leaving walls of rock at the mountain's base of considerable altitude. The road, a short distance from the notch, attains its greatest height, which is probably about five hundred feet above the vale of Fryburgh.

The Saco and a branch of the Amonoosuc have their source in a swamp adjacent. We left the ravine at this place on the 21st of June, and ascended the most elevated part of the White Mountains. The base and lower region was clothed with large timber, principally birch, maple, beech, hemlock, spruce, balsam fir, and wild cherry; mountain ash and the moose bush were observed.

The ascent, though in some places steep, was seldom difficult. We were much annoyed by musquitoes and black flies. These insects are said to disappear from this region in August. Black flies are numerous and very troublesome to cattle during the day, but are quiet at night.

As we ascend, the trees diminish in size, and the ground shaded by groves of perennial verdure, is carpeted with beautiful green moss.

About four thousand feet above the level of the sea, birch, spruce, and balsam fir, though mature in years, and with bodies half a foot in diameter, were only three feet in height. Firm branches, spreading horizontally, form an entangled thicket, enabling the traveller to pass over the forest, stepping from tree to tree. These groves at a greater elevation diminish to the altitude of a few inches, and are blended with moss and lichens.

We ranged several miles in a northern direction on the summit of the ridge, gradually ascending, and passed over a succession of eminences, that rise a few hundred feet above the general level, forming a waving profile. One of these heights called mount Prospect, presents a smooth surface of many acres thinly clad with moss and tufts of grass, and adorned with flowers. From this hill the wild wood clad ranges and peaks of inferior altitude, appear very interesting.

Some of the eminences we passed over, are covered with bare loose rocks and broken ledges. The ridge is sometimes narrow and its sides steep. We looked down precipices upon wood clad ravines, situated several thousand feet below. The rocks of these mountains are chiefly granite and gneiss, embracing light colored feldspar and quartz, with mica sometimes crystallized in six-sided tables. Among the imbedded minerals that occur, are sulphuret of iron in decomposing rocks, tourmalines, garnets, and in one place delicate rose quartz.

On most parts of the summit, bare rocks alternated with light colored moss, lichens, tufts of grass, beautiful white and purple flowers, dwarf cranberry and whortleberry bushes, and shrubs only four inches high. Cranberries were abundant, and pleasant flavored, being deprived of much of their acid by frost. In the autumn, berries are uncommonly acid on this high ground.

Not far from the southern base of Mount Washington, and five thousand feet above the ocean, there is a pond covering nearly an acre. It is a source of two streams which run in opposite directions. One descending west, is the head of the Amonoosuc, a branch of the Connecticut. The other connects itself with waters flowing into the Atlantic through Maine. The pond is deep, and was partially environed by banks of ice, with beds of flowers adjacent.

We encamped at the foot of Mount Washington, on a sheltered spot of the steep eastern side of the ridge, about a mile above the sea. Branches of a lilliputian grove of firs, and dry moss, formed our place of rest. We raised a considerable fire with materials from a dry forest of dwarf spruce and birch, destroyed by fire or frost. The bodies and antling branches were bleached white in the lapse of time, and resembled the horns of moose, or coral groves. Within a few feet of our station, there was a bank of snow six feet in thickness, and several rods square. Though in the valley it was remarked as the warmest night in the season, we experienced much inconvenience from cold on our bleak elevation. The moon and stars moved through a cloudless dark blue sky, and shone in this pure atmosphere with uncommon splendour, rendering the white rocks and banks of snow very conspicuous.

We ascended Mount Washington, the highest point of the range, at an early morning hour. The rise was at first gradual and easy—grass and moss were mingled with rocks—but the sides of the cone soon became steep, and entirely divested of verdure—we were above the region of vegetation. Rocks in situ were rarely seen, but the surface was covered with detached stones, generally in tabular forms, and resting firmly. Our progress, though toilsome, was safe. We attained the summit about sunrise—its elevation above the sea, as calculated by Captain Partridge, is six thousand two hundred and thirty-four feet. The sun rose in a clear sky, and shed a yellow light on the bald peaks, and soon illuminated the rocky ravines.

The view from Mount Washington, in extent and grandeur, much surpasses the prospects exhibited from the Catskill, Highland, Taconic, and Holyoke mountains, and differs from them greatly in the objects presented.—From those elevated ranges, a large portion of the country in view appears like an immense plain under high cultivation, adorned with cities, villages, and navigable streams.

From Mount Washington, the region distinctly seen, with few exceptions, is a wilderness. On all sides, mountains rise above mountains, crowned by numerous peaks, resembling the lofty broken waves of a tempestuous ocean. The adjacent elevations present short ridges, waving with prominent eminences, and separated by deep ravines.—Some of these ridges, for a considerable distance, exhibit bare rocks resembling banks of snow. The ravines and sides of the mountains are generally covered with forests that often have well defined limits, passing at once from a dense low copse, to a surface dressed with grass and moss. In a few remote places, the efforts of pioneers were marked by curling smoke, but in the distance of near twenty miles, but two farms were in view, and from the altitude and rocky surface of the White Mountain range, it will probably always continue in a state of nature. Nor does the distant landscape present many extensively cleared or apparently level districts. In most directions, as far as vision can reach, wood clad mountains, hills and valleys are seen. The Franconia and Moosehillock peaks, in altitude nearly equal to the White Hills, tower in the southwest. The Green Mountains of Vermont, ridge rising above ridge, range along the western horizon for one hundred miles.

Prominent parts of the distant highlands, bordering on Canada, forming a continuation of the Green Mountains, were in view—they form a geological as well as territorial boundary. Much of the northern part of New England is elevated and rocky; frequently marshy, and of a forbidding aspect for tillage. Its rocks, with the exception of a few small transition limestone tracts, are primitive.

On the Canada side of the dividing head lands, a transition, secondary and alluvial region, containing about twenty millions of acres, is situated; it lies between the United States, a mountain range north of the St. Lawrence, and Upper Canada. It is nearly level, but little elevated above the sea, with a surface generally free from stone, and equal in fertility to any portion of the United States, of the same extent. North and north-east of Mount Washington, you overlook an extensive wilderness in a state of nature, comprising much of the uncleared surface of Maine, and of the elevated northern section of New-Hampshire.

A tract in Maine, situated between the rivers Androscoggin and Penobscot, and extending one hundred miles from the rocky seaboard, nearly of the extent of Massachusetts, and rivalling it in fertility, is much of it embraced in the landscape; its clearings are too remote to be distinguished. The inhabitants of this district have generally relinquished the business of obtaining lumber, for regular agriculture; and are characterised by intelligence, enterprise, steady industry, and hospitality. Many of the villages contain an unusual proportion of residents, of respectable attainments in literature and science. Settlements to the east, and the ocean seventy miles distant, are distinguishable in a very clear day. The cultivated tracts distinctly seen, are most extensive in a western direction, comprising the beautiful valley of Lancaster, improvements in the towns of Bethlehem and Littleton, and considerable clearings on the hills of Vermont. A large proportion of these primitive hills, though very elevated, possess a strong soil, and their sides, and fertile intervening vallies are under good cultivation. A diameter of near two hundred miles is embraced in the landscape.

The streams and lakes presented on the map of nature, are numerous and interesting: eastwardly the Androscoggin winds its way through a pine-clad valley. At its head appears an extensive crooked lake, called Umbagog. Other wood environed waters are located in this quarter. There are no settlements within a great distance of these lakes. The wild animals of this wilderness, being rarely molested by man, are numerous. The moose ranges fearlessly—the carabo and common deer are abundant. The lynx, bear, wolverine, loup cervie, and sometimes the panther, are encountered by the hunters. Wolves very rarely occur in New-Hampshire and Maine; rabbits are found in droves; otters are plenty, and beavers linger about the Umbagog, Moose-Head Lake, and other remote waters. Wild geese and ducks abound in the season of their migration, and salmon-trout are large and numerous in the lakes. Several ponds situated in Maine, and various parts of New-Hampshire, were in view. The Sebago Lake, near Portland, and Lovewell's Pond, adjacent to Fryburg, gleamed conspicuously in the morning sun. To the south, the extensive sheet of water called Winipisioge Lake, embracing numerous islands, and diversified by numerous promontories and deep bays, was distinctly seen, together with Squam Lake adjacent, a large and beautiful body of water, and other ponds of minor importance.

The Saco to the south, and the Amonoosuc to the west, appear for many miles winding through woody vales. The Connecticut shews itself in a few places—small ponds are noticed in the valleys leading to Lancaster and Bethlehem.

We descended the White Mountains in the afternoon, and entered the vale of the Amonoosuc. I noticed in several places, granite rocks in a decomposing state, and in a few instances, beds of kaolin. The Rosebrook farm, occupied by E. A. Crawford, a good guide to the White Hills, is the only considerable clearing in the mountain section of the valley for ten miles. The soil of this region is well adapted to grass, summer wheat, rye, oats, and potatoes, but is too cold for Indian corn. The trees of this valley are of the species predominating in northern latitudes. There are no walnut, chesnut and butternut trees in Maine, or most parts of New-Hampshire and Vermont.

Beaver and moose, though formerly in abundance, have disappeared from the valleys of the White Mountains, but the other animals, common in the wilds of New-Hampshire and Maine, are occasionally seen. Venomous snakes are rarely found in New-Hampshire, and in no part of Maine except its western border.

Adjacent to the Amonoosuc, I noticed a mineral spring, containing sulphur and iron. Waters of this character occur in Bethlehem and Littleton. In the last mentioned town, manganese and quarries of variegated marble have been recently discovered.

An interesting morning view of the White and Franconia mountains was presented, from an elevation adjacent to the valley of Connecticut river. It was a summer and winter scene. The weather was mild and fair. Refreshed by rain the preceding night, the luxuriant plants of the valley, and the variegated verdure of the dense groves at the base, and sweeping down the mountains' sides, were contrasted with the lowering summits, covered with snow, and hoary with frost from the recent storm. Fleecy clouds assuming a variety of shapes, lightly brushed the mountains, and sailing away soon melted into air. Mount Washington was partially shrouded by white vapor of a silvery lustre, condensed on its snow-clad surface.

From their elevation and latitude, the grazing lands situated in the northern part of New-England, are best adapted for sheep. The great consumption of fodder incident to long winters, so objectionable to the raising of cattle, is more than compensated to the merino sheep proprietor, by an improvement in the quantity and quality of wool, which is much affected by climate. In tropical countries, sheep are dressed with hair—in more temperate, the wool is generally short and coarse, but longer and finer in cold regions. In Spain, two and a half pounds of wool is the average product of their merinos, and of a quality inferior to ours; in the middle States, and valley of the Hudson, the same; on the elevated ground in the western part of Connecticut and Massachusetts, three, and in some flocks, four pounds In the southern and middle part of Vermont, from four to four and an half. In Maine, the average is five, and, in a few choice flocks, six pounds the sheep. The best merino wool of Europe, is from the bleak mountains of Saxony. The quantity and quality of wool is also considerably affected by the food, management, and selection of flocks—as nature bountifully provides a dress for all animals according to their wants. Furs are found to be good, and the staple long, in proportion to coldness of climate.

The northern part of the United States and Canada, in addition to climate, have, for the raising of wool, an important advantage over England, and the south of Europe, in cheapness of soil, much land being required for the support of sheep. The fee simple of good sheep farms in America, can be procured with the amount of the annual rent and taxes of the same quality of ground in England.

*Postcript to the above.*

Returning from the White Mountains, I visited the Franconia iron works. They are not in a very prosperous condition; the ore is two hundred feet below the surface, and the veins lessen. I passed a day at the copperas works, in Strafford, Vermont. Eleven men are employed, who calculated to make, per ann. four hundred hogsheads of copperas, of fifteen hundred weight each. The sulphuret of iron is no way essentially different from that at the mineral spring at Litchfield, and that forming extensive beds in Morris county, New-Jersey, which I visited in company with Colonel Gibbs. The manufacture of copperas in New-Jersey was rendered unproductive by the erroneous course adopted. They spread the ore ground fine, in thin layers on an inclined plane, over which water was passed, and oxygen was slowly absorbed without sensible heat. At Strafford, the ore is broken to the size of a hens egg and placed in piles of thirty tons upon which water is thrown; a spontaneous combustion takes place—sulphuric acid is readily formed, which takes hold of the iron—the piles continue hot until the mass is pulverized when it cools and is lixiviated. When the pieces of ore are large or the pile small, the sulphate of iron does not readily form. Boston is the principal market for the copperas.

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## INTELLIGENCE AND MISCELLANIES.

### I. Foreign.

Extracted and translated by Prof. Griscom.

1. *Crystallization of sub-carbonate of potash.—Fabronia* chemist of Tuscany, states in the Annales de Chimie of January last, that, contrary to the opinion commonly received, the sub-carbonate of potash, as contained in the potash of commerce, is capable of crystallizing. He evaporates the solution of common potash till it marks, while warm, the 53d degree of Baumés aréometer, when, on cooling, all the foreign salts are precipitated. The liquor is then decanted and evaporated to the 55°. It is, at this point, slightly green, and has a penetrating alcaline odour. It is poured into a deep vessel, and crystals are soon formed in long rhomboidal plates, parallel and vertical, resting on the bottom of the vessel, while the upper ends are attached to a saline crust which covers the surface. Fresh crops may be successively formed by concentrating the mother water to 55°, until the whole of the sub-carbonate is crystallized. By this means, he conceives a sub-carbonate of potash, quite pure, and of uniform properties may be obtained.

2. *Gas lights.*—Some interesting comparative results, relative to the illuminating power of coal gas and oil gas, are stated by Timothy Dewey in the Annals of Philosophy for December last. They were carefully drawn from experiments made of the gas, as it proceeded from the neigh

bouring pipes of two distinct manufactories in London, the one of coal gas, and the other of oil gas.

| | Specific gravity, |
|---|---|
| Coal gas, - - | .4069 |
| Oil gas, - - - | .9395 |

When the flames were rendered equally luminous, the consumption, per hour, was, of

| | |
|---|---|
| Coal gas, - - | 4.85 cubic feet, |
| Oil gas, - - - | 1.37 do. |

A gallon of clarified whale oil was found to produce more than 100 cubic feet of gas.

Results, agreeing very nearly with the foregoing, were obtained by Phillips & Faraday. In two experiments with gas taken from different establishments, they found the spec. grav. and illuminating power as follows.

| | | Coal gas. | Oil gas, |
|---|---|---|---|
| 1st | Spec. gravity, | .4291 | .9637 |
| | Illuminating power, | 1. | 3.567 |

| | | Coal gas. | Oil gas. |
|---|---|---|---|
| 2d | Spec. grav. | .4069 | .9395 |
| | Illum. power, | 1. | 3.541 |

3. *Piercing of hot Iron by Sulphur.*—Colonel Evasin, director of the Arsenal of Metz, in a letter to Gay Lussac, states the following experiments.

I placed a bar of wrought iron, about 16 millimetres in thickness, ($\frac{6}{10}$ inch) into a common forge, fed by fossil coal, and when it was welding hot I drew it out, and applied to the surface a stick of sulphur $\frac{6}{10}$ of an inch in diameter. In 14 seconds the sulphur had pierced a hole through the iron, perfectly circular. Another bar of iron 2 *inches thick* was pierced in 15 seconds. The holes had the exact form of the sticks of sulphur employed, whether cylindrical or prismatic. They were, however, more regular on the side at which the sulphur came out, than on that to which it was applied.

Steel bars, formed of old files welded together, were pierced more quickly than iron, and presented the same phenomena.

Cast iron, heated nearly to the melting point, underwent no alteration, by the application of sulphur to its surface. The sulphur did not even leave a mark. I took a piece of this cast iron and fashioned it into a crucible, and put into it some sulphur and iron. On heating the crucible the iron and sulphur were quickly melted, but the crucible underwent no change.—*An. de Chimie*, *Jan.* 1824.

4. "*The naturalist's guide, in collecting and preserving the various objects of natural history.*"—A Duodecimo volume under this title, price 5*s.* 6*d.* sterling, has been published by Wm. Swaimon of Liverpool. A work of this nature by a person so well qualified to give the needful instruction must be valuable to amateurs. An edition of it, we should imagine, would be saleable in this country.

5. *Public Utility.*—By an edict of the king of Bavaria, a school of *Rural Economy* has just been established at Schleispeim, analogous to the agricultural Institute of M. de Fellenberg. The pupils are divided into three classes. The first comprehends those who are destined simply to subaltern occupations ;—the second those who are particularly devoted to practice ; and the third attends to the most scientific concerns of rural economy. Observation and experience form the basis of all the instruction here given. This establishment, together with the *polytechnic museum*, opened to the public in May last, must be reckoned among the most useful of those which contribute to the progress of national Industry.

6. Wurtemberg. *Organization of the University.*—For a long time past, in Germany, the students have formed associations, either public or private, against which the government has found it necessary to take precautionary measures. In vain has it forbidden those which are known under the names of *Landmanschafften*, *Burschenschafften*, &c. ; they have been ostensibly dissolved, but only to revive under other denominations unknown to the authority.

The King of Wurtemberg, persuaded without doubt of the impracticability of entirely destroying the spirit of independence which the wants of youth and the interests of science so naturally call into operation, has given to the University of Tubingen, a kind of representative constitution, destined to regulate the discipline indispensable in those establishments, without injuring that portion of liberer-erty which youth require. This little charter authorizes all the matriculated students to elect among themselves a council of 15, two thirds of whom are to be renewed every six months. It is necessary in order to become eligible to this station, to have frequented the superior schools during six months, and to have avoided all occasion of censure from the commissioners of Discipline. This body thus organized, is charged to represent before the Academic Authority, all the students of the University, and to submit to that authority all sorts of complaints and propositions, having for their object the perfection of their studies and the welfare of the University. The elective council has also the right, without the approbation of the commissioners of Discipline, to convoke the students in a general assembly. Its principal end is to watch over the morals and studies of the young men, to prevent quarrels and disorders, and to put down all secret associations. During the year since this liberal constitution has been granted to the University, the happiest effects have resulted from it. This method, at once bold and profound, of meeting a question, which, ever since *the era of the congress*, has so much exercised the genius of diplomatists does as much honour to the wisdom, as to the probity of the government. The complete success of such an example may induce other states, placed in a similar situation, to abandon the repressive measures latterly employed against the German youth, and to adopt a system more conformable to the present state of knowledge and the interests of science.

*Rev. Encyc.*

7. *Universities.*—The following is the enumeration of of some of the Prussian Universities, in the summer session of 1822.

| | No. Stu. | Foreign's. | Theol'y. | Jurisp'e. | Medic. | Philos'y. |
|---|---|---|---|---|---|---|
| Berlin, | 1182 | 109 | 227 | 411 | 370 | 174 |
| Bonn, | 571 | 80 | 151 | 206 | 130 | 84 |
| Breslau, | 539 | 60 | 231 | 159 | 46 | 100 |
| Halle, | 866 | 147 | 540 | 198 | 78 | 50 |
| Konisb'g, | 259 | 29 | 84 | 95 | 20 | 60 |

8.—SWITZERLAND. GENEVA.—*Monitorial Instruction.*—A new school, on the plan of mutual instruction, was opened in the latter part of last year, in a new building, within the enclosure of the college yard. This new school is placed under the direction of the same committee, which has had so much success in that of St. Gervais. The latter destined for boys, and that of Grenette for girls, increase every day in usefulness. The method of mutual instruction is also in vigorous operation, not only in the seventh class of the college, but also in the fifth and sixth classes; and it will be extended to the superior classes, as experience shall enable the instructors to employ it. At a time not distant, we may hope that five or six hundred children, which hitherto have received little or no education, will enjoy the benefits of instruction suited to their age and condition, and, elevated in the scale of morals, and in the proper employment of their time, will become useful members of the Genevese family.

9. *Polishing of Granite.*—The most suitable substance for giving a fine polish to granite, is the powder of corundum. It is mixed, not with wax, but with lac, and the greater the care taken in effecting the mixture, the finer and more durable is the polish. It is essential that the powder employed for this purpose should be extremely hard and hence that of emery (corundum,) is preferred.

## 10. *Miscellaneous Notices from the Island of Ceylon.*

Extract from a letter addressed to a gentleman in Middlebury, Vt. by the Rev. MIRON WINSLOW, American Missionary on the Island of Ceylon :—

"In Jaffna, there are no minerals. One entire plain, raised a few feet above the bed of the sea ;—the soil, in many places, made up of decomposed sea-shells and coarse coraline, and all evidently of a secondary formation, covering an extensive substratum of the coral rock, forms the District of Jaffna. The industry of the inhabitants has converted this originally barren spot into an almost continued garden, giving sustenance, from an extent of about thirty miles by ten, on an average, to about two hundred thousand inhabitants. The principal articles raised are, rice, horse-geam, two or three inferior kinds of dry grain, unknown in America, yams, sweet potatoes, small onions, small beans, (or an inferior kind of pulse, between the bean and pea,) and several culinary plants, used by the natives in food, unknown in northern latitudes.

"The fruits are mangoes, plantains, bananas, bread fruit, jack fruit, oranges, limes, citrons, figs, grapes, (the two latter seldom cultivated, but tolerably good when they are,) dates, promegranates, and, indeed, in greater or less abundance, most tropical productions. Water-melons and cucumbers grow well here, and most garden vegetables may be cultivated, but only by having European seeds; and then they do not become very good. In the interior, the climate is much better for gardening. Here, there is almost a constant drought from January to October, and the inhabitants are obliged to water all their gardens and fields from tanks and wells. Cinnamon is found only in the interior, and south of the Island; where also coffee, pepper and cotton are grown. Tobacco is the staple article of export from Jaffna; which does not raise a sufficient quantity of *rice* to support the inhabitants. The cocoa-nut, and small fan palm, called here palmyra, give much sustenance to the natives the latter, particularly, affording food to the poorer class, nearly half the year.

"The *domestic* animals here, are the cow, ox, sheep, goat, dog, cat, horse; and the *wild*, are tigers, jackalls, foxes, cats, hare, deer, and, occasionally, elephants. These all, however, frequent the jungle, principally, and seldom disturb the inhabitants."

*Memoranda, extracted from a Letter to the Editor, dated Alicante, (Spain,) March* 6, 1824, *from* WILLIAM MACLURE, ESQ. President of the American Geological Society, &c. &c.

11. *Difficulty of Mineralogical Excursions in* SPAIN.—" I have been much disappointed by being prevented from executing my mineralogical excursions in Spain, by the bands of powerful robbers, that have long infested the astonishingly extended surface of uncultivated and uninhabited wilds, in this naturally delightful country; not that I require any money worth the robbing, to supply me with all that I need—for the regimen which I adopt, for the promotion of my health, in my excursions, demands nothing but water, and a very small quantity of the most common food; but these barbarians have adopted the Algerine system, of taking you, as a slave, to the mountains, when they exact, as a ransom, as many thousands of dollars, as they conceive the property you possess will enable you to pay."

12. *Gift to the American Geological Society.*—" A box of specimens from an ancient volcanic field, four miles west of Humilla, in the province of Murcia. It appears to be an ancient lava, with the vacancies filled with the crystals of phosphat of lime, called by Werner, Spargelstein. This lava crops out from under an old secondary compact limestone, containing shells; and probably arose from a submarine volcano, or was afterwards covered by the sea, to a considerable depth, and for so long a time, as to allow limestone mountains, full of shells, to be formed over it."

13. *Opinions as to the Principal Rock Formations.*—"As the result of all that I have seen, I am confirmed in the opinion, that the Neptunian and Volcanic formations, of the four classes, that cover the primitive, have been pro-

duced by nearly contemporaneous depositions or ejections; and it is difficult, if not impossible, to decide on their relative time of formation—although every thing seems to prove them, subsequent to the primitive, and constructed from materials taken from it. How far either of the great agents of change, fire or water, or what agent, or whether any has been employed to form the primitive, is a secret of nature, that all our ingenious labors have not yet been able to reach, nor probably ever will. The partial changes that may have taken place, and do now occur in the four classes covering the primitive, are a fair field for speculation, in which to exercise the fancy and imagination of the cabinet student."

14. *Miscellaneous Remarks on the Comparative Political Situation of the Old and New World, and on the progressive Improvements in Education.*—" Since the plots and conspiracies of the great and privileged orders, against the peace, comforts and happiness of the industrious productive classes, have succeeded in Europe, I am mortified beyond measure at the recollection that I belong to the species and am forced for consolation to extend my views across the Atlantic, and hope soon to return to America, that I may be an eye witness to the prosperity of the United States, and enjoy the gratifying sensation of beholding man in the most dignified attitude which he has yet attained. I augur immense advantage to the population of the globe, from the junction of the moral and physical force of the two Americas, in favor of freedom; and trust that we, as the elder community, shall be able to supply our southern neighbors with the means of acquiring the intellectual qualities they are deficient in, by teaching them the shortest, easiest and most agreeable way to knowledge, by a simple and rational education.

To assist a little in that great general good, Mr. William Phiguepal, who has kept school for these last four years, on an improved Pestalozzian system, in my house at Paris, goes to Philadelphia this spring, with the mechanism, prints, instruments, representations, books, &c. &c. to facilitate the giving of distinct and accurate ideas to children, at a much earlier period than has yet been practised, by imprinting the image on their minds directly from the object itself—thus giving a true and exact representation of it, in place of the old, irksome, fatiguing and imperfect way of description. In all the trials yet made, it has succeeded beyond expectation; and from the nature of the method, it is capable of extension and variety ad infinitum, so as to accomplish the improvement of all the intellectual and physical faculties, calculated to meet the expectations of the most refined civilization, and to inculcate useful knowledge by a natural, easy, and agreeable process—making not only youthful instruction, but all the useful and necessary operations of life, an amusement—converting the rugged and difficult voyage through the world into a pleasant recreation. This, you will say, is exaggeration and utopean, but—judge for yourself—do not let hear-say warp your opinion. So many live upon ignorance that I have long turned a deaf ear to all they say against the cheap propagation of useful knowledge.

This method is the apprenticeship of life, and the pupils become journeymen, and gain pay the moment they come from school; while by the old system they must serve from five to seven years apprenticeship, before they earn any pay, and are forced to forget the greatest part they have learned at school, to make room for the useful, that is to benefit them in their intercousre with men.

The design of the school is to teach the pupils to avoid *remorse, fear, misery, and ennui.* To accomplish the 1st, they must act justly and correctly, viz. do as they would wish to be done by—2d, retain all their instinctive courage, and view every thing as it really is—3d, practise economy and frugality in the indulgence of all the natural tastes and appetites, and a total prohibition against acquiring any artificial physical wants—4th, obtain a knowledge of the works of nature and art, and an early habit of receiving pleasure from the examination of them. You will find the ground work in a small pamphlet, entitled Neef's Sketch, at William Duane's, Philadelphia. Phiguepal's method is a vast improvement on Neef's. By the substitution of tangible substances and machinery, in place of tables, and of representations, in place of descriptions, great advantage is gained in conveying ideas to children; for the process of transferring the image to the mind, from the representation, is easy, direct, and exact; whereas the figuring of the object in the mind from description, is, as respects many of the most useful ideas, impossible, and in all very difficult.

### 15. *Notice of the Second Edition of Parkes' Essays.*

Mr. Parkes is well known to the public as an ingenious chemist, and as the author of the "Chemical Catechism," "Chemical Essays," &c. Of the latter work, he has recently published a second edition. It is not intended as a regular system of chemistry, but is merely a collection of essays on different subjects connected with that science, and which have not been fully discussed elsewhere. One great design of the author seems to be, to illustrate the application of chemical principles to the arts, and to show that a knowledge of these principles is essential to the proprietors of extensive manufacturing establishments.

That he has succeeded in this design, will be evident to all who peruse these Essays.

It would exceed the limits of a *notice* to consider minutely, or individually, the articles which compose these volumes, and it might be superfluous to give one article a preference to another, since upon this subject there will necessarily be a diversity of opinion.

For in those articles which are more strictly *chemical*, as well as in those which relate particularly to manufactures, no pains have been spared to collect and arrange all important facts concerning them, and the value of the work is greatly enhanced, by the numerous *practical* observations and suggestions of the Author. It may not be improper to mention, for the information of those who are unacquainted with Mr. Parkes as an author, that the Essays have been twice reprinted at Paris, and once in Germany; but those who have perused his other writings, need only be assured, that the work before us is equally interesting, and equally creditable to his industry and abilities.

This edition is considerably enlarged, is printed in a superior style, and adorned with elegant engravings of apparatus. In short, it may be recommended to the public as a valuable collection of facts, useful to the chemist and general reader, arranged with great clearness, and treated of in that neat and easy style which is characteristic of this author, and which is so admirably adapted to afford amusement, and to convey instruction.

## II. Domestic.

### 1. *Notice of the Mechanics' and Manufacturers' Magazine.*

Prof. Griscom of New York, has issued proposals for a new monthly Journal to be entitled the " Mechanics' and Manufacturers' Magazine," intended to promote the arts and trades of the United States. His prospectus states that it will consist not only of the various fugitive notice, of useful discoveries in our country, but of information derived from the Scientific Journals of Great Britain, France, and other parts of the European Continent. It will be confined chiefly to practical details adapted to the capacity of common readers. Whatever relates to the real progress of the arts, and to the interests of American artizans and manufacturers, such as accounts of all their discoveries and inventions, economical processes, practical applications of the physical sciences, abridgement of labours, domestic receipts &c. will be comprehended in the plan. To these will be added specifications of the most useful patents, both of our own and of foreign countries, thus giving to the work these advantages of the " Repertory of Arts," of London. Space will be afforded for biographical sketches of eminent mechanics and engineers. One department of the Journal will also be devoted to notices relative to the progress of *Education,* comprising a statement of improved modes of teaching,—of foreign schools and institutions distinguished for the excellence of their systems—of useful school books &c. &c. This department however will be subordinate to the main objects of the journal. A monthly journal, limited to objects of this nature, will not, (as the Editor states his belief,) essentially interfere with any known periodical work in the United States.

## 2. *Torrey's Flora.*

The first two numbers of "*A Flora of the Middle and Northern Sections of the United States*," by Dr. Torrey, of New-York, (noticed in vol. VII. p. 178 of this Journal,) have appeared.

The two numbers together amount to 296 pages, comprehending the whole of the first four, and a greater part of the fifth artificial Linnæan Classes. These specimens of the work, it is presumed, will in no degree disappoint the expectations of the public; and, as sureties for the faithful and able execution of the remaining parts, they bear abundant evidence of the persevering industry, accurate observation, and acute discrimination, of the author.

For the honor of our country, and the advancement of botanical science, we rejoice that this work, so much needed, is in the hands of one, who, by his personal qualifications and extensive correspondence, is so admirably fitted for its performance.

## 3. *Lyceum of Natural History of New-York.*

1. *Officers elected at the anniversary meeting of the Lyceum, in February,* 1824.

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| *President,* | John Torrey, M. D., F. L. S. |
| *1st. Vice President,* | D. H. Barnes, A. M. |
| *2d. do.* | James E. DeKay, M. D. |
| *Corresp'g Secretary,* | Jer. Van Rensselaer, M.D. |
| *Recording Secretary,* | F. G. King, Esq. |
| *Anniversary Orator,* | A. Halsey, Esq. |

2. *Torrelite, a new mineral.*—In the 2nd. number of the Annals of the Lyceum, Prof. Renwick has described a mineral, from Sussex County, New-Jersey, which is found to contain *Cerium*. The mineral is supposed to be new, and for it is proposed the name Torrelite, in honor of

the President of the Lyceum. It contains, according to analysis,

| | | |
|---|---|---|
| Silex, | 16.30 | parts. |
| Peroxide of Cerium, | 6.16 | |
| Protoxide of Iron, | 10.50 | |
| Alumine, | 1.84 | |
| Lime, | 12.04 | |
| Water, | 1.75 | |
| Loss, | 1.41 | parts. |
| | 50.00 | |

### 4. *Prof. Hall's Catalogue of Minerals.*

A "Catalogue of Minerals found in the State of Vermont and in the adjacent States, together with their localities," an 8vo. pamphlet of 44 pages, has recently been published by Prof. Hall of Middlebury College. The author has designed this work principally to aid those who attend his mineralogical lectures in making collections of minerals; and it would seem desirable that every lecturer on mineralogy should follow the example of Prof. Hall, by placing in the hands of his pupils a convenient index to the principal neighboring localities. This little work, however, is not a mere catalogue of minerals and localities; but generally the most prominent characters of the minerals, and in some instances minute descriptions are given. To the students of the author, and to persons travelling in the section to which the work is particularly adapted, this manual must be an important guide; and we think it cannot be entirely uninteresting to any lover of the science. A work of this nature admits of continued improvement; and it is presumed that future editions will be rendered still more interesting than the present.

### 5. *Philadelphia Water Works.*

By the last annual report of the Watering Committee of the City of Philadelphia, it appears that the success of the plan recently adopted for supplying that city with good water continues to exceed the most sanguine expectations. The reader is referred to Vol. VI. p. 375 of this Journal, for a notice of the magnificent water works at Fair Mount, two miles* above the city, at the falls of the Schuylkill. The water power here created, by the natural fall of the river, and by an artificial dam, is made to raise by acting on three large wheels, nearly four millions of gallons of water in twenty-four hours—a quantity about three times the ordinary demand of the city. The supply of water is not only more abundant, but much less expensive, than was formerly afforded by steam engines. The annual expense for raising 3,750,000 gallons of water daily, including current daily expenses, interest on the money expended in constructing the new works, damages, &c. is estimaat $25,690; "but," says the report, "if the same quantity were required to be raised by additional steam engines, the annual expense would be at least $75,000"—"exclusive of the first cost of the steam engines."

It is calculated "that with the expenditure of not more than $50,000 for five new wheels and pumps, the quantity can be increased to 10,000,000 of gallons in twenty-four hours, the water power being sufficient to raise even more if required."

A trial of the dam took place last winter from a severe freshet, but "not the slightest injury was sustained; no accident has occurred to any part of the works during the last year, during which they have performed in the most satisfactory manner; the same observation may be made as to the *iron pipes* in the streets, of which there are about nine miles laid without the occurrence of a leak."

## 6. *Molybdena.*†

Molybdena is found, about half a mile to the east of the turnpike, leading from Saybrook to Middletown, on the first road on the right hand, above the turnpike gate, near the house of the widow Pratt. It is not far from Pettipaug meeting house, in a northern direction.

* In the notice referred to, this distance was incorrectly stated as five miles.

† Locality communicated by Dr. Timothy Dwight Porter.

### 7. *Sillimanite.**

On the same turnpike, not far from two and a half miles beyond this, in the parish of Chester, on the left hand of the path, in a flat rock, which is chiefly mica-slate, I believe lying a few rods south of the Post Office, is the above mineral, crystallized in veins of quartz. The Post Office is kept in a room of Denison's Tavern, near a small stream running into the Connecticut.

### 8. *Progress of the Geological Survey on the Grand Canal.*

For the Journal of Science.

To Prof. Silliman.

You having given notice of Mr. Van Rensselaer's intended geological survey of the Erie canal line ;—a short account of the progress already made, may not be uninteresting to those who read that notice.

The first part, which comprises a description of the rocks is printed. It forms a thin octavo volume of 163 pages. But the engravings will not be completed until about the middle of April. One of the plates exhibits a geological profile extending from the Atlantic, at Boston, to Lake Erie. It is four and a half feet long, embracing nine degrees of longitude, and running near the 43d degree of north latitude. It is engraved by excellent artists, Messrs. Rawdon and Clarke, at the expense of $530. The other presents a profile of rocks from the western part of Massachusetts to Boston, drawn by the Rev. Edward Hitchcock, at the request of Mr. V. R.

A very concise view of the nomenclature adopted in the descriptions of the rocks, precedes the descriptions. A concise enumeration of facts, with scarcely a sentence of hypothesis or theorizing, constitutes the whole body

* Communicated by Dr. T. D. Porter.

of the work. Mr. Van Rensselaer insisted upon the total exclusion of every thing which savours of any theory.*

As soon as the engravings are completed you will receive a copy. I will here subjoin a few localities of minerals which I saw in the rocks adjoining the canal; beginning at the Hudson River, and proceeding westerly.

*In transition sand rock.* Anthracite, sulphuret of lead, sulphuret of zinc, green carbonate of copper, lamellar sulphate of barytes, quartz crystals with pyramids on each end, brown spar, brown hornstone and pearly hornstone, large masses of coarse agate, stalactitic quartz, chalcedony, and petrosilex. This rock crosses the canal in Florida, ten miles west of Schenectady; also in Canajoharie, and west of the little falls in Herkimer county. It runs in a north-east and south-west direction.

*In transition limestone.* Numerous petrifactions. Among others, three distinct kinds of the trilobite, which M. Brongniart seems inclined to place among crustaceous animals. One of my assistants, Dr. J. Eights found a specimen which manifestly exhibits the projecting stripes which once supported the eyes, if M. Brongniart is correct in his opinion. This rock every where accompanies the before mentioned transition sand rock.

*In millstone grit.* Sulphuret of lead and sulphuret of zinc, in a quarry in the north-west corner of Westmoreland, three miles south of the canal at Rome; also one mile east of Vernon village.

*In saliferous rock*, or secondary red sandstone and red clay slate. Salt springs at frequent intervals from Vernon, to thirty miles west of Niagara River; a distance of about two hundred and thirty miles. But *gypsum is no where associated with the salt formation* in the state of New-York, nor in Upper Canada, according to the received opinion.

*In ferriferous slate and sand rock.* Argillaceous iron ore in an uninterrupted stratum or layer, extending from near Little Falls to thirty miles beyond Niagara River. Or in other words, I feel authorized to report, that there is a single unbroken specimen (*stratum or bed? Ed.*) of argillaceous iron ore, two hundred and fifty miles long, and from

* Mr. V. R. has consented to my putting this report into the hands of booksellers, to be retailed at $1·50 All the money paid for it is to be applied to improvements in agriculture. A. E.

twenty to thirty miles broad. It is generally from twelve to twenty inches thick.

*In* a slate rock, which may be called *secondary graywacke*, or *calciferous slate.* Numerous beds of gypsum of vast extent. It is found in no other situation in beds; but is every where confined to this slate rock in the state of New-York. It is found in geodes, however, in swinestone, &c. In this slate we find shell limestone, water limestone, epsom salts, copperas, and alum, in numerous localities. This rock underlies all the country over which the stage road passes from Oneida Creek to near Genesee River; parallel to the canal, and from half a mile to twenty miles south of it.

*In swinestone*, or it may be called *geodiferous lime rock.* This rock abounds in geodes, which contain beautiful crystals of sulphate of strontian, limpid cubic crystals of fluor spar, transparent waxy zinc blende, immense quantities of dog-tooth spar and pearl spar, selenite and snowy gypsum, arragonite, though rare, and numerous quartz crystals. It contains many petrifactions also; such as those of the coral family, asterites, and numerous bivalves. This rock extends from Genesee River to a considerable distance west of Niagara River. It forms most of Niagara Falls. The canal at Lock Port is cut thirty feet deep into it for two miles. East of Genesee River it is cut through this rock about half a mile.

*In pyritous shale* of English Geologists; or it may be called *pyritiferous rock*, as it is not always slaty. Thin horizontal layers of bituminous coal, alum, copperas, epsom salts, and immense quantities of iron pyrites. I saw thousands of petrifactions in it. on the south shore of Lake Erie, eighteen miles from Buffalo, which consist wholly of iron pyrites. This rock extends from a considerable distance east of the south end of Cayuga Lake to Lake Erie, and many miles along the south shore of the latter lake.

It may be proper to mention, that the sulphuretted hydrogen gas which issues through water at the foot of the bank a mile above Niagara Falls, and near the head of Otsquago Creek, in Herkimer county, manifestly proceeds from pyritous shale. The gas burns with a flame equal in extent to that of half a dozen candles, at both places. But the carburetted hydrogen gas, which issues from the foot of a hill near the stage road, one mile west of Vernon village, undoubtedly proceeds from crevices in the red rock, which forms the floor of the salt springs. It burns brilliantly, and is considered as strongly indicating the existence of coal beneath the red rock.

The few facts here enumerated I give from personal examination, made since I have been in the employment of the Hon. Stephen Van Rensselaer.

AMOS EATON.

*Troy, N. Y., March* 20, 1824.

## 9. *Ignition of Platinum.*

To the Editor.

*Dartmouth College, April* 29, 1824.

Dear Sir,

I have been engaged in repeating the experiments of Doberciner and others on the ignition of finely divided platinum.

I find that when the vapour of ether or of alcohol is made to pass on to platinum *sponge,* in a manner similar to that in which a jet of hydrogen is thrown upon it, that the platinum becomes brilliantly ignited; but it requires for this effect a *slightly* elevated temperature, yet, so low that the platina sponge may be held with great ease in the hand, before exposure to the vapour. I have not noticed in any journal that this effect has been observed with the vapour of fluids thrown upon *spongy* platina.*

## 10. *New Locality of Cobalt.*

Beautiful crystals of *arsenical cobalt* in octahedra, deeply truncated, have been found at Franconia, N. H. I have some specimens already packed with other minerals which I shall forward to you very soon.

With great esteem yours, S. F. DANA.

* I have seen none later than No. 32 of Brande.

11. *New Locality of Amethyst.*—Communicated by Professor J. Adams.

Amethysts have lately been found at Bristol, Rhode Island. The locality is on the shore of Mount Hope Bay, a branch of Narragansett Bay. A large number of specimens has been found, some of which are regularly crystallized. A few are large and beautiful. Two or three have been wrought into elegant personal ornaments. Many of the specimens have been procured from among the sand and gravel, at and near low water mark. This sand is formed by the constant decomposition of an immense mass of rock, which rises in a precipice of considerable height, close upon the shore. Some specimens have been discovered by digging into the rock, especially that part of it which contains quartz. Most of the mass of rock in question, is feldspar nearly pure. Very minute specks of mica are scattered through it, but they are extremely rare. The mass is occasionally traversed by thin strata of quartz, nearly in a vertical situation.

At this locality of amethysts I found also, two specimens of micaceous iron, and upon the shore near the same place, a great number of crystals of iron. (Sulphuret of iron.) Many of them are very large, crystallized in cubes, whose sides are from a half to three quarters of an inch square in their dimensions. They are imbedded in a hard, light coloured clay slate. This locality of amethysts is about two miles from Bristol village, and near the ferry which leads from Bristol to Rhode Island.

The region in which these minerals are found, is a part of the transition formation which extends from Narragansett to Massachusetts Bay. This transition formation rests upon a primitive foundation, and does not appear to be very thick; since in sinking walls, we sometimes penetrate into the primitive rocks, and in some places, the primitive rises upwards through the incumbent transition formation. This is the case with the summit of Mount Hope, which is granite, and with the mass of rocks which form the locality of amethysts above mentioned.

### 12. *Acid Fumigations.*

Dr Lyman Foot, of the United States' Army, mentions, in a letter to the Editor, the frequent use of fumigations of muriatic acid gas, among the troops sick at Plattsburgh in the latter part of the year 1819. The disease, which was termed *typhus icterodes*, was of a malignant type; and, from the facts stated, the fumigations appear to have had a remarkably salutary effect in correcting the vitiated air in the wards, and in preventing the extension of the disease.

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Dr. Samuel Robinson, of Providence, R. I., has prepared for the press *a Catalogue of American Minerals*, having the towns, counties, or districts of each State arranged alphabetically—the course or distance of each mineral from some known place, and whether abundant. The value of such a guide to the mineralogist, can be duly appreciated only by those who have travelled in search of specimens.

He respectfully solicits the aid of any mineralogist, who can designate any locality, not yet made public. To favor such communications he will postpone the publication until the 1st of July next. All authorities from which he may derive any assistance, will be respectfully acknowledged in the work.

### *Correction.*

Dr. Jeremiah Van Rensselaer, in a letter to the Editor, states, that in September last he visited Prospect Hill, one mile east of the City of Hudson, and found that the "circle of memorial," mentioned by Mr. Finch, in his paper on "*the Celtic antiquities of America*," (Vol. VII. p. 155 of this Journal,) was nothing more than the foundation of an ancient and demolished wind-mill; "it consisted of about a dozen rolled masses of quartz, forming an irregular circle, with stones placed in the centre."

THE

*AMERICAN*

# JOURNAL OF SCIENCE, &c.

## GEOLOGY, MINERALOGY, TOPOGRAPHY, &c.

### Art. I.—*Notices of the Geology and Mineralogy of Sicily, from a Work entitled*Storia Naturale della Sicilià. Cat. 1813; del. Ab. F. Ferrara. Translated and condensed by* James G. Percival.

The Geology of Sicily embraces three very distinct formations, viz. the *Primitive* formation of granite, gneiss, mica-slate and argillite, having its centre in the mountains of Pelorus, and thence extending westward, on the N. of Ætna, towards the centre of the island—the *Secondary Limestone* formation, covering the eastern slope of the mountains of Pelorus, and all the rest of the island, not occupied by the rocks of the primitive formation, nor by the products of volcanoes,—and, lastly, the *Volcanic* products of Ætna and a line of extinct volcanoes extending S. through Val di Noto to Cape Passaro.

The *Granite* is confined to the mountains of Pelorus, a chain extending N. by W. from Taormina, at the N. E. foot of Ætna, to Cape Milazzo, on the N. coast of the island. It forms the centre and base of these mountains, and is covered, particularly on their E. slope, and even to their summits, by limestone. The W. front is steeper, and the granite is there uncovered, as well as in the numerous valleys and ravines of the chain. These mountains correspond exactly to the granite mountains of Calabria, on the opposite side of the *Faro;* and it is evident to the observer, that the Appenines there bend W. and after being interrupted by the Faro, terminate at last in the mountains of

*Received from the Author by the Editor.

Pelorus. This granite is very compact; its feldspar is most abundant, and often porphyritic in rhomboids. It is abundant in large blocks, at the base of the mountain, particularly in the valleys and water courses.

*Gneiss* covers the granite on the sides of the chain. It often contains nodules of earthy iron ore. Mica slate is found at the base and sides of the chain, and forms secondary ridges extending far towards the centre of the island.

Feldspar often constitutes large veins in the granite, and forms entire blocks in the debris of the mountains. There is a coarse grained granite, easily disintegrating, which Prof. F. calls secondary granite. It is probably the coarse, friable granite, so common in veins in gneiss and mica slate.

There is a band of *Transition Rocks* running along the whole W. front of the mountains of Pelorus, and extending from Capo Grosso on the N. nearly to the centre of the island. They consist of *Petrosilex*, schistose and compact; *Argillite*, (*Ardesia*) in inclined strata, forming low mountains, alternating with hills of chalk and shell limestone; it is the matrix of nearly all the metallic ores of the island; *Pietra Cornea*, schistose and compact; including trap or greenstone; *Porphyries* of many varieties, with a base of petrosilex or feldspar; serpentine and steatite in scattered masses at the base of Pelorus; and various aggregated rocks. The nomenclature of the author is here rather antiquated: we would venture to class the rocks here enumerated under the heads of argillite, wacke, greenstone, gray-wacke, &c. Perhaps the limestone alternating with the argillite may be similar to the shell limestone with inclined strata, in a similar relation to the argillite in Dutchess, N. Y.

The limestone of Sicily is arranged under the following divisions: 1. *Primitive* in the veins of gneiss and mica slate, not abundant, too scanty and friable to be wrought for marble; dolomite is not uncommon: *Transition*, (*Calcaria antico*) fine grained, compact, grey, often foliated; found in the Nebrodes, and in the mountains around Palermo, &c. generally very fine grained, and hard as flint; forms excellent lime; sometimes contains anomias, medusas, &c.; sometimes destitute of organic remains; generally occupying the base of the mountains, and covered by a coarser shell limestone: *Compact*, fine grained, often with a confused crystallization, abounds in petrifactions, sometimes contains impressions of fishes, particularly at Syracuse; when sufficiently hard is wrought as marble. The marbles of Sicily are all compact and coloured. The white crystalline marbles in the ancient ruins of Sicily are from Greece or Italy. The most noted *Marbles* of Sicily are the brown, red, &c. of Taormina; the yellow, of Castronuovo; those of Trapani having almost every shade of colour; the red, the dendritic, &c. of Palermo; the *Lumachella*, or snail marble; and the calcareous *Breccias* of Catania, &c. Coarse *Shell Limestone* forms a crust over the whole of Sicily, with the few exceptions already pointed out; all the islands between Sicily and Africa, except the volcanic island, *Partellaria*; and the country around Tunis, where it is completely horizontal. It is always stratiform, the strata from many feet to a few inches in thickness; in the centre of the islands, they are horizontal, in Valdemone turned towards the chain of Pelorus, and every where along the coast dipping downwards towards the sea. In the volcanic districts they are variously inclined, often alternating with beds of lava as many as sixty times. It is almost entirely made up of shells, among which are *ammonites*, *belemnites*, *gryphites*, *turbinites*, *chamites*, &c. and immense quantities of madrepores and other corals. *Oolites* are abundant, particularly at Pedagaggi, near Catania. Calcareous tufas, consisting of masses of shells, barely cemented, are common.

The hills subordinate to the limestone mountains, and the plains consist of *chalk*, and *calcareous breccias*, and *beds of marl and clay*. The chalk is generally yellow or brown, and interspersed with beds of flints and quartz pebbles; sometimes there are large masses of uncemented shells, often siliceous and of an enormous size; (probably similar to the oyster-shell beds of Georgia.)

*Stalactites* are very abundant in the numerous limestone caverns of Sicily. The most splendid are in the grotto of St. Rosalia, near Palermo, and in the *grotto nuova*, in Val di Noto. When these stalactites are large, compact, and with a fine arrangement of differently coloured rings, they are called alabasters. The finest are at St. Rosalia, Trapani, and Taormina.

*Crystallized Carbonate* is found in very fine and perfect specimens, in the primitive rocks of Pelorus, and in the cavities and pores of ancient lavas, whether buried or not under the calcareous stratum covering the island. It is found in these cavities in every state of crystallization, from a granular or laminated mass to the finest fibres and points, shooting across or lining the cavity. It is always white, except in decomposed lavas, where its surface is stained by oxide of iron.

*Magnesian Carbonate* in opaque masses studded with rhomboids, in connexion with carbonate and sulphate of lime. *Brown Spar*, coating stalactites with yellowish three sided pyramids. In minute rounded crystals in the mines of *Spathic iron*, at *Fiume di Nisi.*

*Bituminous Carbonate*, in masses of various sizes in the compact limestone, and in small pieces among the crystals of calcareous spar. The larger and harder masses are used in architecture as a black marble. Sometimes it is so impregnated with petroleum, as to be combustible; and the heat of the sun liquifies the petroleum, forming a mineral pitch in the fissures, &c.

*Powder of Balda*, a mixture of earthy carbonate and sulphur—formerly famous as a *panacea.* It has the usual properties of absorbents and sulphur. The earthy stratum is almost universally *Marl.* The marls of Val di Mazzora are calcareous; those of Valdemone siliceous and ferruginous; and in the volcanic districts of Val di Noto, highly argillaceous and ferruginous. *Indurated Marl* is very common; some of it is wrought as marble; it often forms immense masses, divided by regular fissures into prismatic blocks. In the mountains of Nicosia, &c. are strata of indurated marl, containing petroleum

Sulphate of lime is found in every Corner of Sicily, particularly at Raddusa and Paterno, in the plain of Catania and at Taormina. It forms entire mountains, subordinate to the limestone mountains. It is also imbedded in chalk and marl, and is found in veins in the shell limestone. In all these cases it is secondary. *Primitive Gypsum* is found in the granite of Pelorus. It generally occupies the beds of sulphur and salt so common in the island. A remarkable instance of the sulphur imbedded in chalk, and resting on sulphur, occurs at Raddusa. It is found in the forms of *alabaster*, *fibrous gypsum*, *earthy and farinaceous gypsum*, and *selenite*, or *crystallized gypsum*. Delicate white threads of gypsum are found occupying the cavities of lavas in the crater of Ætna. Great quantities of gypsum are used in *stucco*, particularly at Catania.

*Fluor Spar* is found in small pieces confusedly crystallized, in the mountains of Judica and Torcisi; colour cinereous or violet; rare.

*Barytes*, very common; in almost all the sulphur mines, and as the matrix of the ores of copper, lead and silver, at the foot of the mountains of Pelorus. *Carbonate of Barytes* in the sulphur mines of Asaro and Raddusa, in small scattered grey masses; in the lead ores at Fiume di Nisi, yellowish.

*Sulphate of Barytes*, very common, alone, or united mechanically with carbonate and sulphate of lime; earthy in the sulphur mines of Riesi, sometimes very hard and fine grained; crystallized in the sulphur mines on masses of the compact variety, and of carbonate and sulphate of lime, clay, &c. At Raddusa they find masses incrusted with confused crystals, resembling stalagmites. Fetid sulphate in the sulphur mines; some large laminar masses have the laminæ covered with shining black dendrites.

*Strontites.* The *sulphate* is found in all the sulphur mines, in confused crystals, on the masses of sulphur and sulphate of lime; also, in yellowish white, fibrous, amorphous masses, always associated with sulphur and gypsum. *Carbonate of Strontian*, in the sulphur mine of Asaro, in amorphous masses, grey, with a brilliant scaly fracture.

*Quartz*, in veins in the granite, gneiss, argillite, &c. in rolled pieces and fragments at the foot of the mountains of Pelorus; also, in beds of rolled pieces and pebbles, in the chalk and limestone mountains. Sometimes traversed by veins of calcareous spar. Compact schistose masses of white and violet quartz are found in the streams at the foot of the mountains of Pelorus; also, irregular pieces of translucid quartz, having a tendency to the pyramidal form. In the mountains of Judica and Torcisi are friable masses of violet quartz, composed of an aggregate of irregular prisms. Very minute perfect crystals of transparent quartz, in the paste of the marbles of Taormina. *Siliceous Slate*, in the limestone mountains of Taormina, in inclined strata, opaque, imperfectly conchoidal fracture, colour smoky. *Flint*, in scattered, rolled pieces, in the limestone mountains, and in the chalk and clay strata, often forming entire beds ; the dark yellow, most esteemed for gun flints.

*Agates* are extremely abundant in most parts of Sicily and in very great variety. They have been known from the earliest periods. Petrified or agatized wood is found in Sicily ; also large agates with concentric layers which have been mistaken for the same.

*Jasper* is very abundant, often in enormous stratiform masses ; also in rolled pebbles in the plains and valleys. Sometimes it is divided by fissures perpendicular to the strata into irregular cubes. The Sicilian Emeralds are only quartz or jasper coloured green. *Zeolite* in the cavities of ancient lavas in groups of radiated fibres ; also in a breccia of sand and volcanic fragments and in the lavas of the rocks of the Cyclops.

*Analcimes* (*Cyclopite* Ferr.) found in the rocks of the Cyclops, and also in the cavities among masses of those ancient lavas, now covered with limestone strata—generally in a hard homogeneous lava with minute pores, sometimes so abundant as to form a large part of the mass and give it a brilliant glassy fracture. The crystals are found lining the cavities, solitary or grouped, from a line to an inch in diameter. Sometimes in the fissures of the marl covering the lavas.

*Aluminous and Pyritous schists* are abundant in the transition mountains of Nicorea, Fiume di Nisi, &c.

*Bituminous Schists* are found in mountains of Taormina &c. Some are so highly impregnated as to be used for fuel, sometimes they are traversed by veins of quartz.

*Indurated Clay* abounds in the chalk strata, and among the bituminous schists. *Fullers Earth* is found in many places, particularly at Cantorbi. In some parts they use for the same purposes a mixture of chalk and clay.

*Porcelain Clay* in large veins and in beds of white decomposed feldspar, in the mountains of Pelorus–also in large masses in excavations near Catania—*Pigments* abound in the more recent formations of Sicily ; of every shade of colour. A very delicate green pigment is found at Castrogiovanni.—Sandstones and Breccias are very common in Sicily, and vary in compositions according to the districts in which they are found, and the rocks from which they are formed, granitic, calcareous or volcanic. On the sea coast near Messina, there is aconstant process of aggregation going forward. The soil is calcareous and the mud of the shore hardens, with the sand, pebbles, &c. into a breccia. By drawing the outlines of any object, it may in no great time, be obtained in a solid state. In this way they form millstones &c.

*The Metallic Minerals* of Sicily lie almost entirely among the argillites, whence they extend in winding veins into the mica slate and gneiss. The following are enumerated by Prof. Ferrara. 1. *Silver* : Native Silver in the mines of Fiume di Nisi and Limaria ; 2. Vitreous Silver. Fiume di Nisi and Noora, with galena and earthy iron ; 3. Arseniated Silver in the mines near Bronte on quartz, and in minute superficial grains on green Carb. Copper ; 4. Arseniated sulphuret, laminated on quartz and calc. spar, at Limaria ; 5. Antimoniated Sulphuret, near Francorilla ; 6. Red, brown, or lead-grey, composed of Silver, copper, sulphur and antimony, at Francorilla.

*Copper* : 1. Native Copper, on barytes and quartz, at F. di Nisi ; 2. grey granulated C. on quartz, at Noora ; 3. Vitreous C. iridescent, at Noora ; 4. Violet blue C. on quartz and in bituminous slate, at Ali ; 5. Steel grey, powder black, common at Noora, composed of copper, silver, antimony, sulphur, &c. ; 6. Red oxide, at F. di Nisi ; 7. Blue carb. superficial or in earthy grains, also penetrating various stones, argillaceous and calcareous, and giving them the appearance of *Lazulite*, common at F. di Nisi ; 8. Green carb. superficial on quartz, fibrous, with silver and lead at Noora ; 9. Green C. in stalactitic grains on barytes and earthy iron, at F. di Nisi ; 10. Green C. granular with blue C. and silver on quartz at F. di Nisi; 11. Earthy green C. among the ores at F. di Nisi and in Argillite ; 12. Yellow C. Pyrites, abundant at Taomina, Noora, &c., and in the streams descending from the mountains.

*Lead* : Galena, at Noora and Limina, laminated, in cubic crystals and granular ; mixed with fragments of quartz and copper pyrites, at Limina on barytes : an argentiferous ore is extensively wrought at Noora.

*Antimony* : Arseniated Sulphuret, forms mines in the vicinity of Savoca and Roccalumiera, formerly wrought.

*Molybdena*, mixed with the quartz matrix of the green copper at F. di Nisi, and the galena at Noora ; also in the rolled quartz pebbles in the valleys of Pelorus.

*Iron.* 1. Iron Pyrites, crystallized and amorphous; and sometimes in rolled pieces, with a crystalline or granular fracture, in stalactitic masses; very abundant in Sicily, in the argillites around the chain of Pelorus, and in beds in the chalk and marl strata, associated with sulphur, gypsum and common salt. Sulphate of iron is found at Noora and F. di Nisi formed from the decomposition of pyrites, said to have been formerly wrought in the argillite mountains of Petralia; chalybeate waters are common in Sicily, the best known are at Paterno. 2. Granular magnetic iron, in the sands in the bottom of the valley of Taormina and F. di Nisi. 3. Oligist, near Taormina and Savoca, beautiful specimens are found adhering to the lavas of Ætna, laminated and cellular. 5. Spathic iron, in small masses on quartz in a valley behind Taormina,—some specimens are united with compact earthy manganese. 6. Oxide of iron, abundant in every part of Sicily, particularly around the chain of Pelorus; immense masses are found in the argillite and chalk, particularly in low wet places; red argillaceous oxid in the mountains of Nicoria, &c.; earthy oxid in globular masses, in pieces with blue and green spots of carb. copper near Taormina, in balls with concentric strata, at Nicoria, &c.; often mixed with decomposed pyrites; silicated oxid in granular masses in the streams from the mountains around Taormina, dark, gray, or earthy blue phosphate, in the volcanic tufas of V. di Noto, and in the cavities of decomposed lavas in low marshy places; also in the fissures, and on the surfaces of various earthy substances; in the low metalliferous soils around Pelorus, as at F. di Nisi. Chromate in the metalliferous mountains of F. di Nisi, dark brown, hard, compact.

*Anthracite* is found in several places in the transition rocks around the chain of Pelorus. It is not wrought, however, to a sufficient extent to prevent the importation of large quantities from Riggio and other parts of Calabria. The following are the principal localities: 1. Messina without the walls. It is dug on the surface like a quarry; it lies in argillite, and runs under it in the direction of its strata, burns with difficulty, but keeps fire a long time. It is rather a highly bituminous schist, but serves well for fuel; in its vicinity there are pyritous schists easily decomposing in the air. It is at a little distance from masses of granite alternating with limestone hills and insulated masses of gypsum. First discovered about 1650, repeatedly abandoned and re-opened since; has been used extensively in the foundries of F. di Nisi. 2. At F. di Nisi, very slow in burning. 3. At Castrogiovanni, burns with much smoke and a bright flame. 4. At Taormina. These three last are rather bituminous schists. There are many other localities of bituminous schist, sufficiently combustible to serve as fuel, particularly in the mountains of Patralia. The foliated bituminous earth of Hybla is of this class, yellowish in thin layers, burns suddenly, with a bright flame and a strong odour.

*Naphtha* is found in large quantities in the Lago dei Palici, the waters of the lake are strongly impregnated with it, and it diffuses its odour to a great distance. In the vicinity of Paterno there are lavas imbued with naphtha; all the pores and cavities are filled with it, and it continually drops from the fissures, and hardens into petroleum.

*Petroleum*, very abundant. In ancient times found in great quantities in the vicinity of Agrigentum; now only one fountain is remaining. (*S. Anna.*) At Patralia is a fountain, (*della Madonna di Patralia,*) on the surface of which it collects and hardens around it into tabular flakes. It is less abundant and more dense than formerly. They can collect only two pounds a day. Near Bivona is another fountain yielding still less. Near Alessandria is a rock of crystalline porous limestone imbued with naphta, and from which petroleum trickles. At all these localities there are churches dedicated to the Virgin, (*madonna dell olio,*) and the fountains themselves are under the care of monks residing there. The oil is considered a sacred remedy by superstitious Catholics. There are a great many other fountains of petroleum scattered over the island.

*Maltha* is collected in large quantities at the foot of a bituminous limestone rock, near Ragusa in V. di Noto. Very tenacious, and shining like tar.

*Asphaltum*, in the argillites at Nissoria, near Nicosia; also at Capizzi and Lionforte, where it is called black amber (*ambra nera*); also at Lago dei Palici. There are enormous pieces in the cabinets of Prince Biscari, and the Benedictines at Catania.

*Amber* is very abundant under the argillaceous strata in irregular pieces of various sizes. It is found there, and also in scattered pieces in alluvial soils, and on the sea shore. It is of various colours, transparent and opaque. Some specimens contain insects perfectly preserved. Jet is found on the shores of Catania at the river Simetus. Other subtances are wrought as jet, viz. indurated asphaltum, bituminized wood, found in chalk strata at Licatia, and bituminous schist, very hard and black, from the mountains of F. di Nisi.

*Fossil wood* is found in dry ferruginous soils; specimens are brought from Mascaldi and Cefalu.

*Sulphur* is abundant in almost every part of the island. Mines of sulphur are found in great abundance for a great distance around the river Salso, and also around Girgenti. Where they are not yet discovered, they are indicated by sulphur springs, &c. They are usually accompanied by pyrites, common salt, and gypsum, and imbedded in strata of chalk and clay, in the intervals between the limestone mountains. They often extend in a winding direction in veins more than thirty feet thick. The middle of the veins are pure sulphur—the sides are adulterated. The mines of Riesi, Milocca, Palma, and Raddusa furnish immense quantities. It is found massive and crystallized, of a great variety of colours, yellow, red, green, &c. Very little is found in the crater of Ætna. None of the sulphur consumed and exported in such immense quantities, is obtained from that Volcano.

*Alum* is found in efflorescences among bituminous schists; also in the strata of argil around sulphur mines, particularly those of Raddusa and Palma; also in efflorescences in fissures of the crater of Ætna. The alum of Lipari was famous in ancient times. In the fifteenth century that of Ichia was wrought extensively, and about the same time that of Tolfa in the Roman State. This last has superseded all the others. In the sixteenth, alum was extensively manufactured along the coast from Messina to Taormina at the foot of Pelorus, particularly at F. di Nisi. There are extensive remains of alum works at Roccalumiera. They are now wholly abandoned, and the island is supplied from Tolfa.

*Sulphate of Magnesia* in many mineral waters; also in minute incrustations in the rocks of Monte Albano.

*Muriate of Ammonia*, found in immense quantities in the fissures and cavities of the lavas of Ætna, after cooling and before the rains have dissolved it. It forms a large part of the white smoke of the volcano. It is collected after eruptions for sale.

*Carbonate of Soda*, found also in the lavas after cooling; also in cavities of the ancient lavas, where protected from rains. Collected in great abundance in the ancient lavas of Bronte. Great quantities of soda are manufactured in Sicily from the Salsola Kali.

*Muriate of Soda* is extremely abundant in Sicily, associated with sulphur and gypsum. The mines of Castrogiovanni, Catholdea, Regalmuto, and Cammarata in the territory of Girgenti, are well known. It is wrought extensively at Raddusa, near Catania. Its mineral associations are the same as those of sulphur. The mine of Castrogiovanni is wrought like a quarry. The river Salso receives the waters which flow from it,—whence its name. There are other mines extensively wrought at Augusta, Trapani, Palermo, &c. Around these mines are extensive salines destitute of all vegetation. The purer specimens are called Sal Gem, *occhi di sala*, &c. They are of a brilliant white, and not deliquescent.

*The volcanic products* of Sicily are of two very distinct periods—the ancient or those of the extinct volcanoes of Val di Noto, and the base of Ætna, and the modern, or those of more recent eruptions of Ætna.—The former are simple, the latter compound.—The ancient lavas consist of a compact homogeneous paste-like basaltes, containing only a few very minute scales and threads of feldspar, grains of red quartz, and very minute particles of pyroxene and chrysolite (olivine ?) many of these are schistose, and some break into irregular blocks like trap. Such lavas are found at Pedagaggi; they have a striking resemblance to primitive trap from Monte Albano in Pelorus.—The lavas of the rock of Motta near Catania are basaltic; they form columns of long prisms and sound like bronze.

The modern lavas of Ætna are all compound, i. e. they consist of a paste stuck full of large and distinct crystals of various minerals, which are all derived from primitive rocks. —These are ; 1. *Feldspar*, the most abundant, varying in size from minute threads and scales to distinct prisms and tables.—In some lavas of the middle age they form more than a third of the mass. 2. Black *Pyroxene*, equally abundant, entire, or in fragments.—3. *Chrysolite* (olivine) green or reddish ; the latter colour probably from the more violent action of heat, as they are of a deep red in the porous lavas and scoriæ.—Abbe F. thinks they ought rather to be considered as red quartz. In many lavas, particularly in the great current of Licatia, near Catania, there are large distinct crystals of *Chrysolite* of a beautiful green, 6 lines long, in regular 4 sided prisms, and very brilliant.—When exposed to greater heat or decomposition by water, they are ferruginous. They are easily detached from the lavas, which is not the case with the minute grains, whence Prof. F. concludes that they were only involved by the lavas, but not of coeval formation like the latter. In the currents near Paterno, there are yellow and black scales of *Mica*. No *Leucite* is mentioned by Prof. F. as occurring in the lavas of Ætna. These crystals preserve their form and brilliance perfectly in the compact lavas but are more or less altered in the porous. The lavas of all ages are either compact or porous, owing to the different degrees of heat to which they were exposed ; varying in this respect from the most compact trap-like lava to the lightest pumice, and even passing from one to the other on the same specimens. Scoriæ, sand, and ashes are all formed of the same paste with the most compact lavas, only altered by the greater degree of heat or mechanical violence—Compact lavas are easily compared with the analogous minerals unaltered by fire. The crystals in the lavas are looser, the feldspar in the porphyritic lavas is more distinct in its outlines, less brilliant and drier. The lavas are also more sonorous, fusible and magnetic. In the ancient lavas near Palagonia, there are masses of Black Glass, (Obsidian) formed, says Prof. F. of a fine grained petrosilex. Abbe F. found on the surface of the lava of 1792, a mass of fine grained earthy petrosilex traversed by a vein resembling flint. Some of the more simple lavas resemble the trap, &c., in the mountains of Pelorus.—The finest kinds of compound lavas, such as the shining black lavas inclosing brilliant white plates of feldspar, and a profusion of deep black crystals of pyroxene, and those of Licatia inclosing the same minerals, and large greenish crystals of chrysolite surrounded by minute grains of the same, have nothing analogous in any of the superficial rocks of Sicily—the Abbe F. supposes that all the lavas of Sicily are derived from primitive rocks which extend from the mountains of Pelorus under Ætna and the extinct volcanoes; that the ancient lavas are formed from the upper and less compound strata of these rocks, and that the modern crystalline lavas are brought up from greater depths where the rocks are more compound and stored with minerals which are not found in the upper strata.—The ancient lavas around the base of Ætna, such as the rocks of Molta and those of the cyclops are as simple as those of the extinct volcanoes of Val di Noto, and were probably of the same period.

Besides these minerals, which compose the paste of the lavas, there are others found in the fissures and cavities of the recent lavas deposited by the condensed vapours. These are muriate of Ammonia, very abundant, collected as an article of commerce—several other muriates, particularly those of soda and iron; carbonate of soda and *Fer oligiste* in brilliant scales, and plates lining the cavities and implanted in groups upon the surface of the lavas.—In the ancient lavas of Val di Noto and the base of Ætna, such as the mountains of Paterno, and the rocks of the cyclops—various minerals are found deposited in the cavities by infiltration, viz. carbonate of lime crystallized, zeolite and analcime (*cyclopite.* Ferr.)

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Art. II.—*Analysis of a Memoir, "Sur les Caracteres Zoologiques des Formations, avec l'application de ces caracteres à la determination, de quelques terrains de* Craie; *Par Alexandre Brongniart."* (Ann. des Mines, 1821.) By J. G. Percival.

The design of this Memoir is to establish the relative value of geological and mineralogical characters in determining the *contemporaniety* of formations particularly in reference to certain formations of chalk. The particular formations which M. B. refers to chalk, are found in very distant localities and with very different characters of consistence, stratification, colour, super-position, &c.; yet from similarity or identity of the fossils imbedded in them, he refers them all to the general head of the *Chalk Formation.* He divides this formation into 3 sub-formations—the superior or *White Chalk*—the middle or *Chalk Tufa*—and the inferior or *Green-sand,* (*Glauconie crayeuse* Br.), i. e. chalk mixed with green grains ascertained by M. Berthier, to be silicated hydrate of iron, and not chlorite, as had been supposed. These 3 sub-formations inclose fossil species which are in part different in each, and in part common.

He first considers *the value of Zoological characters in geology.*

The species of shells, zoophytes, &c. found in formations of different periods, differ from each other in proportion to the difference of time between the deposition of the formations, as in proportion to their perpendicular distance. This law is now well established, and its apparent exceptions have been in most cases accounted for by the particular circumstances attending them, and have thus been reduced to the general rule. It follows from this that the different formations, which overlie each other on the earth's surface, were formed at different and distant periods for they are marked by a succession of *generations* possessing distinct and peculiar characters, which could have arisen only from the slow and almost imperceptible change in organized beings during the course of ages. This difference in the character of the imbedded fossils is usually accompanied with other *mineralogical* differences, such as chemical compositions, structure in mass, order of superposition, accompanying minerals, &c.; but sometimes these differences are in apparent opposition to the *geological differences* derived from the imbedded fossils.—The question to be answered then, is the following: " when, in two distant formations, the rocks are different in mineralogical characters, whilst their organic remains are analogous, ought we to regard them as of distinct formation, or, on account of the general *well ascertained* resemblance of the fossils imbedded, to consider them the same period of formation, when the order of *superposition* does not *evidently* oppose it?" M. B. adopts the latter opinion.—He first shews that rocks very different in mineralogical character may be deposited at the same period; as we now see the argillaceous trap-rocks of Vesuvius; and other volcanoes, the calcareous tufas of many springs, and the siliceous deposites of Geyser, &c., formed at the same period, though very different in character. On the contrary, all the organic remains imbedded in them are analogous, and have the common character of the generation now existing.

The circumstances which cause changes in the mineral kingdom may be instantaneous in their operation, such as earthquakes, inundations, &c. Not so with those, which alter the generations of living beings; their action is extended through a long course of ages, and their influence is scarcely perceptible from one age to another. Plants and animals have scarcely varied their characters since the earliest periods of history. The geological characters derived from analogy of fossils are therefore more permanent, and of course of more value in determining the period of formation, than characters simply mineralogical. Of these, that from the nature of the rocks is the weakest —those from the relative height of the formation, the depth of its ravines, &c., and the inclination of strata, are more important; but these may be produced by sudden revolutions, like the earthquakes of Calabria, which have changed the order and direction of strata, making horizontal perpendicular, and *vice versa;* and throwing recent formations apparently below the base of the more ancient. The apparent relative height of formations is a delusive character, but their real relative height is essentially important, though still less so, than that from analogy of fossils. There are some causes of error, even in this, which ought to be carefully appreciated. Climate and locality produce changes in the same species, and may cause a difference in fossils of the same period. Certain species have survived the great revolutions of the globe, and have lived in different periods, and hence they are found in distinct formations—and species belonging to earlier formations, may by the abrasion of these formations have been mixed and imbedded in formations of a much nearer period.

After these general considerations M. B. proceeds to the consideration of several anomalous members of the *chalk formation;* all of which he refers to this formation from the analogy of their fossils.

1. Chalk of Rouen, Havre, and Stonfleur. At the mill of St. Catharine, near Rouen, the white chalk is found overlying the chalk tufa or green sand. The two latter contain many fossils not found in the former. At Havre and Stonfleur, the white chalk is wanting. The inferior chalk is there exactly analogous to that at Beachy Head, and Dover, Eng. and at Saugatte, W. of Calais; it is separated at the two last places from the white chalk or tufa, there present, by a bed of blue marle. All these localities of green sand and tufa are characterized by precisely similar fossils, of which M. B. gives a catalogue.

2. Chalk of the environs of Perigueux. Bayonne.

The chalk of the N. of France terminates at the S. line of Indre Dep. Passing S. W. the chalk-tufa re-appears near Perigueux, particularly to the westward of that town, the high steep hills along the *Lille* below that city, are a grey sandy, and often micaceous chalk, without distinct strata; but its stratification is marked by beds of black *hornstone*, which divide it into numerous layers. It abounds in shells, some of them (*ostrea vesicularis*,) like the smaller specimens of Meudon.

Passing south west, other rocks occur referable to the chalk formation, where it was not before suspected. Such is the hard gray sandy micaceous limestone, which forms the basis of the soil around Bayonne, and particularly the rocks of Biarite. It contains shells analogous to those of the chalk tufa near Paris, particularly the *spatargus obnatus*. Its stratification can be ascertained only by the difference in the solidity of its parts. It is made up of alternate zones of a grayish, crumbling, argillaceous, or sandy limestone, and a hard limestone, divided into a series of irregular nodules, projecting from the *escarpments* like the flints in white chalk. It abounds in fragments of shells, particularly *echinites*, but no *ammonites*. Although many of these shells have specific differences, yet their general character is that of the chalk formation.

3. Chalk of Poland, from these localities—white chalk like that of Meudon, with black flints and belemnites,

from Grodno and Keminiac—white chalk, full of flints and echinites from the castle of Cracow; in the neighbourhood are found shells similar to those of the coarse limestone of Paris, and sub-Apennine mountains.

4. Green Sand or *Glauconie crayeuse (craie chloriteè) de La Perte du Rhone*, near Bellegarde. There are here two very distinct formations. 1. The inferior, a fine, grey, yellowish, compact limestone, in regular, nearly horizontal strata, without any visible petrifactions. It however contains between its strata, as in Jura, beds of marl very different from the superior formation, to be described, and abounding in shells closely analogous to those in the marl beds of Jura; some are also analogous to shells in the marl beds near Havre. 2. The superior, a yellowish limestone often shaded with yellowish ochry veins, stratification distinct, nearly horizontal, with a slight dip S. E.; it seems to be made up of an immense mass of lenticular stones, which are found to be little madrepores, (orbitolites lenticulata; Lam.) Above are alternate strata of marly limestone, and a sandy clay mixed with green grains, (green sand.) This upper formation abounds in shells strikingly analogous to those of the green sand formation, particularly from Folkstone, and St. Catherine. The genera are the same; the species, some identical, and others distinguishable only when laid side by side. There are no shells of more ancient or more recent formations, than that of chalk. Besides the analogy of fossils, this upper formation contains the green sand of the *Glauconie*, and rests upon a bed of pyritous marl like the *Glauconie* at Honfleur and Tesworth, Eng. The lenticular rock is so ferruginous as to be called an iron ore by Saussure; it is analogous to the ferruginous sand found below the green sand in England and Normandy.

5. Formation of the chalk period, in the chain of Buet, resting on rocks of the transition period. This chain proceeds from the summit of Buet, in the Alps of Savoy, and consists of dark coloured summits, nearly perpendicular on one face, and sloping on the other, and very lofty; (about 8000 feet above the level of the sea.)

On the top of one of these summits, (in particular,) that of Fis in the valley of Servoz, is a rock which M. B. refers to the chalk formation. The inferior strata of the mountain, beginning at the bottom, are as follows: 1. Gray wacke slate, in a detached hillock. Then a sloping mass of *debris.*—2 Mica slate, (*phyllade micacé,*) blackish, very hard.—3. Compact greyish limestone, alternating with and less destructible than 2. Towards the upper part, a compact blackish gray limestone, full of numerous veins of calcareous spar, alternating with 2. A second mass of *debris.*—4. Mica slate, very fissile and friable, traversed in every direction by nodular beds of white calcareous spar, and veins of quartz.—5. *Psammite Schistoide*, very compact, but very fissile. A third mass of *debris.*—6. Very compact grayish limestone, with veins of steatite and chlorite, forming in some strata a coarse steatitic breccia; also veined with calcareous spar in short dodecahedra.—7. Micaceous and quartzeous *psammite*, in thick beds, alternating with mica slate, and black *schistose psammite.*—8. Very delicate and friable mica slate, yellowish externally, blackish internally. —All these strata break off at the S. and dip N. W. The declivity of the summits is from E. to W. Above all these strata, on the highest peak, nearly always covered with snow, is the rock containing shells referred by M. B. to the chalk formation. It is a very hard, compact limestone, coarse grained or sub-lamellar, blackish, and when dissolved in nitric acid, leaving behind much carbonaceous matter, full of dark green grains, insoluble (like the green sand) in nitric acid; above, it is a granular, micaceous, whitish gray limestone, similar to chalk tufa. The fossils in these upper strata are moulds or rather relievos in the cavity of decayed shells. They are grouped and compacted very irregularly; but are still sufficiently distinct to be recognized. They are analogous to those of Rouen, *Perte du Rhone*, Folkstone, and even Paris. There are no belemnites nor terebratulas, which are always rare in the inferior chalk. Ammonites are found in the lower transition strata, as well as in these upper strata, but of an entirely distinct character.

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## Art. III.—*Notice of the Malleable Iron of Louisiana.*

In the year 1810 Dr. Bruce published a brief notice of the great mass of *Malleable Iron*, from the south western part of the United States—now the property of Col. Gibbs, by whom it has been deposited in the collection of the New-York Historical Society. As little is generally known, concerning this remarkable piece of metal, we shall republish the notice of Dr. Bruce together with additional facts and remarks.*

"There is at present in this city a mass of iron, which was sent hither a short time since from New-Orleans, by Mr. G. Johnson, and which from its size and weight has excited considerable attention. Its form is irregular. Its length is 3 feet four inches, and its greatest breadth 2 feet 4½ inches. It weighs upwards of three thousand pounds. Its surface, which is covered by a blackish crust, is greatly indented, from which it would appear that this mass had been in a soft state. On removing the crust, the iron, on exposure to moisture, soon becomes oxidated.—Specific gravity, 7.400.

It appears to consist entirely of iron, which possesses a high degree of malleability; experiments having been made without detecting nickel or any other metal. This enormous mass of iron is said to have been found near the Red River. We regret that we are unable to say much as to its geognostic situation or origin, whether native, meteoric, or artificial. We hope, however, from the enquiries we have instituted, to have it in our power, shortly, to lay before our readers some satisfactory information respecting this interesting object."†

In the year 1808, while Capt. Anthony Glass was trading among the Pawnee and Hietan nations, he was informed concerning a curious mineral which had been discovered

* The additional facts are drawn from the following sources, all of them original, and addressed in MS. to the Editor.

1. A letter from Judge Johnson, of the Supreme Court of the United States.
2. A letter from Mr. William Darby, the well known geographer.
3. A letter from Dr. Sibley, Indian Agent at Natchitoches.
4. The manuscript journal of John Maley, an erratic adventurer.—This journal was first mentioned to the Editor by Judge Johnson, and obligingly communicated by Mr. Isaac Riley, of Philadelphia.
5. The manuscript journal of Capt. Glass and company. Information of the existence of this M. S. was obtained from Mr. Darby, and Dr. Sibley was so kind as to cause it to be copied and transmitted to me.

July 10th, 1824. B. S.

† Bruce's Min. Journal, 1810

on the territory of the Hietans, by one of the Pawnees. The mineral could not have been discovered long antecedent to that time, as Capt. Glass saw the Indian who claimed the honour of the discovery. Capt. G. and several of his party went, in company with some Hietans and Pawnees, and saw the mass in situ. He does not mention whether the natives entertained any particular opinions respecting its origin: they however, regarded it with much veneration, and ascribed to it singular powers in the cure of diseases. They informed him that they knew of two other smaller pieces, the one about thirty, the other about fifty miles distant.*

This intelligence, announced on the return of Captain Glass, excited no little curiosity; and confident hopes prevailed† that the mineral would prove to be platina, or something else of much value.

In 1810, two rival parties were made up for the purpose of obtaining this metal—one at Natchitoches,‡ consisting of George Schamp, who had been with Capt. Glass, and nine associates—the other at Nacogdoches, consisting of John Davis, who also had been with Capt. G. and eight or ten associates.

The Nacogdoches party first arrived at the place of destination; but, having in their hurry to anticipate the rival party, made no preparations for carrying away the metal, they hid it under a flat stone, and went away to procure wheels and draught-horses.

The Natchitoches party arrived a few days afterwards, and after searching several days succeeded in finding their object. Being provided with tools they made a truck-waggon to which they harnessed six horses, and set off with their prize towards the Red River. They crossed the Brassos without much difficulty; but, a straggling party of Indians having one night stolen all their horses, they were detained until two of their party could go to Natchitoches for more horses. On arriving at the Red River, some of

*MS. "Journal of a Tour from Nackitosh into the interior of Louisiana, on the waters of Red River, Trinity, Brassos, Colerado, and the Sabine, performed between the first of July, 1808, and May 1809, by Capt. ANTHONY GLASS, of the Territory of Mississippi.''—M. S pp. 28.

† It is scarcely necessary to add, that no person, acquainted with mineralogy, could have expected it to be platina, or any other precious metal.

‡ Pronounced Nackitosh.

their party went down in a boat with the iron, while others took the horses down by land. From Natchitoches the metal was taken down the Red River and Mississippi to New-Orleans, whence it was shipped to New-York.*

In February, 1812, John Maley, a man who, with a roving disposition appears to have possessed a strong and inquiring though uncultivated mind, went with a few associates up the Red River, with a view to explore the country, trade with the Indians, and (if practicable) to bring away the two remaining masses of metal. He saw one or both of the masses; but being unable to make the remuneration for them demanded by the Indians, he continued his tour farther west. Returning he contracted to barter for the pieces of metal a certain quantity of merchandize; to procure which he returned to Natchitoches and proceeded to New-Orleans.

On his second expedition up the Red River, in 1813, he and his associates, being robbed by a party of Osages of their merchandize and horses, were compelled to return on foot relinquishing their object.†

Undoubtedly therefore two masses at least of this metal still remain in that region, and will probably at some future time enrich some cabinet of natural history. Their *precise* situation is not so well known as could be wished. The following hints are subjoined, as they may afford some aid to any who may hereafter explore those regions.

Some hundred miles above Natchitoches, on the banks of the Red River, is a Pawnee village: south-west of which, about 50 or 60 miles are the probable localities of this metal.—The distances however of this village above Natchitoches, and of these localities from the village are variously stated.

" We were informed by the Indians," says Capt. Glass, " of a remarkable piece of metal some days journey to the *southward* [of the Pawnee village] on the River Brassos."

* Letter from Dr. John Sibley, Indian agent at Natchitoches, to Prof. Silliman, dated June 2nd, 1822.

† " Journal of Travels up the Red River, &c. by John Maley." M. S. pp. 180.

—but he subsequently speaks of proceeding *south* and *west* in going to the mass. " The Indians informed me that they knew of two other smaller pieces, the one about thirty, the other fifty miles distant,"* [probably from the Pawnee village.] Capt. Glass gives no estimate of the whole distance from Natchitoches to the Pawnee village; but, from intermediate distances mentioned, he seems to have considered it about 400 miles.

Dr. Sibley frequently conversed with Capt. Glass, and others of the parties which went in quest of this metal. He states the distance from Natchitoches to the place where the transporting party lost their horses, (which must be about the distance from Natchitoches to the Pawnee village,) as *nearly* 400 *miles* by land; and the distance by water, from the place of embarkment to Natchitoches, as *nearly* 1000 *miles*.

John Maley travelled in these regions subsequently to the removal of the large mass, but visited one or more smaller masses. " Crossing the river," he says, " at the Pawnee village, we took a south-west course over large ledges of limestone, and extensive prairies. After a journey of 3 days, we were conducted by the Indians to this metal. It lay a few miles from the mountain which appeared to be the same that I have before described, as running parallel to the Red River." He does not state whether he saw one piece or more, but he afterwards stipulated for "*the two pieces of metal.*" The Pawnee village, he says, is fifteen hundred miles above the confluence of the Red River with the Mississippi.‡

Judge Johnson being in company with Mr. Maley some years since, entered into conversation on this subject. According to his recollection, he was informed by Maley, that " the pieces were found in the midst of an open sterile plain, lying near each other, and appearing as if broken and scattered in the fall of one entire mass."—" The place was described by Maley as about 200 [400?] miles a little north of west from Natchitoches, on [near?]

* Glass' MS. Journal. † Dr. Sibley's Letter.

‡ Maley's MS. Journal.

the ridge between the waters of the Red River and the Rio Bravo."*

The readers of this Journal will recollect some "Notices of the Geology, &c. of the regions around the Mississippi and its confluent waters," by L. Bringier, Esq. of Louisiana, who travelled in this region in 1812.†

Mr. Schoolcraft, who states that the large mass was found about "*one hundred miles* above Natchitoches,"‡ must have been misinformed concerning the distance.

The following hints given by Mr. Wm. Darby, (to whose travels the public are indebted for much important information concerning the western part of our country,) are probably as definite as can at present be obtained. "If with one of Mr. Melish's Maps of the United States in your hand, you run your eye up Red River, to the Pawnee village, you will perceive a small creek entering Red River, a short distance below the village. This creek is called by the French hunters and traders *Bayon Bois d' Arc.* It was at its mouth that the transporting party reached Red River with their prize. Continue your glance upon the map, a little south of west, to the head waters of the river Brassos a Dios, and you will find the words *Haywa Wandering.* Through the latter you will perceive a small creek represented flowing south into the Brassos. From comparing the account of their journey from Red River and of their return to that stream, I am induced to believe that the latter creek flows from or near the place where the mass of iron was found. The place

* Letter from Judge Johnson to Prof. Silliman, dated Charleston, S. C. August 18th, 1821.

† This Journal, vol. iii, p. 15. Mr. Bringier appears to have written concerning this metal from personal observation. In a prairie, "on the head of the river Trinity," says Mr. B. "longitude 95° 10', and latitude 32° 7', are, or were, several blocks of native iron from one thousand to seven or eight thousand pounds weight."

"It is observable that there is a kind of varnish that covers them all over, and prevents their oxidation. I must rest on the suspicion that they proceed from meteoric bodies; and this is countenanced by the manner in which they are scattered about over an extent of about seven or ten miles, without any sign of iron ore or other minerals in the region."

‡ View of the Mines, Minerals, &c. of the Western section of the United States. p. 218.

is about N. latitude 32° 20′, and 20° W. longitude from Washington City. They must have advanced across the upper streams of the Trinity in their expedition. That part of Mr. Melish's map was constructed almost entirely from my papers. When the manuscript lent me by Dr. Sibley,* was in my possession, I collated it as carefully as was in my power, with draughts of the country which I had previously collected, and upon my map traced as nearly as possible the route which the party pursued. I cannot, it is true, guarantee the accuracy of the delineation; as I never was myself upon Red River above the limits of Louisiana; but from the pains I took to arrive at correct results, I think that the general representation may be depended upon with much confidence."†

Aided by these directions alone, a traveller might experience some difficulty in finding the masses now remaining in that region: but it will probably never be difficult to obtain guides from among the Indians. A mineral substance so remarkable generally engages their attention, and often their veneration. These masses of iron, before they were visited by our countrymen, were among the Indians objects of notoriety; and it is by no means probable that their notoriety has diminished since adventurers have manifested such earnestness to obtain them.

Some interesting remarks upon the native iron of Louisiana by Col. Gibbs, are published in Bruce's Journal, p. 218, with a concise account of similar masses from other countries. Col. Gibbs was the first to make the interesting observation of the occurrence of *crystals* in native iron; he discovered two of an octaedral form in the iron of Louisiana. There can be no reasonable doubt that the huge masses of malleable iron from Louisiana are of meteoric origin; and thus their history is rendered extremely interesting. All who have seen them in situ agree that they appear to have been deposited in consequence of some extraordinary natural occurrence, and that it is impossible they should be the product of art. The similar composition of the vari-

* Glass' MS. Journal.

† Mr. Darby's letter to Prof. Silliman, dated Philadelphia, Feb. 28th 1822.

ous masses of malleable iron, which have been found in different parts of the world, on, or just beneath, the surface of the earth, affords almost decisive proof of their common origin. The experiments mentioned in the notice quoted above from Dr. Bruce would indicate that the large mass in New-York forms an exception to this similarity of composition, but experiments instituted more recently by Prof. Silliman, and stated by Col. Gibbs in the notice already alluded to, have detected nickel in this mass. There is much reason to believe therefore that it had a common origin with numerous other masses, found in various places, and containing malleable iron and nickel—some of which are known to have proceeded from meteors. C. H.

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## Art. IV.—*Notice of Miscellaneous Localities of Minerals.*

### 1. By Steuben Taylor and Thomas H. Webb.

1. *Serpentine*, at Newport. It is situated on the Neck, about a mile south-west of the town, occurring in rocks of the secondary formation. The prevailing colours are yellow, yellowish green, and greenish black. When polished, it exhibits a variegated and beautiful appearance. A tract of four or five acres is covered with these rocks, and there is reason to believe that, should they ever be quarried, they will yield an ample reward to those who may engage in the enterprize.

2. *Asbestos* is associated in small quantities with the above.

3. *Jasper*, at Pawtuxet. It is found abundantly in rolled masses, on the shore E. and S. E. of the village.

4. *Vegetable impressions* on argillaceous shale, at do. They are found in water-worn fragments along the shore, for the distance of half a mile. Some of the shale appears in situ about ten feet from the top of the bank. The impressions differ from those that have been before observed in this State; although the shale is probably a continuation of that which is associated with the anthracite on Rhode-Island. We find among them the Pteris aquilina, the Comptonia asplenifolia, and the Bellis perennis.

5. *Yellow Quartz*, at do.

6. *Fetid Quartz*, at do. and at Cranston.

7. *Arenaceous Quartz*, at Johnson.

8. *Peat* in large quantities, at Cumberland and this place.

9. *Basanite*, of a very fine quality, at Newport.

10. *Garnets* in sienite, at Cranston.

11. *Sulphate of Iron*, in the form of an efflorescence, of a snow white and yellowish white colour, at one of the mine holes on the west side of Tower Hill, in Cumberland.

12. Cubic crystals of *Sulphuret of Iron*, in chlorite slate, are abundant at a short distance from the above. The cubes are often elongated into parallelopipedons; some of them are quite large, and all very beautiful, presenting highly splendent surfaces.

13. Earthy azure *Carbonate of Copper*, of a smalt blue colour, is found about three quarters of a mile N. E. of Cook's Tavern, on Cumberland Hill. It occurs occasionally in minute crystals. Associated with it is the

14. Earthy and Fibrous *Malachite*. The three are however to be met with in small quantities only.

15. Ochrey red *Oxide of Iron* may be procured near Diamond Hill, in Cumberland.

16. A large piece of a rolled mass of *Rock Crystal* was found here a number of years since.

17. *Prase* in good specimens at do.

18. *Beryl;* imperfect crystals of this have been met with at Cumberland, North-Providence, and Foster.

19. *Common Jasper*, red, brown, yellow, and flesh-coloured, also eyed and striped do. are found at Diamond Hill.* They are susceptible of a high polish, and form elegant cabinet specimens.

20. *Tremolite* at Tower Hill, in long acicular crystals of a green colour, disseminated through quartz traversing it in every direction.

21. *Do.* white and fibrous in limestone, at Johnson, about four miles S. W. of Providence.

* This is probably the locality noticed in Professor Cleaveland's Mineralogy as being situated on Cumberland Mountain. It would perhaps be unnecessary to correct this mistake, were it not that there is a place about two miles from this, known by the name of Cumberland Hill, which might mislead the mineralogist, and induce him to relinquish his pursuit, as no jasper is found there.

22. Glassy, *do.* at do. in crystals longitudinally striated, and transversely intersected by seams. They radiate from a centre in a stellated form, and are also variously grouped together. The lime in which it is imbedded is of a beautiful snowy whiteness, and very fine grained, having the appearance of compact carbonate. Not far from it is the large grained limestone, which at a distance very much resembles loaf sugar. As it is so near this place, it could undoubtedly be burnt to advantage, would some spirited individuals interest themselves in the undertaking.

23. *Glassy Actynolite*, in flattened hexaedral prisms, of a dark green colour, longitudinally striated, associated with octaedral crystals of magnetic oxide of iron, at do.

24. *Talc*, of that variety termed French chalk, occurs in considerable quantities at a steatite quarry in the neighbourhood of the limestone, mentioned above. Colour dirty white, and green of various shades. Much of the steatite appears to be passing into talc. Some of it contains but small quantities, some of it is composed one half, or two thirds of talc, and other masses have the two so intimately blended that it is difficult to distinguish them from each other. Judging from what presents itself here, one would not suppose that there could be much doubt respecting these two minerals belonging to the same species.

25. *Common Talc*, with chlorite, near do.

This State, so far as it has been examined, bears evident signs of being a magnesian district, and abounds with such minerals as are usually to be met with in those districts. Among these, no one is more abundant than that last mentioned above; which has been observed at a majority of the localities that have been visited. That which occurs at Mansville, is probably not surpassed in beauty by any that has been found at home or abroad. At both of the Smithfield lime rocks, the silvery and white scaly varieties have been noticed, associated with the carbonate and magnesian carbonate of lime; the dark bottle green at Foster; the common green and fibrous, at a number of steatite quarries in North-Providence; and several varieties at different spots in Johnson.

*Providence, R. I. March* 27, 1824.

2. By Thomas H. Webb.

1. *Chlorite Talc* is found in abundance at Foster, near the locality of cyanite mentioned in a former Number of the Journal. It consists of narrow, elongated, compact plates, or laminæ, of a dark green and greenish black colour. Associated with it we find,

2. *Actynolite*, compact and fibrous, of a dark green colour, surface splendent, and longitudinally striated. It sometimes runs parallel with the above, often passes at right angles with it, but generally occurs intersecting it irregularly. It is imbedded in a fine grained granite.

3. *Common Serpentine*, in the hill upon which the University stands, in this town. Its colour is brown, with a yellowish cast, and is striped in some parts with pale black; its fracture is uneven, and it exhales, when moistened, an argillaceous odour.

4. *Dendritic Limestone*, at Harriss' lime rocks, in Smithfield. The dendrites are often superficial, though they sometimes extend through the mass.

5. *Magnesian Carbonate of Lime*, at do. of a smoky, or bluish black colour, having a shining pearly lustre. Near it occurs a very pretty variety of

6. *White Limestone*, figured with yellow and blue streaks and spots.

7. *Scaly Talc*, colour pearly white, at Dexter's lime rock, in do.

8. *Porcelain Clay* at do.; observed while digging a well.

9. Pale *rose-red Quartz*, at do.

10. *Do.* at Dedham, Mass.

11. *Crystals of Quartz*, at Seekonk, Mass. Some handsome groups have been found here, consisting of regular formed crystals of the common shape, held together by the intervention of a small quantity of dirt only.

12. *Amethyst*, at Westborough, Mass. The crystals are of the hexaedral form, and occur loose in the ground, from which they are occasionally ploughed up. Many do not believe that they are natural productions, but suppose them to have been thus modelled by the inventive genius of the original lords of the soil, and preserve them as relics of the red man's ingenuity.

13. Ochrey red *Oxide of Iron*, at Scituate, eight miles

from Providence, on the Plainfield turnpike road. It was accidentally discovered during the late war, purified, and sent to market. By many it was considered equal, if not superior, to the Spanish Brown, and was much used as a substitute for it. It is of a brownish red, and blood red colour, easily reduced to powder, and is so pure as to require but little preparation previous to being employed.

14. *Amethyst,** in small quantities, at Bristol, on the shore near the ferry. Many of the specimens are fragments of crystals. The colour is violet, of different shades, some very beautiful. The predominating rock here is a coarse grained granite, in a state of decomposition, traversed by wide veins of quartz. As but few if any of the specimens have been found in this rock, but most of them having been procured at low tide, it is probable that the rock which contains them is covered by water.

*Providence, R. I., March* 29, 1824.

*Additional Communication in a Letter to the Editor, dated June* 26.

Great quantities of the Amethyst have been found within a few weeks past, most of which are fragments of very large crystals, of the hexaedral form ; the colour of some of them is far superior in beauty and delicateness of hue, to that of specimens from any other locality which I have ever seen. It occurs both East and West of the ferry-house, in detached pieces, and also in *large veins*† of quartz traversing a granite rock in a state of decomposition. This is the prevailing rock at the locality, and all of the specimens found in it, appear to be *confined* to *quartz.*‡ There is but little doubt that this will prove an important

* This locality of Amethyst was mentioned in our last Number, on the authority of Professor Adams. We are informed that the place was first visited by Professor De Wolfe, but afterwards Mr. Webb and Mr. Taylor spent a day in the research, and brought the locality into notice.—*Ed.*

† Professor Adams says, the rock is "occasionally traversed by *thin strata of quartz;*" but this is a mistake.

‡ He also speaks as though the amethyst were met with in other parts of the rock, besides the quartz ; he says "some specimens have been discovered by digging into the rock, especially that part of it which contains quartz ;"—so far as I am able to judge, it is confined to the quartz altogether.

locality, if properly managed. Many specimens have been sent here, to be cut and polished by Davis & Babbitt, lapidaries, and to be set by Col. Baker, for breast-pins, ear-rings, and other articles of ornament. *Carbonate of iron* in considerable quantities, is found at the locality of yenite, tremolite, epidote, &c. in Cumberland. We occasionally meet with specimens of semi-transparent quartz, containing within them small crystals of yenite.

*Amethyst* is found on the banks of the Blackstone River, in Cumberland. We have not had an opportunity as yet of examining this locality, sufficiently to decide whether it will probably prove to be as important as that at Bristol.

Very large *crystals of quartz* of the common form, with perfect terminations, are ploughed up upon Cumberland Hill.

*Idrocase* is found in the walls back of Brown University.

REMARK BY THE EDITOR.

Prof. Dewey, at p. 50 of our last number, has questioned the propriety of applying the name Vermiculite to a particular variety of talc described by Mr. Webb, p. 55, Vol. VII. We have received a letter from Mr. Webb, dated June 26, in vindication of the name above mentioned :—but we conceive it unnecessary to publish his remarks at large, because his reasons are sufficiently explained in the original communication already alluded to.

In confirmation of Mr. Webb's observations as to the curious effects of heat, we would add, that specimens brought to us, two or three years ago, from the same locality, by Dr. D. S. C. H. Smith, of Sutton, exhibited under the blowpipe the same appearances which are so accurately described by Mr. Webb.*

3. By Dr. Samuel Robinson.

*Providence, R. I. March* 25, 1824.

In Cumberland, *Prase* associated with *actynolite* 1 mile east of Cumberland *Meeting-House*, which is about 12 miles N. E. from Providence.

* Messrs. Webb and Taylor, or either of them, will exchange the minerals of Rhode-Island for those of other States.

*Yenite*, at the same place associated with calcareous Spar, Actynolite and Quartz.

*Sulphate of Iron*, same place—coating considerable vertical surfaces of rock.

*Ferruginous Quartz* crystallized in closely imbedded pyramids on siliceous stone, on "Diamond Hill," which is about 4 miles N. of E. from Cumberland Meeting House, and amorphous in detached masses near C. M. H.

*Micaceous Oxide of Iron*, ½ a mile N. N. W. from C. M. H. associated with Quartz and *Epidote*.

*Sulphuret of Molybdena* with *magnetic oxide of Iron*, and *magnetic pyritous Iron*, ½ a mile N. N. E. from C. M. H. at a place called the "Mine Hole," on the west side of a Hill which overlooks "Sneerch's Pond," where a shaft was sunk for Copper 70 feet deep, 40 to 45 years ago.

*Carbonate of Copper*, connected with Magnetic Oxide of Iron, same place, also ½ a mile N. of C. M. H. on magnetic Iron ore, where a shaft was once sunk.

*Steatite* a little distance south of the "Mine Hole."

*Peat* in abundance and of good quality on the borders of "Sneerch's Pond." Also in a meadow ½ a mile N. of C. M. H.

*Zoisite*, in veins of Quartz traversing a rock composed of distinct angular grains of translucent Quartz, imbedded in Quartz finely comminuted, of a yellowish brown colour, and hornblende, half a mile N. W. of "Diamond Hill."

*Fluor Spar*, in the same veins of Quartz.

*Galena* in small quantities—same locality.

*Schorl*, in detached masses of Granite without mica, S. of "Diamond Hill," and in several other parts of the town.

*Oxide af Manganese*. It appears at the foot of a hill which rises 30 or 40 feet, on the east side of Blackstone River 2½ miles N. of Pawtucket, in a stratum of 6 to 18 inches thick, visible 20 to 30 yards in length, 3 or 4 feet above the water, in gravel, resting upon a stratum of *Ochrey brown Oxide of Iron* of equal extent with the manganese. Prof. DeWolf exhibited oxigen gas obtained from this manganese, in his Lecture on the 3d inst. before his class.

*Dendritic* formations of Manganese on Limestone are common at the Harris rock in Smithfield.

In SMITHFIELD, I obtained

*Green Talc* about ½ a mile west of Blackstone river, and some more than a mile west of C. M. H. in veins of 6 to 12 inches wide running N. and S., dipping to the west, traversing coarse *steatite*.

*Indurated Talc, Chlorite and Loam.* Its Laminæ are from 6 to 12 inches in length, of a beautiful green. This locality is in the middle of the road, and was discovered a few years since by the workmen in repairing the road at this place. I obtained from ten to twelve hundred weight. Dr. Chas. B. Halsey was the first mineralogist who obtained specimens at this place—(about two years ago.)

*Fasciculite* of Mr. Hitchcock, on Mica Slate 1 mile N. E. of Woonsocket village.

*Micaceous Oxide of Iron* in quartz—Blackstone factory.

In Johnson 4 miles N. N. W. from Providence, *Granular Limestone, Steatite, Indurated Talc, French Chalk*, and varieties of *Tremolite*.

*Fire Stone and Whet Stones.* Woonsocket Hill is about a mile westerly of Woonsocket village, Smithfield. It extends about a mile northerly and southerly, and is composed of a Quartzose rock of peculiar qualities. It appears on the surface on various parts of the hill. The hill terminates abruptly in projecting cliffs at the southern extremity, and slopes in a gradual declivity on the northern extremity. It declines regularly to the N. E. It appears to be a kind of sandstone slate or micaceous sandstone—it is fissile, and some of it is easily quarried. Some of it is easily pulverised and very white, other parts of it are hard to break and traversed by veins of compact Quartz. The Quartz of this rock is granular and of angular structure, a little yellowish, and some of it is reddish—the Mica is reddish and white. This stone has the property of withstanding the effects of heat, beyond any other, and has been transported in waggons 50 or 60 miles for furnace hearths for 40 or 50 years. It is called "the furnace stone," when pulverized and rubbed with tallow, on what the mowers call rifles, it answers extremely well to sharpen their scythes, and has long been used by them. It loses some of its sharpness and strength by being exposed to intense heat, although it pulverizes more easily.

The famous Whetstone Quarry commences about ½ a mile N. E. of Woonsocket Village, extending about a mile S. W. From 6 to 8 thousand dozen of whet stones have been quarried in a year. But 3 thousand dozen would be an average, perhaps, for ten years past.

Note.—Dr. S. Robinson will exchange the minerals of Rhode-Island for those of other districts.

4. By Jacob Porter.

*Limpid quartz*, in transparent prisms and well crystallized, on Broad Mountain, Penn.

*Laminated quartz*, at Cummington and Plainfield. It occurs both of the milky and smoky varieties, and is very well characterized.

*Common jasper*, generally blue, on the margin of a brook, Worthington.

*Plumose mica*, abundant in granite, at Williamsburg.

*Black tourmaline*, at Goshen. The crystals are generally small, finely striated with a shining surface, and confusedly intermixed. Some of them are formed on granite, and protected by a covering of white quartz more than an inch thick.

*Scapolite*, in the south-west part of Goshen. The crystals are often several inches in length. Their surface is very distinctly striated, the structure foliated. The longitudinal fracture exhibits a shining and even metallic lustre, the color a lively silver gray; the cross fracture is often splintery. In some specimens the crystals are curved, blended and curiously interlaced. Some of the smaller crystals have a shining surface, and are nearly translucent. The scapolite at this place, as also at Chesterfield, is generally associated with white quartz.

*Cummingtonite of Prof. Dewey*.—The rock, that contains this mineral, has been known to the common people for several years, under the name of the Copperas Rock. Pieces of it have been occasionally used in dyeing as a substitute for the sulphate of iron. It lies by the road side in the east part of Cummington.

*White augite*, at the celebrated locality of indicolite, Goshen.

*Magnetic oxide of iron*, in small cubic crystals, at Plainfield. This variety occurs in arenaceous quartz.

*Black oxide of manganese*, compact and earthy, at Cummington. There are also two localities of the compact variety of this ore in the westerly part of Plainfield, at both of which it occurs in great abundance, and of excellent quality.

*Plainfield, Mass. June*, 1824.

### 5. By Martin Field.

TO THE EDITOR.

*Chrysoprase and Pimelite.*

A locality of *Chrysoprase* and *Pimelite* has lately been discovered, by my son, at New Fane. They occur in veins, in serpentine. The chrysoprase is found amorphous, and its fracture is a little splintery. Its specific gravity is 2.75. It is of an apple green colour, and translucent. The colour of the green earth or pimelite is very similar to that of the chrysoprase, which it accompanies, and which, in some specimens, it almost envelopes. The pimelite is easily reduced to a dry powder. These minerals have been exhibited to Prof. Dewey, and other experienced mineralogists, who do not hesitate as to their nature.

I have no information, that chrysoprase and pimelite have before been discovered in this country. They are beautiful minerals, and I will improve the first opportunity, to send you specimens of them.

At the same locality are found, precious serpentine, steatite, pot stone, chlorite, scaly talc, indurated talc, actynolite, chalcedony, calc. spar, bitter spar, diallage and asbestos.

*New Fane, July* 16, 1824.

### 6. By Prof. J. F. Dana.

*Green carbonate of copper*—earthy. } Franconia, N. H. rare.
*Blue* " " " }

*Green carbonate of copper*, small needle shaped diverging crystals. Littleton, N. H.

*Green carbonate of copper* earthy in mica slate. Hanover, N. H.

| | |
|---|---|
| *Black schorl* in milk white quartz, abundant.<br>*Zoisite*,<br>*Epidote*,<br>*Yellow* and *blood-red ferruginous quartz*, —quartz rock. | Hanover, N.H. |
| *Galena*,<br>*Green quartz*. | Enfield, N. H. |

### 7. By Charles W. Shepard.

*Schorl*, in large masses, not regularly crystallized, but exhibiting a crystalline tendency, Pelham, Mass.

*Black mica*, fine specimens, do.

*Green Hornblende*, do.

*Compact Asbestos*, do.

*Epidote*, do.

*Actynolite* in Asbestos—and likewise a granular variety of the same mineral, in large masses—the grains equalling in size the grains of coarse gun-powder, and very easily separable. Its granular structure may be the result of semi-disintegration. Do.

The most interesting mineral from Pelham, however, is one which is, undoubtedly, a *sub-species of quartz*. It strongly resembles chalcedony. It possesses but little lustre. Its fracture is nearly even, somewhat splintery, and flat conchoidal. It breaks readily under the blow of the hammer, into large, indeterminate, sharp-edged fragments; sometimes exhibiting concretions. Its colour is leek-green, uniformly diffused, excepting, occasionally, small whitish dots, which are distributed through the mass at nearly equal distances. It is translucent. Before the blowpipe, it loses its colour, and becomes white. Should it belong to the sub-species chalcedony, it is the variety called Plasma, a mineral which has not, hitherto, been found in the United States. It was discovered in digging a cellar, in a rounded mass, upwards of two feet in diameter.

*Native Alum*, in mica slate, Ware, Mass.

*Brown Spar*, associated with amethyst, found by Mr Alonzo Chapin, West-Springfield, Mass.

*Amherst, Mass. March* 31, 1824.

8. By George W. Carpenter.

*White Beryl.* This beautiful Beryl is in well defined, regular, hexaedral prisms, (with occasional small modifications,) which vary in size from one quarter to one inch in diameter, and from one to two inches in length, colour white, occasionally yellow and pale green, and several specimens which I have collected possess a pure, uniform, and rich green; it occurs imbedded in granite, on the old York road, five miles from Philadelphia.—Rare.

*Radiated Steatite.* This mineral is composed of little tufts, or more irregularly grouped. Each of these tufts is made up of acicular crystals, or fibres, diverging or radiating from a centre, exhibiting a silky lustre. It occurs on the Wisahicon creek, one mile above its confluence with the Schuylkill. Abundant.

*Philadelphia, June* 20, 1824. }
No. 294 Market-street. }

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Art. V.—*A Sketch of the Geology of the Country near Easton, Penn.; with a Catalogue of the Minerals, and a Map.* By J. Finch, F. B. S. &c.

Easton, in Pennsylvania, situated at the confluence of the Lehigh and Delaware, is distinguished by the beauty of its scenery, and by the varied and extensive views which the surrounding country affords.

It is also interesting in a geological point of view; the oldest range of rocks is probably the

*Sienite* of Chesnut Hill, which is near four miles in extent, in the immediate vicinity of the town. The central part of this ridge is composed of feldspar, quartz, and hornblende—but these minerals are variously combined. Sometimes the hornblende predominates, and the rock passes into hornblende slate; in other parts the rock is composed of feldspar and quartz, coloured by epidote and chlorite.

*Sienite* forms also a range called the Lehigh Hills, which run parallel with the Blue Mountains; in a south-east direction they extend into Virginia, and terminate at Monticello, the residence of Mr. Jefferson. Large quantities of iron ore are found in various parts of this range; the rock is distinctly stratified, and the strata nearly vertical.

*Serpentine*—under this generic term may be classed a formation of talcose slate and steatite, which accompanies the sienite of Chesnut Hill. It occurs on the south-east side, varies from one to three hundred feet in width, and contains a great variety of minerals.

*Transition Limestone* abounds in the vicinity of Easton. It has a bluish gray colour; splintery fracture; and contains veins of hornstone. Hitherto it has not been found to contain any fossil remains. Its strata are inclined at different angles, from 10° to 80°, and are sometimes curved. Caverns abound in this formation; an interesting one may be seen at Durham, about nine miles from Easton, and in many places this rock presents isolated summits of the most picturesque form. Every part of its surface is distinguished by the fertility of the soil.

*Transition Granite*—the most singular feature in the geology of Easton is a rock of granite which appears to repose on the transition limestone. It is found at Mount Parnassus, about four hundred yards south of the Delaware bridge, in the State of New-Jersey. This granite is well characterized, consisting of quartz, feldspar and mica, and is inclined at an angle of 70°. Diluvial debris surround it on every side, and thus its exact junction with the limestone cannot be perceived; but it has the same inclination as that rock, and contains a vein of limestone.

*Transition Clay Slate* extends from the foot of the Blue Mountains, nearly half way across the valley: there is a marked difference between the fertility of the farms situated on this tract, and those of the transition limestone.

Slate quarries have been opened on this formation near the banks of the Delaware, by a company of proprietors in Philadelphia; but the inferiority of the transition slate has rendered the shares not very productive.

*Transition Sandstone*—this name may be applied to a quartzose breccia, of which the Blue Mountains are composed in this part of their range. They may be distinguished at a great distance by the shadowy tint of the forests by which they are covered, and by the even line with which they bound the horizon. Where the Lehigh river passes through the mountain, the breccia exhibits polygonal forms, with four and sometimes six regular sides. They resemble basaltic rocks.

*Diluvial*—many of the valleys and the shores of the rivers are partially covered by this formation, which consists of sand and clay, containing fragments of the older rocks.

The following is a list of some of the minerals which are found near Easton. They were all discovered by Dr. Swift, who resides there, and who has been indefatigable in his exertions to ascertain the minerals in his vicinity. The public are indebted to him alone for exploring this locality.

*In the Sienitic range of the Lehigh.*

*Hornblende*, compact and lamellar; two and a half miles from Easton, near the old Philadelphia road.

*Prase,* at the same place.

*Chlorite,* compact and crystallized, do.

*Tourmaline*, in imperfect crystals.

*Epidote*, compact and crystallized.

*Sahlite*, eight miles from Easton, by the side of the river road to Philadelphia.

| | |
|---|---|
| *Native Magnet*,<br>*Common Magnetic Oxide of Iron*,<br>*Micaceous Oxide of Iron*,<br>*Compact*, *Scaly*, and *Ochrey Red Oxide*,<br>*Hematitic Brown Oxide of Iron*, compact and fibrous,<br>*Argillaceous Oxide of Iron*, | These occur in various parts of the Lehigh range. |

*Titaniferous Iron Sand* is found on various parts of the sienitic hills, after heavy rains.

*In the Sienite of Chesnut Hill.*

*Sahlite*, in small quantity.

*Tourmaline*, perfect, in veins with quartz.

*Hornblende*, compact, slaty.

*Epidote*, compact and crystallized.

*Manganesian Epidote*, in hexaedral prisms.

*Chlorite.*

*Micaceous Oxide of Iron. Red Oxide*, compact and scaly.

*Argillaceous Oxide.*

*Chromate of Iron*, in octaedral crystals.
*Silico-Calc. Ox. Titanium.*

### *In the Steatite of Chesnut Hill.*

*Calcareous Spar*, flesh-coloured.

*Magnesian Carbonate of Lime*, compact and crystallized.

*Brucite*, or *Chondrodite*, crystallized in carbonate of lime, about one hundred and fifty yards above Mr. Wolfe's quarry, on the opposite shore of the Delaware.

*Zircon*, imbedded in talc, in four sided prisms, terminated by a four-sided pyramid at each end; the crystals vary in length, from one sixth of an inch to two inches, and in breadth from one tenth to one half of an inch: colour, clove brown. These crystals have been found in three different localities, but are not very abundant.

*Mica*, lamellar and crystallized in prisms.

*Nephrite*, in large masses; colour greenish white; fracture splintery and dull; translucent; very difficult to break.

*Saussurite*, bluish green, translucent.

*Schaalstein*, in small prismatic concretions. When immersed in nitric acid, it falls into grains.

*Tremolite*, common, glassy, and fibrous; very abundant.

*Amianthus;* compact and ligniform asbestos.

*Augite*, green, imbedded in flesh coloured carbonate of lime.

*Scapolite*, in four-sided prisms, truncated on the edges?

*Coccolite*, various shades of green.

*Hornblende.*

*Actynolite*, glassy and fibrous.

*Precious Serpentine*, dark green, various shades of yellow and green.

*Common Serpentine.*

*Talc*, crystallized in large masses, green, white, silvery white, common; indurated, and scaly.

*Steatite.* A quarry has been recently opened to obtain this mineral, which occurs in large quantities.

*Graphite*, granular and foliated, imbedded in talc and tremolite, in different parts of the range.

*Green Carbonate* and *Red Oxide of Copper*, in minute portions.

*Cubic* and *Dodecahedral Iron Pyrites.*

*In Transition Limestone.*

*Rock crystals.* } In some of the ploughed fields these *Quartz crystal.* } crystals have been abundant. Dr. Swift has one crystal, a flat six sided prism very much compressed, in length half an inch, three eights of an inch in width, and one line in thickness; this crystal has eighteen facets: also prisms with a terminal pyramid at each end.

*Calcareous Spar*, in hexaedral prisms.

*Pearl Spar*, in rhombs.

*Brown Spar.*

*Agaric mineral* and *Fossil Farina* occur abundantly in all the fissures of the limestone.

*Veined Marble.* A stratum has been found four miles north west from Easton, but the quantity is not yet ascertained.

*Hornstone*, of various colors, generally black.

*In the Diluvial Formation.*

*Jasper*, *Chalcedony*, *Lydian Stone*, *Hyalite*, &c.

No. 126, Broadway, New-York.

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Art. VI.—*Additional remarks on the Geology of a part of Massachusetts*, &c. (See Vol. VIII. No. 1.) By Prof. Chester Dewey.

Since the publication of the Geology of this section, I have made additional observations upon the southern part, and still farther south and west in the states of Connecticut and New-York. These observations will extend our knowledge of the geology of the country above the highlands and east of the Hudson, and continue the section in the state of New-York considerably farther to the south.

The alternations of mica-slate and granular limestone, mentioned Vol. VIII. p. 15. are more numerous than I had before noticed. In passing across the direction of the strata in Sheffield, and in Salisbury, Conn., I observed the occurrence of these rocks *nine* times* in the distance of three miles, making *four* alternations of the two, and leaving the mica-slate on the west of the limestone.

The county of Dutchess lies directly south of Columbia county, and extends to the state of Connecticut. The small county of Putnam, which contains the principal part of the highlands east of the Hudson, is on the south of Dutchess county.

The mica-slate of the Taconick mountain is continued southwards along the western part of Salisbury and Sharon, Con., and inclines rather more to the west, passing towards the highlands and a little east of them, and leaving some portion of the counties of Dutchess and Putnam on the east of it. I crossed it in two places, and found the mica-slate associated with primitive argillaceous slate upon both sides of it, as described in the above geology, Vol. VIII. p. 19, of this Journal. The granular limestone is continued parallel with the range of mica-slate along the east side of Dutchess county, and, according to information, of Putnam county also. It is associated, as in Berkshire county, with great quantities of dolomite, so friable as to be continually falling into sand, and of common magnesian limestone. There can be no doubt of the continuation of the range or beds of primitive limestone in this direction from Berkshire county towards Long Island Sound.

The rocks between this range of mica-slate and the highlands I was not able to examine. Although it is very desirable to have the result of an examination of this section; the continuity of this range of mica-slate cannot be affected by it. For, if this range of mica-slate should be distinctly connected with the gneiss of the highlands, it would only show the repetition of some of the older rocks on the west of the mica-slate, and nearer to the transition rocks. If transition rocks are interposed between the two, the highlands would only be more distinctly separated from the primitive rocks of New-England.

* With respect to Salisbury this fact is mentioned, p. 211, Vol. II. of this Journal, on the authority of the Editor.

Between the range of mica-slate and the Hudson, the the same rocks are found, as have been already described in the counties of Columbia and Rensselaer, Vol. VIII. pp. 21—24. After passing the range of mica-slate, we find transition limestone, transition argillite, gray wacke, and the argillite along the Hudson. In this part of Dutchess county, the transition limestone presents generally the same characters as in the two counties north of it. I found masses, however, which contained many fragments of argillite, determining the age of the rock very clearly. The same rock lies along the west base of the highlands in the south part of this county. It appears to be associated with gneiss on the east; while on the west it is, as before stated, connected with transition argillite. It appears also in beds in the argillite.

Gray-wacke appears to be less abundant in Dutchess co. than in Columbia co. It occurs however in masses over much of the western half of the county. In the town of Washington is a huge ledge of it, composed chiefly of quartz cemented by an argillaceous substance. Specimens, similar to this, are found in the gray-wacke, E. of Troy, but I had never seen such an extensive mass of this variety.

Transition argillite is the principal rock in Dutchess co. west of the mica-slate. Although it sometimes contains limestone and gray-wacke, or alternates with them, it is essentially the same rock where it first appears and where it forms the banks of the Hudson—full of seams and easily broken into angular fragments. In the town of Fishkill, I noticed several beds of gray-wacke so disposed in it as to show that the origin of the two rocks must have been cotemporaneous. The argillite and gray-wacke in Newburgh, opposite to Fishkill, contain petrifactions of several kinds. Some masses of gray-wacke are composed almost wholly of Terebratulites; while in others, there are fragments of argillite, siliceous slate, &c., like those of the same rock at Troy. In Fishkill too I found petrifactions in siliceous slate, like those at Hudson, associated with argillite.

The range of mica-slate, before mentioned, seems to have a small inclination to the direction of the strata themselves. The hills, which constitute the range, lie more nearly on the meridian and the strata themselves are nearly in the same line, while by the termination of one hill or mountain, and the origin of another farther west, and extending farther south than the preceding, the inclination of the whole line of hills is more to the west. See plate II. at the end, on which NS is the meridian, A, A, A, are separate hills, and the line AA their general direction.

On the west side of the mica-slate and the transition limestone, the strata of argillite appear to be still more inclined to the west, while the general direction of the argillite is parallel to the range of mica-slate. This is represented on the same figure. The dotted space, BB, is the transition limestone, and the lines CC are the argillite. The whole is represented from the appearance to the eye, as no angles of inclination were attempted to be measured.

The following minerals or their localities, may be subjoined to those published with the geology :—

*Native Alum*

Effloresces on rocks in considerable quantity—Sheffield. It is yellowish, white, and green, and is united with a small quantity of sulphate of iron. The rock is mica-slate containing aluminous slate. A similar rock, containing native alum, I have lately found in Pownal, Vt., several miles south of the locality already published.

*Spodumene?*

In small quantity in granite—Chester. By the action of the blowpipe it is first converted to scales or plates, which then melt into a glass. The mineral is brittle, scratches glass, yellowish or pale green.

*Iron Ore.*

Beds of this ore are found in Hillsdale, N. Y. in the same range with that already mentioned in Amenia, N. Y. and several miles north of the latter place.

*Chrysoprase.*

I have lately received from Gen. Field,* of New-Fane, Vt., specimens of this mineral found in that town associated with serpentine. It closely resembles the chrysoprase from Kosemutz, Silesia.

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Art. VII.—*Notice of a singular conglomerate, and of an interesting locality of trap tuff or tufa, in a letter to the Editor.*

Sir,

I have had several years in my possession a specimen of a very singular conglomerate rock, which I found as a rolled mass on the banks of Deerfield river, and of which, I have never met with a description. It may be described, as *a mica slate, in which are imbedded numerous rounded pebbles of limpid quartz.* These vary in diameter from one quarter of an inch, to two inches; and their colour is light gray, or milky, and, in some instances, especially in the smaller nodules, they have a strong resemblance to semi-opal. They are in general perfectly rounded, may be disengaged from their bed, and appear precisely like quartz pebbles that are found along the banks of rivers. They constitute, in general, one half of the rock, and in no instance, (although I have recently seen numerous specimens,) have I discovered a pebble of any other sort. The base of the rock has a schistose structure; but I have not noticed any thing like planes of stratification. The mica is abundant, though in small plates; and the quartz is granular, and *may be* merely comminuted portions of the imbedded nodules.

It was not merely the peculiar composition of this conglomerate that attracted my attention; but its locality also. Deerfield river, in all its course before it reaches the spot where I found this rock, does not pass over, or near, any secondary rocks. Its bed is entirely primitive, consisting

* See Gen. Field's own notice among the miscellaneous localities.—Ed.

of mica slate, hornblende slate and granite. The enquiry then arose, must not this conglomerate belong to a primitive series?

The present season I have discovered this rock in numerous bowlders on the west side of Hoosack Mountain. These are most numerous half a mile or a mile, west of Windsor meeting-house, only two or three hundred feet below the top of the mountain, and, without doubt, many miles from any secondary region. The number and size of these loose masses (some of them 6 or 8 feet in diameter,) preclude the idea of their having been removed very far from their original bed. But I had no opportunity of searching for the rock *in situ.* The rock in the vicinity is gneiss and mica slate, succeeded, a few miles west, by granular limestone; and I have no doubt this conglomerate will be found associated, in some way or other, with this series.

I send a specimen of this singular rock with this notice, with the request, that if I have mistaken its character, or if it is already described in any geological treatise, you will not admit this communication into the Journal. I have not at this time an opportunity to consult all the most recent geological publications of Europeans.

*Flint?* I send also a specimen having the conchoidal fracture and grayish black colour of flint. I found it in bituminous shale of the coal formation, in West Springfield, on the bank of Agawam river; to which locality I was conducted by Mr. H. Herrick, of New-Haven. From appearances I conjectured that this mineral had formed around a branching zoophyte. If it be not flint, it is a hornstone approaching very near to it.

*Trap Tuff.*—In the 6 vol. of the Journal of Science, I have given some account of this rock, from a hasty examination of it; and I am now able, from a re-examination, to corroborate the suggestions there made, and to add a few more remarks. It exists on the east side of Mount Tom in the easterly part of Northampton and East Hampton, in an extensive bed, between a red slaty rock of the coal formation and greenstone. I traced it four or five miles, and towards its southern extremity, I had an opportunity of seeing distinctly the junction of the tuff with the slate; the latter mounting up on the back of the former at an angle probably between 10° and 15°—I say probably ; for I had no clinometer with me. The tuff, near the junction, has a partial and imperfect stratification ; but farther from this line, the marks of stratification entirely disappear. In general, the rock is composed of rounded masses of greenstone (basalt ?) and sandstone, united by decomposed and comminuted greenstone and wacke. Near its junction with the sandstone, I found a few pebbles of quartz and feldspar : but these are rare. The imbedded masses vary from the size of a pea, to one and even two feet in diameter. Most of these masses are compact, some are vesicular, and a few, perhaps, are amygdaloidal. The base too is sometimes vesicular, like the slag of a furnace. Near the line of junction, I observed in some instances, what Dr. MacCulloch calls " a troubled mixture" of the two rocks, and numerous alternations a few inches in thickness. The bed appears to be very irregular in its width—or perhaps in some cases the tuff alternates with the greenstone. In some places I noticed the width of the tuff to be between a quarter and an half of a mile ; and on the side next the greenstone, the imbedded nodules appeared to be less numerous. I did not however find the actual junction of the tuff and the greenstone :—but perhaps some future observer may be more fortunate.

The sandstone imbedded in the tuff is the *same as that which lies above it.* This fact, unconnected with others, would be inexplicable. But fortunately I found out a clew to it. It so happens that the stage road from Northampton to Hartford passes over the greenstone, the tuff, and the sandstone, in such points as to exhibit their most interesting connexions. In going towards Hartford, as you rise easterly out of Northampton meadows, you first meet the old red sandstone, lying beneath the immense greenstone pile that constitutes mount Tom. After passing the north end of this mountain, a few rods beyond Lyman's tavern, you cross a small stream, where, in its channel, you see the red slate cropping out, at a moderate dip, beneath a pile of greenstone. Passing over this greenstone a few rods, you come to the trap tuff, and going a little farther, you meet the same red slate, lying above the tuff. Thus it appears that the greenstone contains at least one bed of the red slate ;—and probably more. From these, as they are below the tuff, the imbedded sandstone masses in that rock must have proceeded. And this is one of those cases in geology, in which it is demonstrable, that a long interval must have elapsed between the formation of different beds of the same rock. In this instance, it is certain, that the lower beds of the slate and greenstone must have been first arranged and consolidated; and then, some violent convulsion must have taken place, in which water, no doubt, was the principal agent, and by which, the slate and the greenstone were abraded and the detached masses round them : the process must have been reversed, and the tuff cemented and consolidated ; and finally, the agents employed must have been brought to the same state as when the lower beds of slate were deposited, in order to the production of the same slate above the tuff. Such a remarkable series of revolutions must have demanded a considerable length of time. I have no leisure, nor disposition, to discuss the bearing of these facts upon existing geological systems ; nor to point out their important relation to the first chapter of Genesis. I know of no facts in the geology of our country, that show so irrefragably, that long periods of time must have been occupied in the formation of the secondary rocks.

E. H.

P. S. Upon further examination, I am inclined to refer the comglomerate rock described above, to the *Conglomerate Quartz Rock* of MacCulloch, as described in his geology of the Western Isles, and in the London Geological Transactions, Vol. 1. p. 60. *Second Series.*

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ART. VIII.—*Notice of the Ancram Lead Mine, by* CHARLES A. LEE.

TO THE EDITOR.

I LATELY visited the lead mine at Ancram, Columbia County, N. Y. and as I have seen no notice of this locality in the Journal of Science and Arts, the following particulars may not perhaps be wholly uninteresting.

In passing from Salisbury to Ancram, we first meet with alternations of Gran. Limestone and Mica Slate and the alluvion of the iron ore bed. Soon after passing the N. Y. State line, we come upon well characterized Argillite, which in some places appears to pass into chlorite slate. The strata or laminæ are regular, generally inclined to the west, forming an angle of about 60° with the horizon—sometimes however they are nearly vertical. Blocks of gray wacke are scattered over the surface, and chlorite connected with milky and fetid quartz often occurs.—Soon the argillite begins to disappear, and Limestone intermediate between the granular and compact takes its place. As we proceed west it becomes finer grained and is evidently the commencement of the transition. It cannot however be regarded as a regular distinct stratum, for it lies on and alternates with the argillite. As we approach the mine the *argillite again appears, and extends, alternating with the limestone to the Hudson river.

The lead mine lies in the S. E. part of the town in a hill of argillite and transition or metalliferous limestone. Some of the slate is glazed like that at Troy, N. Y. and closely resembles Bituminous shale. It is often regularly fissile, and furnishes very good samples of roof-slate. This variety however forms but a small part of the hill. As we penetrate the rock it becomes of a grayish white color, has a conchoidal fracture, and *effervesces in acids*. The slate and Limestone appear to be passing into each other, and the lime and alumine are in very nearly equal proportions. It might perhaps be called an *Argillo-Calcareous Slate*.

The vein of Galena intersects the rock nearly vertically. At the surface it was not very thick but increased as they descended. The mine was worked 4 or 5 years when it was abandoned about a year since, as it was said, on account of the scarcity of the ore. Several excavations were made of considerable depth, but little ore however was found except where the vein was first opened. The pits are now partly filled with water.

The *galena* obtained here is argentiferous, and probably

* The uniform direction of the veins of quartz and the dividing seams which intersect the argillite cannot but attract the attention of the Geologist. Bakewell remarks that "in the rock at Charnwood forest the slaty laminæ make an angle of 60° with the principal seam by which the rock is divided." The same remarks will apply to the argillite of this region, as well as that of Albany and Renselaer Cos. as noticed by Mr. Eaton in his Index to the Geology of the Northern States. p. 172.

as rich as any in the U. States. Its fracture presents broad laminæ, which on breaking fall into cubes. It likewise occurs granular, sometimes resembling micaceous oxid of Iron. In contains imbedded an abundance of clear perfect quartz crystals, which by carefully breaking the ore can be detached entire. In addition to the Galena* the following minerals occur:—

1. *Molybdate of Lead?* Occurs in small tabular crystals of a pale orange yellow color, and distinctly foliated. They are translucent and have a glistening lustre—yield easily to the knife, and melt before the blow pipe into a dark colored mass—rare.

2. *Sulphate of Barytes*, in veins of considerable thickness in the argillite and limestone. Three varieties, the *concreted*, granular and compact. In some places it forms a gangue for the Galena.

3. *Sulphuret of Zinc.* The brown variety is most abundant—the yellow not uncommon. Lustre highly splendent and metallic—generally associated with quartz.

4. *Pyritous Copper.* Abundant, of a brass yellow color, and often richly tarnished exhibiting a handsome play of colors, connected with the blende. It is mostly massive, sometimes in small regular crystals. It is sometimes of a bluish color, and would then undoubtedly come under that species, called *black copper* by Jameson.

5. *Green carbonate of Copper.* Compact malachite is common associated with the galena. It is of a beautiful green color, and extensively tinges the quartz connected with it.

6. *Quartz.* Perfect six sided crystals are contained in the galena. They are very abundant, sometimes with flattened sides, and their situation evidently shows that the lead was deposited round them, often in small geodes.

*Radiated Quartz.* Associated with copper, blende and galena.

*Milky Quartz.* This variety includes much of the

* From the appearances I should judge that the vein was of considerable extent. 'Tis true that several attempts to discover the ore proved unsuccessful; but they were made at a considerable distance from the direction of the vein, and in one instance at nearly a right angle with it. Should it again be explored, a drift from the adjacent valley would much facilitate the operations, and nothing would be lost in the end on the score of economy.

quartz found in the mine, and is often beautifully tinged with malachite in dendritic forms.

*Fetid Quartz.* Forms a gangue for the blende.

7. *Puddingstone.* In considerable masses, deposited on the argillite.

8. *Clay.* Of a grayish color, produced by the decomposition of the slate.

9. *Sulphuret of Iron.* In small cubes in the argillite, and also amorphous.

*Salisbury, July* 18, 1824.

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## Art. IX.—*Notice of the Granitic veins and beds in Chester, Mass. by* E. Emmons.

Chester, July 8, 1824.

The face of the country in and about Chester is hilly and mountainous, rising into abrupt precipices of various heights, from 10 to 50 or 80 feet in perpendicular elevation. The direction of the rock strata and hills is N. and S. with an inclination of only a few degrees to the E. or W. and in some places, as in deep vallies, the strata are vertical. The principal rock is mica-slate of fine and nearly compact structure. It breaks into rhombic fragments of various sizes, having sharp and well defined edges. Imbedded in the rock are garnets of the size of small shot, staurotide and cyanite. In many strata these minerals constitute by far the largest portion of the rock. The dark colour is owing in some instances to a mixture of primitive trap, in others, to the presence of carburet of iron. On examining the rocks of Chester, the attention of the geologist is attracted to the number and variety of the granitic beds and veins. The granite is gray and of a coarse texture, containing in many instances large blocks of feldspar and quartz. The plates or tables of mica are often beautiful and are portions of regular crystals. The quartz is always strongly fetid, while the feldspar in immediate contact is inodorous. The quartz is often beautifully impressed by insulated tables of mica. There are several positions in which the granitic beds and veins are found. The first (see fig. 1. pl. II.) which I shall notice, is a horizontal vein supported on the vertical edges of the strata of mica-slate. An area of several square rods is exposed to examination, unconcealed by the soil. It is uniformly about four inches thick and fills the inequalities of the inferior rock. The vein is not in one continued plane, but projects downwards into the mica-slate, and gives off narrower branches which terminate within a few feet of the principal vein. This vein appears three times in an area of twenty square rods, though not in an unbroken mass, yet they were evidently once connected.

Another position in which granite occurs may be seen, fig. 2. These veins and bed were discovered in Norwich. The bed is five rods in length and in the thickest part three feet thick and about the same in width. Two parallel veins eight inches thick come up from below and unite with the bed. The bed is irregular in its shape, and gradually tapers each way, till it terminates in points. At these points, it is distinctly seen to rest on the edges of the strata and not to penetrate between them ; it once extended farther N. and S. than at present, for masses of granite are still seen adhering to the mica-slate for several rods. On the east side, the rock which constituted the wall, is entirely broken away, and exposes the whole mass to view. There are many other masses or beds of granite which are apparently in the situation of this last, though it cannot be determined whether they are connected with veins, yet it is probable they are. It is very certain that in many places the principal masses of granite do not penetrate deep, as they can be seen to become thinner as they descend between the strata of mica-slate, and a few thin veins which I have seen, actually terminate after penetrating a *few inches* downwards.

Fig. 3. Pl. II. represents a section of a granitic bed*. It rests against the mica-slate on the west, but on the east it is exposed to view. It is four feet thick, and is twisted and contorted in a remarkable manner. It contains green and blue tourmaline, rose quartz, emerald, cleavelandite and prismatic mica. One crystal of blue tourmaline is to be seen three inches in diameter. One of green has been

*I am not pleased with the common definition of beds and veins. I should call all the granite which occurs here, granitic veins. In some instances it is impossible to determine whether the granite is in beds or veins.

detached measuring two inches, and enclosing one of blue. Fig. 4, represents a bed still more twisted. Veins of granite are sometimes broken off and thrown out of their course, as in fig. 5.

In conclusion I would remark 1st. that where granite occurs in *horizontal veins* as in fig. 1, it does not appear probable that they were deposited in this situation, but rather in *perpendicular* ones. For I believe there is sufficient evidence to prove that the mica-slate, was once deposited in horizontal beds and that the present vertical position was caused by an exertion of force below sufficient to break and upturn the strata.

There are veins which approach nearer to a perpendicular position than the example given. In this case the mica-slate is less vertical—so that the relative position is still preserved.

2nd. Granitic beds as fig. 3. were deposited in the same period as the mica-slate and were elevated to their present position at the same time.

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## Art. X.—*Sketch of the Geology and Mineralogy of Salisbury, Con.*; by C. A. Lee.

[Prepared for the Lyceum of Natural History in the Berkshire Medical Institution.]

### *Geological Remarks.*

A single township affords but little room for geological investigation. The inclination of the strata can be observed, and the relative position of the rocks; but it is only on the large scale that the science can be studied to advantage, or any theory be formed which will rationally account for all the facts.

The principal rocks in Salisbury are mica-slate and granular limestone. The former is most abundant and forms all the highest hills, and the *Taconick range.—

*This is written *Taghkannuc* in Pres. Dwight's Travels, and as it is the Indian name, had perhaps better be retained. Taconick is the popular pronunciation.

For the most part it is easily distinguished; sometimes, however, it might be mistaken for gneiss, and occasionally from its soft texture it might be called talcose slate, or talco-micaceous rock of Eaton. But such appearances are rare. It is often fissile, and easily split into tabular and rhomboidal masses. Veins of fetid quartz several inches in thickness often intersect it perpendicularly to the strata. It contains iron ore, (of which the brown oxide, hematitic and argillaceous are most common,) feldspar, graphite, manganese, sulphur, garnet, staurotide, hornblende, epidote, augite, &c. The frequent alternations of granular limestone and mica-slate in this town, were noticed by Prof. Silliman in a former number of this Journal.* In examining them the geologist will be convinced of any thing sooner than of "regular continuous strata." In many instances the slate appears in insulated patches lying in the limestone, in others the limestone reposes in unstratified beds on the slate. They also pass into each other, forming with the quartz and mica mingled with it a singular aggregate "scarcely capable," as Prof. Dewey remarks, "of being named, and hardly worth the trouble of doing it."

In the last number of this Journal Prof. Dewey describes a rock of mica-slate as resembling a pile of huge *saddletrees;* the convex side uppermost, showing the application of some force from beneath. There is a rock of the same kind in this town, but the convexity is reversed. How any of the existing theories would account for such appearances I know not. The strata are often undulating or of a zigzag form, the layers being distinctly parallel. There are many such facts which confound the geological inquirer. We may suppose how such appearances *may have been* produced, but how they *were* may be another thing. The imagination can picture an internal fire, heaving the massy granite above the incumbent rocks, or a plastic world slowly obeying the laws of affinity, and arranging its solvent materials as attraction dictates, yet we might be as far from the fact as ever.

* Vol. II. p. 211.

### *Natural Ice-Houses.*

Chasms of considerable extent are met with in the mica-slate,* forming natural ice-houses, where the ice and snow remain most of the year. One of these in the east part of the town is perhaps worthy of a particular notice. The chasm is several hundred feet long, sixty feet deep, and about forty in width. The slate is of a very compact kind, and must have required a powerful convulsion to have separated it. The walls are perpendicular and correspond with much exactness. At the bottom there is a spring of cold water, and a cave of some extent. As you enter the chasm, you are struck with the romantic beauty of the spot. Above it is completely overreached with lofty pines (pinus strobus) and hemlock (p. canadesis), together with stately walnuts (juglans porcina) and butternuts (juglans cinerea), &c. &c.; while below the ground is adorned with a great variety of plants, and the rocks with numerous species of mosses, lichens, and ferns. These, together with its coolness and entire solitude, make it a very pleasant retreat in summer. It is called Wolf-Hollow from its formerly being a famous haunt for wolves.

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### *Granular Limestone.*

This is a continuation of the western range of Dewey, commencing in Vermont, and extending through Bennington, Williamstown, Lanesborough, West Stockbridge, Sheffield, and so on through Connecticut, terminating near New-York. It has formerly been quarried for building stones and other purposes, but at present is not worked. Much of it is as fine grained as the Stockbridge marble, but in many places, it is very coarsely granular. It is well adapted for the manufacture of lime; it is also extensively used as a flux in the furnaces, for each of which upwards of a hundred tons are anually employed. I have already stated that it forms beds in mica-slate, and alternates with it. It is sometimes stratified, with variously inclined strata.

* Lat. about 43° N.

In the south part of the town the limestone presents a curious appearance. In an abrupt hill of mica-slate several hundred feet in height, it forms a regular segment of a circle supporting the slate. The ledge where this is seen to the best advantage is perpendicular, about seventy or eighty feet high. The limestone rises fifty feet, and gracefully bending forms the arch. The rocks are united so as to present the appearance of having come in contact when in a state of partial solution. The limestone is magnesian, and appears to form the nucleus of the hill.

The *dolomite* of this region is to a great extent flexible, and much resembles the magnesian limestone of Sunderland, Eng. Like that it dissolves in acids as readily as pure carbonate of lime. Its flexibility however does not appear to diminish by loss of moisture. Pieces of a small size which have lain on the surface of the ground for years, appear as flexible as when newly dug. In this respect also,it resembles the Sunderland limestone, whose flexibility remains after the water has entirely escaped.

The surface of the limestone is often colored by the decomposition of sulphuret of iron, besides which it contains tremolite, tourmaline, mica, talc, &c.

## *Alluvial.*

The alluvial deposit of this town is of considerable extent. Taking Eaton's division of primary and secondary, the former embraces the iron ore beds, and many valleys remote from the principal streams; while the latter forms the banks of the *Hooestennuc and its tributaries. Indian skeletons are often washed from the bank in nearly a perfect state of preservation. Trees also are frequently laid bare, which have probably been hid for centuries.— These, when exposed to the atmosphere, soon decay.

## *Simple Minerals.*

*Carbonate of Lime,* abundant, sometimes phosphorescent, intersected with *Calcareous Spar,* both crystallized

*See Pres. Dwight's Travels.

and laminated; crystals obtusely rhombic—somewhat lenticular.

* *Granular Limestone.* See Geological Remarks.

*Calcareous Sinter*, occurs in a stalactical form, under limestone rocks.

*Calcareous Tufa.* At the falls of the Hooestennuc, the bank for some distance below appears to be principally composed of calcareous Tufa. The rocks above and adjacent are lime, which accounts sufficiently for its formation. The surface is very compact and hard, and the solidity diminishes in proportion to its distance from the surface. In some places its consistency is that of paste, remaining in the same state in which it was deposited. It is cellular, and contains sand and fluviatile shells—color yellowish white.

*Calcareous Incrustations* are common.

*Magnesian Carbonate of Lime*, abundant,—alternates, or rather is mingled with granular limestone.

*Bitter Spar*—occurs in beautiful rhombic crystals.

*Dolomite*—very abundant, sometimes compact, generally friable, phosphorescent—flexible.

*Fetid Carbonate of Lime*—occurs in plates, rhombs, &c. abundant.

*Sulphate of Alumine*—very abundant in yellowish white concretions, and efflorescing on mica-slate. Often very pure, and by lixiviation might be extracted in considerable quantity. The mica-slate is extensively impregnated with it, which renders its texture loose and friable, and subject to decomposition. It is used by the inhabitants in dying, and for other domestic purposes.

### *Quartz.*

*Common Quartz*—extensively disseminated, crystallized and massive.

*Limpid Quartz*—in six sided prisms, of a considerable size; occurs in alluvial soil, sometimes in geodes in common quartz.

* Pulverized limestone has lately been tried in this town as a substitute for gypsum. From this experiment it seems to answer nearly the same purpose.

*Smoky Quartz*—In amorphous masses. The best specimens are found in mica-slate, in which it forms veins of considerable thickness, and often exhibits a beautiful play of colors.

*Yellow Quartz*—In rolled masses.

*Rose red Quartz*—In detached pieces, color of different shades, tinged with yellow.

*Irised Quartz*—Rare—colors produced by fracture, and a coat of metallic oxide.

*Milky Quartz*—Common in large masses.

*Granular Quartz*—Occurs in masses of considerable size, not met with as a *rock*. Many of the preceding varieties are cellular—cavites of various forms—appear to have been produced by the decomposition of other crystals.

*Ferruginous Quartz*—Amorphous—beautiful specimens of an ochrey yellow, and deep red color are associated.

*Fetid Quartz*—Very abundant—resembles the common quartz, tinged with gray. Some specimens are so fetid that a single stroke of the hammer will nearly fill a room with the odour.

*Siliceous Sinter*—Abundant, investing the surface of Hornstone, in botryoidal concretions.

*Hornstone*—Occurs in amorphous masses—one which I found weighed above a ton. It resembles that found in Litchfield, and has the same associations.

*Jasper*—Of various colors, black, red, yellow, &c., in small rolled masses—sometimes of a slaty structure. Sometimes it is met with in the shape of barbs for arrows; but hornstone and flint were more commonly employed by the Indians for this purpose. A few years since nearly a peck of these barbs of different sizes, and formed for different warlike weapons, were ploughed up at one time. They are very abundant in the north east part of the town.

*Staurotide*—Associated with garnets in mica-slate—six sided prisms, two opposite planes broader than the others—summit diedral. The crystals often intersect each other at the usual angles of 60° and 120°. Sometimes three prisms cross, forming six equal angles. Crystals mostly small.

*Mica*—Black, yellow and white, disseminated in quartz and mica-slate, sometimes occur in pyramidal crystals.

*Schorl*—in amorphous masses, and fragments composed of capillary crystals.

*Tourmaline*—abundant, brown and yellow, in quartz and carbonate of lime—crystals irregular—generally flat. compressed, and longitudinally striated.

*Feldspar*—compact variety in mica-slate, and detached masses.

*Beryl*—occurs in beautiful greyish green crystals, associated with quartz, hornblende, augite, epidote, massive garnet, &c. small.

*Wacke*—in large blocks, scattered throughout this region, and Berkshire County, resembles that found in Columbia County, N. Y.

*Scapolite*—in white four sided prisms, and plates resembling mica, answers the description of that found in Chester.

*Garnet*—very abundant in mica-slate, crystals perfect, from the size of a pin's head to an inch in diameter, frequently truncated on all their edges. It also occurs in granular amorphous masses of a reddish color.

*Epidote*—occurs in compact masses of a greenish grey color, and in hexagonal crystals, associated with sulphuret of iron, augite, quartz, and hornblende. The variety zoisite is not uncommon.

*Tremolite*—abundant in dolomite, and investing the surface of quartz .Presents all its varieties common—fibrous and baikalite. The last is often very beautiful, the crystals radiating from a centre, several inches in length, of a pearly lustre. The crystals are sometimes tinged with yellow.

*Augite*—a rare variety of this was called *nephrite* by Prof. Dewey in the last number of the Journal. He has since ascertained it to be augite. It scratches quartz, yet analysis shows it to contain more lime and less silex than is usual for this mineral. It occurs amorphous of a white and greenish white color, and in tabular and six sided prisms, of several inches in length. Associated with epidote. graphite, &c. and contains red oxid of titanium.

*Hornblende*—lamellar, slaty and fibrous surface ferruginous brown. In veins traversing quartz—also in fibrous groups constituting the fasciculite of Hitchcock.

*Actynolite*—occurs in large gray masses composed of an aggregation of acicular and capillary fibres, silky lustre, scratches glass, melts with a little intumescence into a gray enamel, associated with augite, mica-slate, and graphite.

*Talc*—green and white, in quartz and augite—also indurated with curved layers.

*Chlorite*—massive, connected with quartz.

*Argillaceous slate*—in small fragments, not common. It occurs in place ten miles north, in the west part of Sheffield.

*Clay.*—Potters' clay is abundant in nearly every part of the town. It generally lies a few feet below the surface, and is of a grayish white color, sometimes tinged with blue. The iron ore hill lies in clay, which appears to have been produced by the decomposition of the slate which is of a very soft texture.

*Sulphur.*—Pulverulent on mica-slate.

*Petroleum*—on stagnant waters, giving them an irised appearance.*

*Graphite*—In a natural and artificial state. It is found in all the furnaces in irregular *crystals*, and scaly masses. It is disseminated in a mixture of calcareous lime and mica-slate in a compact form, soft, and of a very good quality—abundant.

*Iron.*

*Sulphuret of Iron.*—Common variety in cubes and amorphous masses, also granular. Sulphate of iron is formed in many places by its decomposition. In limestone, quartz and mica-slate.

*Hepatic Pyrites*—abundant in quartz.

*Magnetic oxid of Iron.*—Crystallized and massive. In cubes and octaedral crystals in mica-slate.

*Specular oxid of Iron*—abounds in shining plates in quartz. Laminae of various thickness.

* This appearance, in such cases, is commonly owing to Iron.—Ed.

*Brown oxid of Iron.*—Va. *Brown hematite—at the ore bed in beautiful stalactites, coated with maganese.

*Compact brown oxid of Iron*—associated with the hematite at the ore bed.

*Ochrey brown oxid of Iron*—Yellow ochre is in considerable abundance at the same locality.

*Argillaceous oxid of Iron.*—In Cleaveland's mineralogy granular argillaceous oxid of iron is said to be found in this town—but it must be a mistake—no variety of this is found here but the common, which has a compact structure, color yellowish, fracture conchoidal.

*Sulphate of Iron*—occurs on the summit of a high hill, (*Barrue Monteith,*) half a mile east of the meeting-house. Discovered about 20 years since by Mr. Samuel Moore, surveyor. It is produced by the decomposition of iron pyrites which forms a vein of considerable thickness in mica-slate. It is sufficiently abundant to make it worth collection.

*Sulphuret of Lead. Galena.*—Rare, in thin laminae, in limestone. A vein of it passes through Ancram 12 miles distant which is very rich. It is also met with in many places in Dutchess county, N. Y.

*Zinc*—In some form at the ore bed—probably the *siliceous oxide*—also in artificial masses of a striped aspect in the furnace.†

*The formation of the ore in this town is involved in some difficulties. While the position of the stalactites indicates the action of water, and their regularity of form the laws of crystallization, other masses have the appearance of having been acted on by fire. They often resemble ore that has been melted and gently agitated when cooling. What tends to convince the observer of the action of fire is the frequent cccurrence of sharp and angular fragments projecting from smooth surfaces as if they had fallen there when the mass was in a fused state. There are, I think, insuperable objections to the agency of fire in forming the stalactites. The following is extracted from a letter from Prof. Dewey on this subject. "There are great objections to Mr. Eaton's notion of the formation of your stalactical ore. For if heat be the cause as he supposes, you have ore crystalized and adhering to a mass half an inch thick only which shows no action of fire at all—and you cannot believe that the inside of a ball four inches in diameter has been melted and the adjacent parts incrusted on."

†Cadmia is not produced when the ore is previously roasted, being volatilized by the heat. For the chemical characters and analysis of the cadmia, see Torrey in No. 2. Vol. 5. of this Journal.

*Manganese*—the compact ore, at the ore bed, and in the north part of the town.

*Titanium*—very abundant in small hexagonal crystals in the mica-slate forming the walls of the ore bed—species red oxide. Also in large prisms in quartz and augite.

*Breccia*—common, cement ferruginous, fragments principally quartz.

*Puddingstone*—in considerable masses, with a calcareous cement, near running water.

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For the Journal of Science.

To Prof. Silliman.

Art XI.—*Ought American Geologists to adopt the changes in the Science, proposed by Phillips and Conybeare?* See Review, Vol. VII. pp. 203 to 240.

This treatise has received much public approbation in England and a degree of homage in America. The talents and industry of the authors, certainly deserve such a tribute. But a question, very different from any which respects the intrinsic merit of the work naturally presents itself. Shall American geologists follow the new method introduced by its authors in generalizing our rocks and alluvial deposits? I am desirous, that those who control public opinion by the authority of a great and well-earned reputation, should pause a moment before they compel us, who have as much zeal in the cause as they, but no authority, to submit to these very unexpected changes.

These authors propose, that we should begin at the upper surface of the earth and proceed downwards, when we study its structure. To one who never gave any attention to the subject, it would appear very reasonable, that we should commence with the surface which is visible, and proceed from this known and visible part towards the hidden parts beneath. But every experienced geologist knows, that the subjects of the superior order of these authors have their true characters much more concealed and obscure, than those of their inferior or primitive order. By their own admissions, the former cannot be studied without a knowledge of the latter, from whose fragments they are created.

It is said, that this arrangement exhibits an utter exclusion of all hypothesis. See Vol. VII. p. 208. I would ask, how these authors know, that granite, gneiss, &c. pass under their superior order? *Surely by the extension of an hypothesis, far beyond any which is necessary in the Wernerian arrangement.* And should this hypothesis be abandoned we must expect to be burdened with another system. For example, our primitive rocks crop out in the Green Mountain range. This new arrangement requires for its very existence full confidence in the hypothesis, that these rocks pass under those on the shores of Lake Erie, three hundred miles west from the place where they are visible. Whereas the Wernerian scheme leaves us to believe or disbelieve. It is sufficient that we show the series of rocks *at the surface* in that order of succession denominated primitive, transition and secondary. The objection to the Wernerian names, because they suppose a knowledge of the chronological succession of the three great formations, appears to me most extraordinary. Does not every science require revolutionizing upon the same principle? In truth a large proportion of the words now in use must be expunged, if we would retain none which originated in hypothesis or unfounded conjecture. The word Electricity originated in the opinion, that amber was the only substance with which it could be excited. Why do we not abolish the names of the constellations, which originated in a conceit, known even at the time to have no foundation in truth? Why do we retain the name *cornu ammonis* for a well known petrifaction, which no one now believes to be one of the cast off horns of Jupiter?

Above all other objections, it appears to me that this new arrangement would require a different starting point in every district. In the Green Mountain range we must begin with the last order, which is the first of Werner. Near the west line of Massachusetts, with the fourth.—On Catskill Mountains, with the third.—Between Utica and Genesee River, with the lowest part of the second as we have no oolite, &c.—And never definitely with the first, as we have no chalk. Whereas every part of the earth, yet explored, justifies our starting with the well known and universal rocks, granite and gneiss.

The subdivision of alluvial formations into alluvial and diluvial is probably tenable. But shall we adopt these names ? It is said Vol. VII. p. 210, that, " not one thousandth part of those tracts, marked as alluvial in this country really belongs to that formation." That is, if a modern writer choose to change the original and legitimate use of a word, this change renders all the previous applications of it improper. This is very extraordinary ; but still it does not equal a remarkable omission which we may almost say characterizes American writers. I mean that of neglecting our own countrymen in order to do homage to Europeans. This same distinction in alluvial formations was suggested and enforced by our countryman, Mr. Schoolcraft, long before the suggestions of Buckland or Conybeare reached this country. Instead of restricting the word alluvial and thereby leaving no general term to express its original import, he uses the more appropriate terms *primary* and *secondary* alluvion. I published a short account of Mr. Schoolcraft's views on this subject four years ago in the 2d, Ed. of the Index to the Geology of the northern States. pp. 262—6.

I have made these few enquiries and remarks with a view to invite discussion before such an entire revolution in the science is sanctioned in America. I would not be understood to imply that I will not follow these authors, as far as the geological structure of our country can be made to yield to their views. New names must be given, when new discoveries are made. But such an entire and radical change of classification is too great to be adopted, before our own rocks and alluvial deposits have been extensively consulted.

Most respectfully,

Yours,

AMOS EATON.

*Troy*, (*N. Y.*) *March* 16, 1824.

# BOTANY.

Art. XII.—*Caricography; (continued from Vol.* VIII. p. 99.) *Communicated to the Lyceum of Nat. Hist. of the Berkshire Medical Institution.* By Prof. Chester Dewey.

20. Carex *bromoides.* Schk.
Muh. Pursh. Eaton.
Schk. tab. Xxx. fig. 175.

Spiculis pluribus alternis oblongis erectis, suprema inferne mascula, ceteris femineis vel androgynis inferne masculis; fructibus erectis lanceolatis acuminatis scabris nervosis bifidis, squama ovato-lanceolata duplo longioribus.

Culm 10—18 inches high, leafy towards the base; leaves linear, scabrous on the edges, shorter than the culm; bract scabrous, lanceolate, awned, supporting the lowest spikelet, and about its length; stigmas two; spikelets all pistillate, all staminate, the highest staminate below, and the others pistillate, androgynous above and below, and staminate in the middle, or the middle ones staminate below, having a single staminate plant at their base.

Though the common appearance of this species, is shown on the fig. of Schk., the variations of the spikes form some obstacle to the ready knowledge of it. Muh. remarked several of these variations. As the androgynous spikes are staminate below, it should be removed, as the description of Muh. requires, from the section in which it is placed by Ph. and Eaton, to the next following section. It occurs in small bogs, or cespitose clusters, and is readily recognized after it is once found. Pursh says it grows "in dry fields and woods;" but, according to Muh., it inhabits marshes or wet situations, in which alone have I found it, or known of its being found, in the Northern States. Flowers early in May—common.

21. C. *Muhlenbergii.* Schk.
Muh. Pursh, Eaton, Persoon. No. 49.
Schk. tab. Yyy. fig. 178.

Spiculis alternis sub-quinis obtusis approximatis superne masculis; fructibus ovatis compressis nervosis bifidis margine scabris sub-divergentibus, squama ovata mucronata paulo brevioribus.

This species is admirably figured in Schk., and though rather a rare plant, has very distinct characters. Culm 12—18 inches high, triangular, striate, scabrous above; leaves sheathing linear-lanceolate, glabrous, scabrous on the edges, keeled, longer than the culm, lower ones abbreviated; sheath glabrous, striate, terminating in a straight stipule opposite the leaf; spikes 5—7, rather clustered, staminate above, supported by an ovate bract ending in a scabrous awn, longer than the spikelet; fruit ovate, compressed, somewhat concavo-convex, scabrous, or ciliate-serrate on the edge, bidentate, nerved, and somewhat diverging; pistillate scale ovate, nearly the length of the fruit, and terminating in an awn extending a little beyond the fruit. Stigmas 2.

In the aggregation of the spikelets, this species often resembles C. cephalophora, from which, however, it is easily distinguished by its fruit, and scale.

Found on the borders of mountain woods, with C. cephalophora, and C. straminea—Stockbridge. Also at Phillipston, N. Y. Dr. Barrett.

22. C. *sparganioides.* Muh.
Muh. Pursh, Eaton, Persoon. No. 62.
Schk. tab. Lll. fig. 142.

Spiculis superne masculis sub-octonis ovatis sub-distantibus bracteatis; fructibus ovatis compressis margine scabris divergentibus acuminatis bidentatis, squama ovata mucronata duplo majoribus.

Culm 18—24 inches high, leafy towards the base; leaves nearly flat, striate, glabrous, three lines broad, lanceolate, nearly as long as the culm, abbreviated near the base; sheaths striate; stigmas two; spikes many, clustered above and somewhat remote below, ovate, supported by ovate-lanceolate scabrous bracts, sometimes leafy and much longer than the spikelets; fruit diverging and nearly horizontal.

yellowish towards maturity, compressed, sub-convex above, distinctly two-toothed, scabrous; pistillate scale ovate, acute, or shortly awned, yellowish green, and about half the length of the fruit.

Though the fig. of this species in Schk. is excellent, the plant is not easily distinguished from its related species by the common descriptions merely, because the pistillate is not described with sufficient particularity. It varies much too, in its lower spikelets. Instead of single spikelets, we often find several spikelets on a branch, which occupies the place of the lower ones, and becomes their common rachis.

Grows in moist soil; flowers in the latter part of May,—not very abundant.

23. C. *disperma.* (Mihi.)

Spiculis superne masculis subternis sub-approximatis erectis, infima bracteata; fructibus ovatis obtusis nervosis plano convexis glabris, squama ovata acuta submucronata duplo longioribus.

Culm 6—12 inches high, slender, triangular, scabrous above, leafy towards the base; leaves linear, narrow, channelled, shorter than the culm, subradical with short sheaths, lower ones abbreviated; spikelets 2—4, generally 3, rather near, two-fruited, with a staminate floret between and above them, pretty erect, the lowest, and sometimes the two lower, supported by an ovate bract, often ending in a long slender, scabrous leafet; staminate scale lanceolate, white; fruit ovate or oblong, nerved, obtuse, scarcely beaked, entire at the orifice; pistillate scale ovate, acute or shortly awned. white, with a brown keel, and about half the length of the fruit. Occasionally a spikelet has only one fruit, with the staminate flower on its side and a little above it; and sometimes we find three fruit in a spikelet, and diverging. Stigmas 2.

This new species appears different from any one described by Schk. It is related to his C. gracilis, but very different from his C. loliacea, a variety of the same, both of which are staminate below; it has not been described by any botanist of our country.

Grows in wet open woods, on hills; also, high on Saddle Mountain, in the same situations. Flowers in May and June—abundant.

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Art. XIII.—*List of the Rarer Plants found near Easton, Penn.;* by the Rev. Lewis De Schweinitz, *of Bethlehem. Communicated by* Mr. John Finch, 126 *Broadway, New-York.*

Mr. Finch—*Dear Sir,*

In compliance with my promise, I have noted down the following as the rarer plants hitherto observed by me in my occasional visits in the immediate vicinity of Easton, almost all of which are met with principally on the shady rocks up the Delaware, or on the rocks at the mouth of the Lehigh.

1. *Trees and Shrubs.*

Fraxinus pubescens
sambucifolia
juglandifolia
Azalea viscosa
Caprifolium gratum
Diervilla Tournefortii
Ribes pennsylvanicua
oxyacanthoides
prostratum
Euonymus atropurpureus
Celastrus scandens
Nyssa sylvatica
Ulmus fulva
Celtis occidentalis
Viburnum prunifolium
dentatum
pubescens
acerifolium
Sambucus pubescens
Acer rubrum
saccharinum
striatum
montanum
Dirca palustris
Andromeda racemosa
Hydrangea vulgaris
Prunus virginiana
serotina
borealis
Cratægus coccinea
Aronia botryapium
Rubus strigosus
obovalis
Tilia glabra
Betula nigra
lenta
Comptonia asplenifolia
Quercus montana
prinoides
Banisteri
alba
tinctoria
bicolor
prinus
ruber
Juglans cinerea
nigra
alba
tomentosa
sulcata
glabra
amara
Morus rubra
Pinus canadensis
rigida
Juniperus virginiana

2. *Herbaceous Plants.* (Only those which do not grow generally in the country are mentioned.)

Veronica *intermedia*, L. D. S. commonly called beccabunga
scutellata
Monarda fistulosa
Salvia lyrata
Podostemon ceratophyllum, (in Delaware river)
Heteranthera graminea, (Bushkill)
Carex cephalophora
Muhlenbergii
muricata
retroflexa
rosea
*costata*, L. D. S.
marginata
anceps
umbellata
*nigromarginata*, L. D. S.
Scirpus planifolius
Cyperus mariscoides
Oryzopsis (Piptatherum) melanocarpa
Muhlenbergia erecta
Poa spectabilis
annua
Bromus purgans
pubescens
Elymus philadelphicus
canadensis
Galium boreale
Phlox subulata
Plantago virginica, (Jefferson hill.)
Cornus sanguinea
alternifolia
paniculata
Potamogeton perfoliatum, (Lehigh)
crispum, ibid.
Hydrophyllum virginicum
Campanula americana
rotundifolia, (rocks)
Viola cordifolia (sororia)
blanda
*eriocarpa*, L. D. S.
rostrata
debilis
Gentiana crinita
Aclepias syriaca, very common
Chenopodium ambrosioides
Smilacina canadensis
Polygonatum latifolium
pubescens
Trillium cernuum
Veratrum viride
Silene pennsylvanica
Sedum telephioides
Cerastium arvense, (rocks)
Arenaria stricta
Potentilla norwegica
Geum album
Aquilegia canadensis
Atragena pennsylvanica
Scutellaria lateriflora
Verbena hastata
spuria
Bartsia coccinea
Pentstemon pubescens
Orobanche americana
Obolaria virginica
Arabis falcata
thaliana
lyrata
Geranium robertianum
Corydalis cucullaria
glauca
Polygala paucifolia
Hyoseris amplexicaulis
dichotoma
Prenanthes serpentaria
alba
crepidina
cordata
racemosa
Hieracium paniculatum
fasciculatum ?
marianum
Erigeron purpureum
Senecio balsamitae
obovatus
aureus
Aster macrophyllus
paniculatus
cordifolius
Ambrosia trifida
Goodyera pubescens
Malaxis liliifolia
Valisneria spiralis
Lycopodium dendroides

As I have not had an opportunity more than cursorily to examine the vicinity of Easton, I am conscious that the above is a very imperfect list. But very few of the plants it contains are unusually rare.

With great respect, &c.

L. De SCHWEINITZ.

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## ENTOMOLOGY.

### Art. XIV. *Notice of the Melolontha, or May Bug.* By Jacob Cist.

Communicated by Col. George Gibbs.

[See Plate IV.]

This is a very common insect in Pennsylvania. It is nearly one inch in length; head, thorax and shells of an uniform dark chesnut brown colour; abdomen and hair on the breast, of a pale yellow brown. The shells are shorter than the abdomen, thin and flexible, and have a club shaped ridge on each.

Its larva, which is one and an half inch in length, is the grub so common in our meadows, and so destructive in particular seasons to the grass, corn, and other crops. In a wet season, the damage done is trifling compared to what they produce in a dry one. They feed on the succulent roots of these plants. In a moist season, however, the plant is enabled to recover by pushing out young fibres; but in a dry season the damage they cause is very great. I have known one third of our corn* crops destroyed by them: from ten to fifteen of them may sometimes be found in a single corn-hill. The withered plants may be raised without much effort, and will be found to have all the

* Indian Corn, Zea Mays. Ed.

lower parts of their roots cut off. In our meadows, in such seasons, particularly on dry hillocks, the roots of the grass are so cut off that the withered grass may be raked off for rods. In such places I have collected from twenty to forty in the space of a square foot.

These worms are the favourite food of the blackbird, which devours them in such numbers as to render it a question of policy whether this bird ought not to receive legislative protection, rather than be placed, by offering a bounty on his scalp, (as is the case in some States,) *under the ban of the empire*. I verily believe the damages he does bear no proportion to the services he renders.

How long they remain in the larva state is uncertain. The usual time of the first appearance of the bug is the latter end of April, or early in May. Shortly before this time it may be found immediately under stones, in meadow, or moist lands, occupying a cell or chamber, which it has formed in the earth previous to its intermediate or pupa state. It remains but a short time in this state, when it undergoes its final or perfect change. They are then at first feeble, of a pale yellow brown colour, and it is some time before they take flight. During the twilight of a summer evening they may be seen in great numbers on the wing, making a loud humming noise as they fly about.

As the larvæ are found in great numbers, during the summer, doing most damage in the months of July and August, it is probable they are more than one year in that state.

There is a vulgar, but very prevailing opinion among farmers, that these grub-worms change to a briar!

In meadows where they are abundant, it is not unusual to find a number which have attached to them, vegetable sprouts, which are in some instances three inches in length. These "sprouts" proceed generally from between the head and the under part of the thorax, and in a few instances from the mouth. These appear to be a species of Fungi. There is generally but one to each grub, though in several instances I have met with two. In every instance, however, the grub is not only dead, but in a state of decay, and the sprout rising about the ground, indicates where they may be found.

I am inclined to believe that the seed is taken internally by the worm, and causes its death; and that in the following spring it vegetates, finding a suitable bed or soil in the decayed worm.

JACOB CIST.

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# MECHANICS, PHYSICS, CHEMISTRY, AND THE ARTS.

## Art. XV.—*Description of two new Voltaic Batteries;* by Elisha De Butts, M. D. *Professor of Chemistry in the University of Maryland.*

[In a Letter to the Editor.]

*Dear Sir,*

Perhaps no branch of science is more important at this moment than electricity.

The power possessed by certain galvanic arrangements to elevate temperature to extraordinary degrees, when associated with our present views of chemical theory, renders them justly objects of great interest. But when we reflect upon the phenomena which have resulted from a power which they also possess to affect the magnetic condition of bodies, we cannot be surprised that so much of the attention of the scientific world is devoted to this department of study. A consideration of the facts developed by the experiments of Oersted, Ampere, Arago, &c. made me desirous to repeat them and to pursue the subject, and as the most remarkable magnetic effects appeared to have been produced by large plates, I endeavoured to construct an apparatus, upon a plan which should not only have that advantage, but also those by which it might be adapted to operations connected with chemical researches, and in relation to both to possess if possible, in a greater degree than any of our galvanic instruments, all those circumstances of mechanical facility that have been found useful in the hands of other experimentalists. My motive for addressing you now is merely to describe the plan which I have adopted, as I have found it to be eminently useful in relation to the objects to which I have alluded. The result of a series of experiments in which I am engaged shall be communicated to you for a future number.

Eight wheels (see plate III.) made of strong pieces of plank, screwed to each other transversely, four feet in diameter and one inch and five-eighths in thickness, are placed upon an axle six inches in diameter, and five feet nine inches in length, having brass gudgeons one inch and a half thick, at each extremity. These wheels are arranged in pairs, each carrying thirty semicircular plates of copper and zinc, thirty-nine inches in diameter. In order to prepare them for the reception of the plates, they are placed about ten inches from each other and retained in their positions by eight strong pieces of ash, morticed and screwed into their edges, by which they are firmly connected. Five of these cross pieces are indented by a saw that they may receive the edges of the plates, and keep them at proper distances. Each pair of wheels, charged with the plates, is separated about two inches from the next, as they are all intended to revolve in a cistern with divisions. The plates are counterbalanced by pieces of lead, painted and varnished, attached to the cross pieces on the opposite side of the wheel. The dotted lines d. d. indicate the situation of these counter-weights. The cistern is supported by strong pillars of glass—is six feet long, four feet four inches wide, and two feet three inches deep. It is divided into four cells, by three pieces of one and a quarter inch plank, morticed into the bottom and sides, and rising to within four inches of the top of the cistern, for the purpose of permitting the axle to turn freely. The whole is well painted with white lead, and covered with several coats of copal varnish. The plates are arranged as in fig. 2, and the terminating plates of each division are connected by a strap of copper, four inches broad, soldered to their edges. This strap rises from one plate (for example) until it touches the axle, then passes through the wheel in contact with the axle, until it passes through the opposite wheel; it then dips down to join the edge of the first plate of the next division, which is in a different electrical state. In order to enable the operator to experiment conveniently, the poles are brought to one end of the set of wheels, a brass bar almost as long as the axle is placed upon that side of the axle which is uppermost when the plates are immersed, and, with the exception of the terminating wheels, passes through all the rest near their centres. One end of this bar is connected by copper straps to the positive plate, and the other to a copper strap which, rising from the axle, passes through a slit in the front wheel; it is then bent down, and fastened by a plate of brass, fig. 3, which is screwed firmly upon it. Another strap is soldered to the negative plate, passes through another slit, and is fastened in the same way, by a similar brass plate.* These brass plates, with the pincers for experiment, mounted, are represented at a. a. In fig. 1, plate iii. the wheels are in the position which exhibits the plates out of the fluid. The pincers and brass plates are here shown to avoid the necessity of another plate, although not in their proper places. It is evident that, when the plates are immersed in the fluid of the cistern, the dotted lines b. b. mark the places which properly belong to them, and which must then be uppermost. When the operator has finished, and is about to turn the plates out of the fluid, he must first draw the pincers, &c. out of the brass plate. That this may be done almost instantaneously will be perceived by referring to fig. 3, which represents one of the brass plates with the pincer holder in its place—fig. 4 represents one of the pincers. It is hardly necessary to state, that the instrument which I have now described is sufficiently powerful to melt the metals, ignite charcoal intensely, &c. In fact, with one part of nitric acid to ninety of water, I found it to be impossible to fix platina wire, one tenth of an inch thick, and several inches long, in the pincers, as it melted instantly when in contact with the poles. In conformity with common observation relative to large plates, it produces neither shock nor decomposition. As in a certain position, the uniting wire situated east and west, a magnetic needle suspended below and near the wire is reversed, the north pole pointing directly to the south, its power in this respect is probably sufficiently great to accomplish all my purposes. I think it is not inferior, in re-

* These two straps are well varnished.

lation to this power, to any of the instruments reported, and certainly superior in point of convenience either to the coil of Colonel Offerhaus,* or that of Mr. Pepys.† As it is necessary, however, to have instruments capable of producing the other galvanic effects, it occurred to me to form a battery of small plates upon the above plan. Fig. 5 represents one of this kind, with semi-circular plates, eight inches in diameter, and arranged as in the large apparatus. This is four feet in length, and contains one hundred and forty-four plates, namely, forty-eight of zinc and ninety-six of copper. Two of these placed parallel to each other, I have chosen to connect by an arc of thick brass wire at one end and at the other by having plates of copper connected with the terminating plates inside, fixed to the outside of the wheels, as at *c*, with a sheath to each to receive the ends of the conductors, as in fig. 6. I am preparing another battery of this kind, with a much larger number of small plates. To facilitate the work of soldering connecting pieces to plates situated close to each other, suppose the third of an inch, one or more straps must be soldered to the edge of each plate, before they are fixed in their places, and then, by causing one strap to lap over the other, they can be easily united by the soldering tool.

You will perceive my dear Sir, that according to the arrangement of both these instruments, we possess the advantage to be derived from the simultaneous immersion of all the plates, an advantage which has been so ably illustrated by my friend Dr. Hare's calorimotor and deflagrator, and that by half a revolution of the wheels, which may be done in a few seconds by a slight effort,-the plates are all in the air, and may be easily washed by a little water poured from a garden pot, or other convenient vessel. In this position they will remain unaffected until required for operation.

I am, dear Sir,

your obed't humble serv't,

ELISHA DE BUTTS.

* Edinburgh Journal. Vol. VIII. † Brande's Journal, 1823.

## Art. XVI.—*Remarks on Mr. Patten's Air-Pump,* (described in the last number) by Prof. J. F. Dana.

To the Editor, Dear Sir,

Some months ago I proposed a construction of an air-pump on the principle of that, of which an account was given by Mr. Patten in the last number of your Journal; but as I had not the *means* for making a practical trial of the principle it was relinquished by myself, although several scientific friends urged its prosecution. The *detail* of the construction as well as the principle are so nearly alike in Mr. Patten's pump and that which was proposed by me, that the coincidence seems to have been concerted. There was one difference between the construction proposed by myself and that proposed by Mr. P. and by which I hoped to accomplish a great desideratum in the construction of air pumps, viz. to dispense with all valves, oil, &c. &c. between the air the working piston and the receiver. This I hoped to effect by means of a stop-cock, which the accompanying sketch will explain, and which is to be placed between the glass globe (K Mr. Patten's drawing) and the receiver, and which I consider as much more simple than the form proposed by Mr. P.

A is the receiver on the plate of the pump, a. (see Plate II.)

B the stop-cock, in which there are two passages, viz. D e which in the present position of the apparatus allows a free communication between the atmosphere and the glass globe K but which, if the stop-cock was turned *half* round, would open a communication between the atmosphere and the receiver A; the other passage C in the present position of the apparatus allows no communication through it in either direction, but if the stop-cock was turned one quarter round, this passage would then be vertical and allow a free communication between the glass globe K and the receiver A and at the same time the communication between the atmosphere and the apparatus would be cut off. Now suppose the apparatus to be in the position represented by the drawing and the mercury was rising in the globe by the action of the piston in Mr. P's apparatus, the air would pass through the passage D e and be totally expelled; now turn the stop cock one quarter round and the communication between the air and the globe would be cut off, but that between the receiver and the globe through C would be opened, and as the mercury fell to its level, the air in the receiver would be rarefied ; restore the stop-cock to its original position, and the air in the globe might be again expelled by the mercury. Now suppose the receiver, by this method, to be exhausted of air ; turn the stop-cock half round, and a communication is opened between the atmosphere and the receiver. The requisite motions were to be communicated to the stop-cock by the same power which was employed to work the pump, and methods of effecting this will readily suggest themselves. I mention this matter not as claiming the credit of having proposed a construction of an air-pump, of the *practical* advantages of which I have great doubts, but simply as an improvement of that suggested by Mr. Patten.

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## Art. XVII.—*On the cause of the heat produced by friction*; by James T. Watson.

TO THE EDITOR.

*Dear Sir,*

I have made some attempts to explain the cause of the heat excited by friction, an account of which I hope will be acceptable to you.

In rubbing two bodies together it is evident that the air in their pores, and interstices will be compressed, and as air readily yields heat by pressure, it is possible that the heat excited by friction may be thus explained.

If two subtances were rubbed together, and if at the same time, there could be similar friction in vacuo, by a comparison of the results an opinion might be formed of the effect of air with friction in exciting heat. I mentioned this explanation to Professor Renwick, and Dr. McNeven ; they thought it probable, furnished air-pumps, and assisted in making experiments.

A wooden spindle was fitted to a socket, and a similar spindle also fitted to a socket within the receiver of an air-pump, these were connected by a brass rod, passing through a collar of leather, and being quickly turned by a cord, heat was readily excited; several trials were made, in all of which, except one, when the density of the air was diminished, less heat was excited. In that, about fourteen fifteenths of the air was exhausted—notwithstanding this, the heat was greater within the receiver than without. In this instance pressure was applied as far as could be, and allow the spindle to turn rapidly, the experiment was afterwards repeated with the same apparatus and gentle pressure, and the heat was much greater without the receiver than within.

Upon considering all the experiments there appears reason to believe that air assists in exciting heat by friction, and the question arises, is it wholly by compression, or is there any other cause?

If the experiment should be repeated it would be well to ascertain that the spindles excited equal heat—that time be allowed for the air to leave the pores of the wood—and that the density of the air in the receiver during the experiment be noted.

Respectfully, Yours,

JAMES T. WATSON.

*New-York, May* 8, 1824.

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Art. XVIII.—*On the stopping of Astronomical Clocks;* by Wm. Howard, M. D., *Professor of Natural Philosophy, University of Maryland.*

One cause of the stopping of delicate astronomical clocks has been supposed to be the attraction exerted by the weight on the bob of the pendulum when the two become opposite to each other. The very minute quality of this attractive force renders it difficult to conceive that it can so disturb the motion of a heavy pendulum as finally to stop it; and the following observations induce me to believe that in the cases which have been thus explained, the true cause is very different.

I have a French clock with a very heavy half-second compensation pendulum, fitted with Lepaute's dead beat escapement. A weight of one and a half pounds in descending eleven inches keeps it in motion a week. The pendulum is supported by a strong upright bar of steel, which also supports the pully, over which passes the cord which suspends the weight.

This clock I found frequently to stop when the weight descended nearly opposite to the pendulum from which it was then distant about three fourths of an inch. This I attributed to the attraction of the weight and pendulum, and determined to remove the weight to a greater distance. Before this was done, however, on attentively observing the clock, I found that before it stopped, the weight acquired a considerable oscillation, evidently communicated from the pendulum through the common support.

To destroy these oscillations, I placed a perpendicular wire by the side of the weight, the whole line of its descent. On this a ring was fitted to slide, and was connected with the weight by a delicate spring. This spring by constantly pressing the weight towards one side prevented the oscillations from taking place and completely effected the object, and the clock has since continued to go without any interruption.

The experiment has been often repeated, of supporting two clocks on the same horizontal beam. If one be set in motion it will in a short time communicate its motion to the other, and if both pendulums be of the same length, they will continue their beats with perfect isochronism. This *sympathy*, which also exists between two watch balances which are supported by the same plates, has been ingeniously used in practice by Breguet, who has constructed clocks and watches, each including two distinct movements, having no connection together except by the plates which form the common support. In these timekeepers the pendulums and balances beat perfectly together, and thus one pendulum or balance is made to correct the irregularities of the other.

If this experiment be made where the pendulums are of different lengths, the clock first in motion will be stopped. This effect can be transmitted through media apparently very solid, and probably has taken place in the instances when the clock's stopping has been attributed to the attraction of the pendulum and the weight; in such cases the weight suspended by its cord becomes a pendulum of nearly the same length as that of the clock. The remedy is easy: merely to conduct the cord of the weight to a different support from that which sustains the pendulum.

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## Art. XIX.—*Reply to Mr. Quinby on Crank Motion.*

TO PROFESSOR SILLIMAN.

*Sir,*

In a note to an article on "Crank Motion," published in the last number of the American Journal, Mr. Quinby, the author of that article, says: "Since I wrote the above solution, I have learned that the North-American Review contains an article in which it is stated that the *crank* motion occasions a loss of *three fourths* of the whole power employed!!

"On referring to the article alluded to, I find the following statement relative to the loss of power *supposed to result* from the reciprocating motion produced by the *crank*." Mr. Quinby then quotes the words of the Review as follows: "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, not very satisfactorily accounted for, considering the magnitude of the loss, which on an average amounts to three fourths of the whole power, as appears from the reports of the performance of the engines used at the mines in Cornwall."

Now, 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?* Even the term is not to be found on the page from which he made the quotation; if, indeed, it occurs in the article. It is expressly said that the loss of power "is not very satisfactorily accounted for," an observation which surely would not have been made, if the author had attributed it to the crank. The fact of the loss is stated in all its nakedness, and on authority to be seen directly; and the cause of it was not connected with any mechanical agent whatever, and no such connexion can be inferred without violence to the whole statement.

Mr. Quinby next says, "With respect to the reports on the performance of the engines used at the mines in Cornwall, I have no knowledge, and am, therefore, not able to refer to the authority by which they were made out.

"It must, however, be concluded, that a very great blunder has, in some way, been committed by those who made the estimate, since the reciprocating motion of the steam engine does not in truth (abstractly considered,) occasion any loss whatever of the acting power."

Before Mr. Quinby concluded 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. If he had consulted so common a book as Rees' Cyclopedia, article Steam-Engine, he would have found the following statement: "By agreement of a number of respectable proprietors of tin and copper mines in Cornwall, who resolved to have ascertained the real work their respective steam engines were performing, &c.—" it was agreed that a counter should be attached to each engine, and all the engines put under the superintendence of some respectable and competent engineer, who should report, monthly, the following particulars." Then, amongst other particulars enumerated, "Pounds, lifted one foot high, by a bushel of coals."

"Messrs. Thomas and John Lean were appointed to the general superintendence, and since that time they have published monthly reports, &c." By these reports, it appears that two large engines used for pumping, raise on an average about 50,000,000 pounds one foot high, for each bushel of coals consumed; and one of them raised, for one month, 56,000,000 pounds: again, says the same work; "Before quitting the subject of double engines, employed to give a rotative motion to machinery by a crank, we must notice a remarkable difference, shewn by Messrs. Lean's reports, between the performance of the small engines, employed in drawing the matter out of the mines, and those in pumping water."

"We should think the loss of power from friction, in drawing up buckets by a rope, would not be greater than the friction of the pump buckets, and of the water moving in the pipes; therefore, all the difference must be attributed to the application of the rotative motion, and to the smallness of the engines. These are usually fourteen, sixteen, and twenty-four inches in diameter; but their performance with respect to coals is only three, three and three quarters, four, and five millions. The best engine they have, draws only from nine and a half to eleven million pounds one foot high for each bushel of coals; which is only one third of the product of the best large engines, employed in pumping.

"One of Woolf's double engines at Wheel Fortune mine, in May 1816, drew only three million pounds one foot high, with each bushel; but another at Wheel Fortune mine drew six millions.

Taking from the preceding statement two facts, and those not the most favourable to the account given in the Review, and comparing the highest performance of the rotary engine with the best pumping engine: viz. 11,000,000 with 56,000,000, gives the performances as 1 to 5.09, a difference even greater than is stated in the Review.

Now it is asked, does Mr. Quinby suppose that his demonstrating what the writer of the Review never for a moment doubted, that motion may be communicated by a crank without loss of force; is to put down a long series of facts so carefully ascertained as those reported by the Messrs. Leans? It is submitted for any unperverted mind to judge, whether the paragraph in the Review is not a fair, and, on the whole, a narrow statement of the loss, "as appears from the reports on the performance of the engines used at the mines in Cornwall."

Mr. Quinby favors us with his opinion that the frequent attempts to make a rotary engine are "unnecessary and idle." No notice would have been taken of this opinion was it not connected with a sentence of the Review, in a manner by which it may be supposed that the author of the Review appreciates these attempts more highly than they deserve. But this is by no means the case. A plain relation of attempts to accomplish a particular object is made, and the unsuccessful result of those attempts is as plainly stated. This was certainly within the professed object of the article in the Review, and appeared to the writer a necessary relation.

It may be observed, however, 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 very long and patiently continued, end in inventions of considerable public utility.

*The writer of the article in the N. A. Review.*

Boston, May 19th.

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## Art. XX.—*Facts tending to illustrate the formation of crystals in geodes.*

The great number and diversity of crystals, in the mineral kingdom, sufficiently prove, that natural modes of solution have existed, and probably still exist, which our chemistry is unable to imitate, or imitates very imperfectly. Who can inform us, in what mode the innumerable crystals of quartz, found in almost every geological formation, and remarkable, in different cases, for their transparency, the geometrical accuracy and exquisite beauty of their finish, and occasionally for their great size, were dissolved and crystallized? Was it effected through the medium of water, containing fixed alkali or fluoric acid, with the subsidiary aid of heat, and if so, or if any other foreign agents have been employed, why have the numerous analyses of quartz given us no traces of these agents, or of any other power adequate to produce the effect.

If nothing satisfactory can be said on this subject, still less shall we be prepared to answer a similar inquiry with respect to the emerald, the chrysoberyl, the sapphire, the ruby, and the diamond. The topaz, indeed, contains fluoric acid; and the encreasing number of minerals, in which modern analysis continues to discover this powerful agent, seems to countenance the supposition, that it may have been an active agent, in effecting the solutions of earthy substances; although it is not easy to understand how fluoric acid would have been very efficient, in dissolving a mineral substance, in which itself forms an essential constituent part.

Even the two new fluids,* recently discovered by Dr. Brewster, in the cavities of minerals, immiscible as they are, and possessed of such remarkable physical properties, but existing in such minute quantities, as to be discernible (if we are not deceived) only by the aid of powerful microscopes, can scarcely aid us in explaining the solution of earthy bodies; unless indeed this very curious and important discovery should lead to the conclusion, that these fluids and possibly others exist, in minerals, in very considerable quantities.

These reflections were suggested by an accidental observation, recently made by Mr. Bennet F. Northrop of the senior class in Yale College. He was occupied in breaking the ballast stones, thrown ashore from a vessel, which arrived at this port from New-Orleans, where it is supposed the stones were obtained. They were chiefly pebbles, consisting of hornstone, flint, chalcedony, and quartz. Many of them contained cavities lined with crystals of hyaline quartz. Some of the cavities were occupied by mammilary chalcedony, and others by a white spongy deposite, resembling an earthy precipitate. On breaking an ovoidal pebble of hornstone, whose diameter was three inches by two, Mr. N. was surprized to find, in the centre of the stone, a cavity of three fourths of an inch by half an inch, filled with a milky fluid, having very much the appearance of water, in which magnesia is suspended. Not expecting such a circumstance, he unfortunately spilled the greater part of the fluid, and before the remainder could be secured, it was exhaled (it being a very hot day) by a rapid evaporation, leaving a white spongy precipitate, lining the cavity, and staining the surfaces produced by the fracture. While this rapid evaporation was going on, minute prismatic crystals shot from the fluid, even under the eye of the observer, occupying not only parts of the cavity, but also of the surfaces of the fracture. Both the crystals and the spongy mass were easily ascertained to be silex. They neither effervesced nor dissolved in acids, and when rubbed between surfaces of glass they took hold of it with great eagerness, instantly depriving it of its polish, and scratching it as distinctly as a file does iron.

* See Edin. Philos. Jour., Vol. ix. p. 94.

This was true not only of the spongy matter, but of the separate crystals, which we are entitled to consider as crystals of quartz, almost instantaneously deposited, from a rich siliceous solution. These crystals were of a rather dull white, without much lustre or transparency. Their diameter was that of fine sewing silk, and their length not exceeding one sixth of an inch. It is much to be regretted, that no opportunity was afforded, of examining this fluid, so that it is impossible to say, whether it were some modification of water, or a distinct fluid. The earthy deposit and the crystals were tasteless, and proved to be a very sharp grit between the teeth. Mr. N. was so fortunate as to break another pebble, whose diameter was five inches by three, and consisting of a mixture of hornstone and chalcedony, in whose centre was a cavity of an inch and a half by one inch. This cavity, although strictly speaking not occupied by a fluid, was nearly filled with the spongy siliceous deposite already described, *but it was still moist*, to such a degree as to form a pulpy or gelatinous mass, very soft and impressible; this mass was also soon dried by the intense heat of the weather. As there was less fluid to evaporate, so, as might have been expected, there were but few crystals formed; still, they shot, here and there, as in the other cavity. The spongy mass in the cavity of the larger stone admits a knife to penetrate it more than an inch, and portions of its surface have a mammillary and stalactical appearance. It is silex like the other. Many pebbles, from the same heap of ballast stones, have been broken for the purpose of discovering more of the fluid, but none has yet been found. Numerous cavities have, however, been observed, some lined with the spongy siliceous deposite already mentioned, intermixed with minute prismatic crystals, which last have however rather more lustre than those which were so rapidly formed; and it is observable that the stone, forming most of the immediate walls of the interior of the cavities, is of an opaque enamel white, as if it had been *penetrated* by a fluid, and in some measure *softened*, by incipient solution. Other cavities were lined with distinct and beautiful crystals of transparent quartz of the usual form, perfectly well defined, but exhibiting little more than the pyramidal termination. In a few cavities, the siliceous matter had concreted into well characterized mammillary chalcedony.

Although we have to regret, that the fluid escaped examination, we submit the following conclusions as flowing from the facts which have been stated.

1st. The cavities have been occupied by a fluid holding silex in solution.

2dly. This silex has been in some cases deposited, in the form of quartz crystals, transparent and perfect, and this may be presumed to have happened in the course of a long time.

3dly. Where the crystallization has been rapid, the crystals have been more opaque and dull, and also longer and more slender.

4thly. Under different circumstances, probably where the evaporation was more rapid, the silex has assumed the appearance of a dried precipitate mixed, in some cases, with imperfect crystals.

5thly. It is at present quite impossible to say what fluid forms the solvent, or what imparts to it its extraordinary powers, nor is it easy to say, what is become of the fluid, in the cavities which are dry and lined with the spongy silicious deposit, or with crystals more or less perfect, or with chalcedony.

In enquiring for parallel cases, we are not able to recollect more than two. We do not consider as parallel the drops of transparent water, or possibly other fluids, occasionally found in rock crystals, or other stones, nor do we consider the microscopic fluids of Dr. Brewster as of this class. It is possible that they may prove to be so, but circumstances do not at present appear to justify this conclusion.

Of the two facts, just now alluded to, one is derived from the oral statement of Eli Whitney, Esq. of this city, and the other is found in the writings of Count Bournon.

Mr. Whitney states, that being in Georgia, in the year 1806, he was informed of the following facts, and saw the specimens by which they were established. On Brier creek, a stream which passes through Millhaven, and empties into the Savannah river, and at the distance of two or three miles from the road leading from Savannah to Augusta, the people were occupied in excavating a raceway for a mill; the mill dam was built on a solid mass of agate* which crossed the creek, and formed a natural basis for this superstructure. In clearing the passage for the water, below this dam, the workmen discovered a great number of hollow balls, in their form, resembling bomb-shells. Some of them were as large as a man's head, and some even eight or nine inches in diameter. They had a dark rusty appearance, the crust looked like an iron ore, outside of a snuff colour, inside of a light brown. When broken they proved to be mere shells, the walls of which were from five eights to three fourths of an inch in diameter, and the capacity of the cavity was from a pint to two quarts or more. This cavity was filled with a milky fluid, so perfectly resembling white paint, or whitewash, that it was used to whiten the fire places and the walls of the rooms of the neighbouring houses. Unfortunately no experiments were made to ascertain the nature of the fluid, or of the white matter suspended in it, and it is to be feared that the opportunity is now lost—with the hope however, of exciting enquiry we add, that, at the time, Mr. W. B. Wilkinson lived on the spot, and could give all necessary information, which we beg leave to solicit from the friends of science in that part of the country, and also specimens of the shells (and should any more be discovered) of the fluid.

The region around is a sandy pine-barren, destitute of stones of any description, *on the surface*—but, for a mile around the place where the balls were discovered, were scattered numerous arrow-heads, and fragments of agate, from which the arrow heads were chipped, by the aboriginal Indians.

The other fact, alluded to above, we cite from count Bournon's Mineralogy, Vol. 2. p. 33.

Count Bournon informs us, that in the vicinity of Lyons, in France, there is a calcareous rock, which contains here and there geodes often very large, having for their envelope silex mixed with lime—often alternating in concentric layers. In the midst of these geodes, beautiful crystals of carbonate of lime occur, mixed with those of quartz, which

* The people there called it agate—it was at least a silicious stone, and agates of great beauty are found in and near it. Specimens from this place given us by Mr. Whitney, consist of a mixture of jasper, hornstone, quartz and chalcedony.

they rivalled both in perfection of form, and in transparency. Count Bournon caused numbers of these geodes to be broken ; some of them were full of water ; on a particular occasion a happy fracture left half of one of these geodes, containing unspilt the liquor which it had enclosed. Perceiving that the fluid moved heavily, in a kind of mass, (almost like mercury,) he concluded that it must be a very concentrated solution, and as it was in the middle of a very warm day in the month of July, the fluid was all evaporated, in little more than a quarter of an hour, and there remained in the geode, a spongy amorphous crystalline mass of carbonate of lime. This fact is certainly very instructive as to the formation of crystals in geodes. Count Bournon observed the same thing at Vougy, about the same period, but the geodes were composed of black oxide of manganese lined with crystals of carbonate of lime.

If the above facts should appear to others as they do to us, worthy of being preserved, we hope that all similar facts which our readers may be acquainted with, will be communicated to the public. They may throw important light upon certain occult natural processes.

P. S. Since the above was written the following paragraph has been observed in the 15th number of the Edinburgh Philosophical Journal.

" *On the Formation of Rock-Crystal.*

Spallanzani remarks that the numerous beautiful rock-crystals in the cavities of the Carrara marble, continue still to form, and from a pure acid fluid. Ripetti in his tract " Sopra l'Alpe Apuana ei Marmi di Carrara, 1811," adduces some new observations in favour of this opinion, and tells us, that on opening a drusy cavity, there was found 1½ lb. of the above fluid, and among the solid crystals, a soft mass the size of the fist, which, on exposure to the air, hardened into a substance having the characters of calcedony. According to Daubuisson and Beaudant, the opal of Hungary is sometimes found in a soft state."

Art. XXI.—*Remarks respecting Mr. Vanuxem's Memoir on a fused product, erroneously identified with the fused Carbon of Professor Silliman; with some additional facts and observations.* By Prof. Robert Hare.

Professor Silliman about two years ago, published an account of some phenomena observed during the ignition of pieces of charcoal by a galvanic deflagrator, the poles of which they had been severally employed to terminate. On the charcoal attached to the positive pole, a projection was observed to ensue—in the other, a corresponding concavity. The projection he supposed to consist of carbon, fused, volatilized and transferred from the charcoal of the opposite pole, where the concavity was discovered.

In a late number of the Journal of the Academy of Natural Sciences of Philadelphia, Mr. Lardner Vanuxem communicates his observations on a supposed specimen of fused charcoal sent to Professor Cooper by Dr. Macneven of New York, which appears to have been iron—and the author appears to have received, and evidently intends to convey, the impression, that the substances considered as fused or volatilized carbon by Professor Silliman, must have been similarly constituted.

Mr. Vanuxem, speaking of the mass which he has examined, informs us, that—

"It consisted of one large and one small globule, connected together by a thread, or thin bar of the same material, and resembled a double headed shot."

And again he says :—

"It was then put into an agate mortar, pressed and struck with considerable force—finding it yielded without breaking, and observing that it received a polish, it was examined, and found to resemble iron. To confirm the analogy, it was next tried with a file, which acted upon it as it would on soft steel or iron—after this it was subjected to a magnet, to which it readily attached itself—and lastly, with a hammer : by its great malleability, conjoined with the characters just mentioned, it proved its identity with iron."

He moreover states, that the substance in question was attacked by nitric acid, and afterwards was chiefly taken up by muriatic acid, whence an hydrated peroxide of iron was precipitated by ammonia.

On reading this account of the substance examined by Mr. Vanuxem, it was evident to me that it had not the slightest resemblance to those which Professor Silliman had described as fused carbon. A product which I had myself obtained, and which corresponded perfectly with his description, had been preserved in a glass tube. This substance crumbled, when subjected to pressure—acquired no polish by hammering or filing—was utterly devoid of attraction for the magnet—was not acted upon by nitric acid—nor did muriatic acid, which had been digested on it, yield any oxide of iron, or give any other indication of that metal.

These observations were made by my friend Mr. G. T. Bowen, under my inspection. Mr. Bowen assisted Professor Silliman at the time when he first made his observations on the fusion of carbon. On perusing Mr. Vanuxem's memoir, Mr. Bowen was no less convinced than myself that there had been a mistake, which, considered as the foundation of a broad and unreserved, though indirect contradiction,* given to Professor Silliman's representations, is really unfortunate.

I do not feel authorised to decide whether the substance analyzed by Mr. Vanuxem, was that which Dr. Macneven forwarded. By *oversight*, one minute portion of matter

* Professor Vanuxem makes statements, and advances opinions, irreconcilable with the representations of Professor Silliman, although he does not name him. This I call an indirect contradiction—and I say it was broad and unreserved, because its force was not restricted, nor its final influence on the reader suspended, by any expression of doubt of his own premise or conclusions, nor of any deference for those which he controverted.—Upon the minds of all with whom I conversed, Mr. Vanuxem's Memoir had the effect of a most unqualified contradiction, as respects the observations of Professor Silliman on the fusion of carbon. One of my friends, last spring, after a visit to Baltimore, stated that, in consequence of the publication of that memoir, several distinguished gentlemen of that place no longer believed carbon to have been fused by the deflagrator.

Professor Silliman, in his reply to Mr. Vanuxem, observes: "Mr. Vanuxem has not done me the honour to mention me, or my experiments; but as no other person (within my knowledge,) has published any thing on the fusion of charcoal, I am obliged, however reluctantly, to appropriate his remarks, and to consider them as intended to invalidate some part of the results which I have published."—See American Journal of Science for May last.

may be exchanged for another, as easily, as mistaken—but supposing that the mistake originated with Dr. Macneven, it should be recollected that he did not act under the idea of any serious responsibility. He was writing to a friend, not controverting the conclusions of a skilful chemist.

It was in January last that Dr. Macneven first operated with a deflagrator. I then sent him the first he ever had. Notwithstanding his well known accuracy, in cases where his opportunities of observation are duly great, it is not unaccountable that amid the hurry of his lectures and his practice. he should have mistaken a globule of iron for a specimen of fused carbon. But considering Professor Silliman's great experience and skill as a mineralogist and chemist, and his having operated with the deflagrator for nearly a year before his memoir on the fusion of charcoal was published, it ought not to have been so readily supposed, that in scrutinizing the substances which he had obtained, *with a view to communicate the result to the public*, any *advantageous* employment of the magnet, the hammer, the file, or the mineral acids had been omitted.*

It is true, as Mr. Vanuxem observes, that the incineration of charcoal proves it to contain impurities—but those impurities are well known to be earth or alkali, with a very minute portion of iron, if any. These facts, thus cited by him, are therefore irreconcilable with his inference, that a piece of charcoal of about one inch in length, and less than a quarter of an inch in thickness, could, instantaneously, at its point, form a projection of matter almost solely ferruginous.

I will take this opportunity of observing, that the most

* It appears from Professor Silliman's Memoir, (Vol. V. p. 363, American Journal of Science,) that he did employ boiling sulphuric and boiling nitric acid; and moreover, it is evident that the products which he represented as fused carbon, could not have been iron, both on account of their habitudes with these acids, and on account of their disappearance when subjected to the solar focus in oxygen gas. Of course no "*advantageous*" application of the magnet could have been made. In examining the globules produced upon plumbago, when exposed to the deflagrator, it will be found that Professor Silliman did resort to the magnet. Iron being a constituent of plumbago, it was in that case rational to expect that the globules might be magnetic. The magnet was also employed by him in testing the globules procured from anthracite, by means of the deflagrator.

interesting phenomena observed by Professor Silliman, do not to me appear to be dependent for their importance on the nature of the projection which arises on carbon, when forming the negative pole of the deflagrator. That such an excrescence arises, and that a corrresponding crater or pit takes place in the charcoal on the opposite pole, are the facts which principally interest me.

I should have done more to prepare myself for the solution of the doubts which have been excited respecting some of the observations of Professor Silliman, had not my eyes been so much affected by a powerful deflagrator, made about two years ago, as to be distressed by any subsequent employment of them in the same way.

From a cursory observation made last winter, I was led to suppose the light of the deflagrator to be equal to that of sixteen hundred candle flames, condensed within a space no larger than that usually occupied by one.

Since the above was written, in trying a deflagrator made for Professor Nott, the operator had his eyes so much affected as to be bloodshot next day.*

By means of the same deflagrator, a specimen of the fused or volatilized charcoal was obtained. This did not prove to be magnetic. Instead of being malleable, or susceptible of a metallic polish, it was friable, and the fragments were without brilliancy. Seen by the aid of a powerful microscope, before it was broken, it was, both in colour and shape, exactly like the depositions or concretions of carbon, which have been formed in some instances during the gas-light process.

P. S. It is remarkable that, since the observation last mentioned was made, I have found that Mr. Conybeare, in some speculations on the concretions of carbon, noticed in gas-light cylinders, infers that they may have some analogy

* I have considered it proper to dwell on the injury thus sustained by the eyes, that others may by due caution, in the first instance, avoid the evil. The deepest green spectacles should be used, putting two glasses together, when one is not enough. Persons not provided with proper spectacles, may use a piece of card, or paper, pierced with some fine holes. Through a hole made by a pin, the phenomena may be viewed satifactorily.

with the products described by Professor Silliman as fused carbon.*

REMARK.

It was not the intention of the Editor to have revived the discussion contained in Doct. Hare's communication—but, from the frequent reference made in that paper, to the experiments of Prof. Vanuxem, it is thought proper to republish his paper, as it appeared in the Journal of the Academy of Natural Sciences, of Philadelphia, for April 1824.

*Account of an examination of Fused Charcoal.* By LARDNER VANUXEM. [*Read March* 30, 1824.]

THE specimen examined was sent to Dr. Cooper by Professor Macneven of New-York, who obtained it by means of the deflagrator invented by Dr. Hare.

Dr. Cooper was so good as to present me with the fused charcoal, knowing that it was extremely desirous of experimenting upon it, being very sceptical as to its resulting from the fusion of the carbonaceous part of the charcoal, believing on the contrary that it was little else than the metallic, earthy, saline, or alcaline materials, probably enveloping charcoal in the black globules, or if iron were present, combined with that metal, constituting a product analogous to steel.

My opinion that the fused charcoal in question was derived from the impurities of the charcoal, was principally owing to the sources of error not having been removed; and that these sources are very considerable is well known not only to those who have been engaged in the analyses of the different kinds of our ordinary combustible substances, but is obvious to the common observer by the quantity of ashes which is left, when wood or coal has been incinerated.

Dr. Macneven did not mention that he made any experiments upon the fused charcoal, other than that of as-

* Doctor Hare has given me a specimin of the concretions mentioned by Mr. Conybeare, and they appear to me to be very similar to the Carbon fused by the deflagrator; the concretions are however larger and more uniform in their colour, which is light ash gray, and they are perhaps rather more brilliant.—ED.

certaining its comparatiue density with sulphuric acid, in which liquor is sunk.

The fused charcoal consisted of one large, and one small globule, connected together by a thread, or thin bar of the same material, and resembled a double headed shot; externally its colour was black, and without lustre, and was perfectly opaque. It weighed 2.5 centigrammes or 0.385 of a grain.

In the first experiment it was heated red hot by a blowpipe in a silver spoon with caustic potash, which had no action upon it; for when well washed and dried, the weight remained the same.

It was then put into an agate mortar, pressed, and struck with considerable force; finding it yielded without breaking, and observing that it received a polish, it was examined and found to resemble iron. To confirm the analogy, it was next tried with a file, which acted upon it as it would on soft steel or iron; after this it was subjected to a magnet, to which it readily attached itself; and lastly with a hammer; by its great malleability conjoined with the characters just mentioned, it proved its identity with iron.

The fused charcoal was next subjected to the action of nitric acid in a small platina capsule, there was no effect till the acid was heated, it then attacked the mass, very violently disengaging nitrous fumes, and separated it into several pieces; although fresh additions of nitric acid were made, yet the whole did not dissolve. The unattacked part was separated from the liquor, and examined with a microscope; it still exhibited the same appearance and still was magnetic. However, by a further division of the substance, it was all dissolved by nitric acid, except one small piece reserved for exhibition.

The nitric liquor was evaporated to dryness; muriatic acid and water were then added to dissolve the iron, which took up the whole of it, leaving a small quantity of whitish matter, from which the liquor was separated by decantation; this matter resembled silex, the quantity however, was too small to ascertain correctly its nature, for it weighed no more than 0.0025 gramme.

Ammonia added to the liquor, gave the reddish brown precipitate of hydrate of per oxide of iron; separated from the liquor, dried and calcined, it weighed 0.0175, equal to 0.012 gramme of metallic iron.

Hence we have for result—

| | |
|---|---|
| Iron, - - - - - | 0.0120 |
| Silex, - - - - - | 0.0025 |
| Loss, - - - - - | 0.0105 |
| Gm. | 0.0250 |

From the results obtained, it is very evident that this product of the fusion of charcoal must consist merely of the impurities contained in the charcoal, and is not a *fusion of its carbon*, as has been supposed; moreover, it must consist chiefly of iron, for its lustre, its being acted upon by a file in the manner aforementioned, its great malleability, &c. &c. preclude all idea of any considerable intermixture of other substances with it. The great loss in the analysis is due to the violent action of the nitric acid upon it, (the capsule being small,) also to the filing of the same, and to the great difficulty of correctly operating upon so small a quantity of matter.*

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## Art. XXII.—*Notice of illuminating Gas from Cotton Seed*; by Professor Denison Olmsted, *of Chapel Hill, N. C.*

It is well known to the inhabitants of the southern States that in all the cotton districts, a vast quantity of cotton seed is annually accumulated, forming a useless, and in many instances, an offensive and noxious pile around the cotton gins. For this article, no important use has been hitherto discovered. Some limited and imperfect attempts have been made to obtain the oil with which it is known to abound; but the absorbent nature of the rind that envelopes the seed, and more especially of the cotton that obstinately adheres to it, after it has passed through the process for cleaning, has proved a great obstacle to the success of this operation. A small quantity is given to cattle, and a greater quantity is applied to land as a manure. Though it is very fertilizing at first, yet on account of its rapid decomposition, its powers are speedily lost.

* Vide p. 147 of this Vol. for the Editor's reply.

Nearly three fourths of the entire cotton crop consist of seed. The quantity of cotton *exported* from the United States in the year 1817, according to Morse's Tables, was more than 85,000,000 pounds, and was rapidly increasing. It is now probably at least 100,000,000, for which we may estimate 300,000,000 of seed, leaving that part of the crop, which affords our domestic supply to furnish seed for the ensuing y ar. Of this immense quantity of cotton seed, only a trifling proportion is applied to any use whatever.

The recent accounts which have been published in Great Britain respecting the manufacture of illuminating gas from oil, suggested to the writer the possibility of employing cotton seed, although he was not aware at that time that oleaginous seeds had ever been used in this way. A single seed pierced with a pin and held in the flame of a candle or spirit lamp, afforded a light so white and brilliant, and so copious in quantity, as greatly to favor the idea, and to stimulate to farther inquiries. A few seeds were introduced into a tobacco pipe, and its orifice being closed with a clay stopper, the bowl, when dry, was placed among hot coals, and speedily raised to a red heat. A large quantity of inflammable gas issued from the stem, burning, when set on fire, with peculiar whiteness and beauty. These trials induced me to undertake the following experiments.

Ex. 1. One ounce avoirdupois, or 437.5 grains Troy, of green cotton seed in the state in which it is found at the gins, having a little cotton adhering to it, was placed in a ladle over the fire, and when it was quite dry, a red hot iron was introduced among it, which burnt off the cotton, leaving the seed naked. A similar drying and singeing was practised in all the subsequent experiments. The seed thus prepared was introduced into an iron tube, which was placed in a furnace. To the open end was luted a flexible tube, connecting it with a pneumatic cistern. Before the tube became red hot, a copious stream of oily vapour issued from the conducting tube, which was immediately brought under a receiver. The gas shortly came over very freely, while the tube in the mean time reached a full red heat. The whole product of gas was 475 cubic inches. The first portions burnt with a reddish flame, but the gas speedily became more luminous, and continued of good quality until near the close of the operation, when it began to burn with the blue flame of carbonic oxide.

It was obvious that, provided the experiment could be so managed as to convert the oily vapour, which came over undecomposed, into gas, the quantity of the latter would be increased and its quality improved. That the oily vapour constituted no inconsiderable part of the whole product, was evident, not only from the appearance of the receiver, but also from the fact that the residuum weighed only ninety grains. This was pure charcoal, the seeds retaining their perfect form, and the tube being quite dry and clean. With the hope of decomposing this vapour, our next arrangement was as follows:—

Ex. 2. The same quantity of seed being introduced as before, the tube was laid horizontally across the furnace in such a manner, that the bottom containing the seed, projected into the open air, while the upper parts of the tube were raised to a red heat. As soon as the heat had so far reached the seed as to begin to expel oily vapour, the tube was drawn slowly forward into the furnace. A very abundant evolution of gas immediately ensued, greatly exceeding the product of experiment 1, though an accident prevented my estimating it accurately. In illuminating power, however, it was inferior to the former product,—a circumstance to be attributed, no doubt, to the effect of the upper part of the tube, (which was at a full red heat,) in decomposing the olefiant gas into the lighter carburetted hydrogen. These hints enabled me to manage this experiment more judiciously.

Ex. 3. The same arrangement being made as in Ex. 2, the part of the tube within the furnace was *slowly* raised to a *low* red heat, and the oily vapour suffered to come into contact with it, as it gradually rose from the bottom of the tube, which was still remaining without the furnace. As the gas, however, began to fail, the tube was drawn *very slowly* forward as before, until it lay wholly within the furnace. This mode, it will be seen, was suggested by that practised by the Messrs. Taylors of London, in manufacturing oil gas, when the oil is admitted into the retorts kept at a low red heat, drop by drop. This process proved quite successful. Very little oily vapour came over undecomposed; the quality of the gas was fine; and (neglecting sixty inches of the first and last portions) the product was 1018 cubic inches, and the ounce of cotton seed was found reduced as before to ninety grains. The receivers as they were filled, were successively emptied into a common recipient, and a specimen of the mixed products was subjected to the action of chlorine, as directed by Dr. Henry. This trial has been repeated a number of times on the entire product, and on specimens taken at different stages of the process, and the proportion condensible by chlorine has varied from thirty to forty per cent., indicating a very large portion of olefiant gas.

Making this experiment then the basis of calculation, it appears, that one pound of cotton seed is capable of affording 16288 cubic inches, equal to 9.425 cubic feet of illuminating gas. Indeed it is probable that a more perfect apparatus, which should decompose all the oily vapour, would afford a larger and better product. This amount multiplied by 300,000,000 pounds, which are estimated to result annually from our cotton crop, above what is necessary for planting the ensuing year, gives 2,827,500,000 cubic feet—indicating an abundant resource for gas illumination, in the United States, from this article alone.

According to Sir William Congreve, (Annals of Philosophy for June, 1823,) the whole quantity of gas manufactured annually to supply the city of London, is upwards of 397,000,000 cubic feet, and requires more than 33,000 chaldrons of coal. Peculiar circumstances have prevented my taking the specific gravity of the cotton seed gas; but judging from the high proportion of olefiant gas which it contains, as well as from its splendid appearance, I should estimate its illuminating power at nearly double the average power of coal gas. Its flame, like that of oil gas, is distinguished for purity and softness, and like that, this gas also admits of the greatest simplicity in its apparatus. In the earlier stages of the process for obtaining it, a portion of carbonic acid comes over, which amounted in one instance to ten per cent. This materially impairs the illuminating power, but it is readily washed out. Near the close of the operation carbonic oxide is produced; but the gas continues, almost to the end, sufficiently luminous to be worth saving.

In deciding upon the eligibility of employing cotton seed for the manufacture of gas lights, it should be recollected that this article is at present scarcely rated at any price, while coal is still in this country a scarce and expensive article. On account of the cheapness of the seed, therefore, the quality of the gas, and the simplicity of the apparatus required for its manufacture, it appears not improbable that it may be found the most eligible substance for gas illumination, especially in the United States.

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## Art. XXIII.—*Analysis of an Hydrate of Iron, (Bog Iron Ore,) from Monmouth Co. New Jersey*, by Henry Seybert.

The colour of the specimen, used for the analysis, was deep brown, powder reddish brown. Fresh fracture resinous, opake, massive, cellular, very frangible, almost friable, infusible before the blowpipe. Specific gravity 3.003. A portion of the mineral, by distillation, furnished drops of water.

### *Analysis.*

A. 3 grammes of the pulverized mineral, after a strong calcination weighed 2.405 grammes, therefore the diminution of weight occasioned by the loss of the water amounted to 19.833 per 100.

B. The calcined mineral was boiled with concentrated nitro-muriatic acid—it nearly all dissolved, affording a solution of a deep brown colour, the residue appeared flocculent and colorless, the whole was evaporated to dryness; the mass was treated with acidulated water, and by filtration 0.10 grains of insoluble residue were obtained, equivalent to 3.333 per 100.

C. The filtered solution (B) was treated with subcarbonate of ammonia, as long as a precipitate was produced; the precipitate was reddish brown and flocculent—it was collected on a filter and after a strong calcination weighed 2.25 grammes. It was then calcined with caustic potash in a silver crucible, no *cameleon* having been formed, Manganese was not present, the mass was treated with water, the solution being of a light brilliant yellow color, indicated a trace of oxide of chrome. The residue, which was not dissolved by the potash, being separated from the solution, and again acted on by the alkali, was found free from Alumina and Phosphoric acid. This residue was dissolved in muriatic acid, the solution was supersaturated with ammonia, the filtered liquor was tested for lime, with oxalate of potash, but none was detected; therefore, the residue was peroxide of iron, it weighed 2.11 grs. on 3 grs., or 70.333 per 100.

The alcaline liquor was supersaturated with muriatic acid, after ebullition it was treated with caustic ammonia, there was formed a precipitate of phosphate of Alumina, weighing 0.05 grs., or 1.666 per 100.

After the separation of the phosphate of alumina, the liquor was treated with muriate of lime, the phosphate of lime thus formed weighed 0.145 grs., equivalent to 0.0806 grs. of phosphoric acid on 3 grs., or 2.686 per 100.

D. The liquor (C) from which the precipitate by the subcarbonate of ammonia was separated, was tested successively with oxalate of potash and phosphate of soda and ammonia, but neither lime nor magnesia was present.

The constituents of this iron ore are, per 100 parts.

| | | |
|---|---|---|
| A. Water, | 19.833 | |
| B. Argile, | 3.333 | |
| C. Peroxide of Iron, | 70.333 | |
| C. Phosphate of Alumina, | 1.666 | |
| C. Phosphoric Acid, | 2.686 | which combines with (1.936 of oxide of iron. |
| | 97.851 | |
| | 100.000 | |
| | 2.149 | |

ART. XXIV.—*Analysis of the Melanite, from Franklin Furnace, Sussex Co. New Jersey,* by HENRY SEYBERT.

THIS mineral so nearly resembles the Melanite of Frascati, near Rome, that a description of it is deemed unnecessary.

*Analysis.*

A. 3 grammes of the mineral by calcination at a red heat, diminished in weight 0.01 grs. hence we have 0.333 per 100 of moisture.

B. 3 grammes finely pulverized were boiled in concentrated muriatic acid, the solution was reddish brown, the insoluble portion became colourless and gelatinous, the mixture was evaporated to drive off the greater part of the excess of acid, water was then added and the solution was filtered, the Silica remaining on the filter, after calcination weighed 1.06 grammes, or 35.333 per 100.

C. A portion of the liquor (B) which was of a lemon yellow colour, was decomposed with an excess of subcarbonate of ammonia ; the supernatant liquor was decanted from the precipitate and tested with phosphate of soda and ammonia, but no magnesia was present. The precipitate was redissolved, and the solution after ebullition was added to the preceding liquor, it was decomposed with an excess of caustic ammonia, the reddish brown precipitate after calcination weighed 1.03 grs. It was calcined with caustic potash, the green colour of the solution in water indicated a trace of manganese—after all the alumina was separated, the peroxide of iron weighed 0.90 grs. or 30.00 per 100.

The alumina estimated by difference amounts to 0.13 grs. or 4.333 per 100.

D. The lime was precipitated from the liquor (C) with oxalate of potash ; the oxalate strongly calcined gave 0.84 grammes of lime, or 28.00 per 100.

The constituents of the Melanite of Franklin are, per 100 parts,

| | | |
|---|---|---|
| A. Volatile matter, | 0.333 | containing oxygen |
| B. Silica, - | 35.333 | - - - 17.772 |
| C. Peroxide of Iron, | 30.000 | - - - - 9.198 |

| | | | |
|---|---|---|---|
| C. Alumina, | 4.333 | | 2.023 |
| D. Lime, | 28.000 | | 7.865 |
| | 97.999 | | 19.086 |
| | 100.000 | | 17.772 |
| | 2.001 | Loss. | 1.314 |

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ART. XXV.—*Remarks on the common methods of detecting Cobalt.* By. Prof. J. F. DANA, *of Dartmouth College.*

[The following letter was addressed by Prof. Dana to the Editor, in consequence of doubts expressed by the latter, as to the genuineness of some specimens of arsenical cobalt, whose locality was announced in the last number of this Journal. It is but fair to say, that those doubts are now removed, so far, at least, as the question of the *existence* of cobalt in this ore is concerned.—*Ed.*]

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*Dartmouth College, Hanover, N. H. June 19th,* 1824.

[To the Editor.]

DEAR SIR,

IT gives me much pleasure to acknowledge the receipt of your favour of the 15th instant; I am happy to hear that you received the "*Arsenical Cobalt,*" and particularly happy to learn that your health permits you to make *any* experiments. I had made some preliminary experiments on the ore of which you now have a specimen, and intend a full analysis of it as soon as I can satisfy myself of any good method of separating *arsenic, cobalt* and *iron*, perfectly, from each other—three metals, each of which adheres to the others with the most obstinate pertinacity. The *Franconia ore contains* these *three metals,* and also gives *indications* of sulphur. I am aware that *Arsenical Cobalt* is liable to be confounded with *Arsenical Iron;* the latter is crystallized in four-sided prisms, terminated by diedral summits; and the ore in question is in four-sided prisms, also terminated by diedral summits, in many cases. In the arsenical iron these summits stand on the *acute* lateral edges, but in the ore in question, I am greatly deceived if these summits do not stand on the *obtuse* lateral edges; and some of the crystals are terminated by four-sided pyramids. I have not been able to find any octahedra, but have found rhombs. Now can these forms, in this instance, arise except from deeply truncated octahedra?—but this I submit to crystallographers.

The presence of *cobalt,* under all circumstances, CANNOT be detected by fusion with borax; if oxide of iron, in comparitively large portions, be mixed with cobalt, the colour communicated to borax before the blowpipe is, as you found it, "only green, or reddish, according to the degree of dilution;" and consequently *this test of cobalt is not deserving of confidence* when such quantities of iron are present; indeed, I am disposed to believe that it is of no value, when equal parts of iron and cobalt are mixed. Stromeyer, you recollect, found more than 74 per 100 of iron in an *arsenical cobalt* which he examined; and I am confident that, by the fusion of that ore with borax, a blue colour would not be communicated. It has always appeared to me a great *misnomer* to call such minerals "*arsenical cobalt,*" when more than two thirds of them are iron!

The following experiments I regard as decisive respecting the value of *borax,* before the blowpipe, as a sufficient test for cobalt when iron is present in comparatively large portions.

1. Take a small bead of borax, rendered blue by a substance *known* to be cobalt, and fuse it before the blowpipe with a little oxide of iron: the *blue* colour instantly *vanishes,* and is replaced by a "green or reddish colour, according to the degree of dilution."

2. The same effect is produced by fusing a particle of *smalt* with oxide of iron, if the colour be sufficiently diluted to be distinguished.

3. Reduce a minute portion of *cobalt* to powder, mix it with about an equal quantity of protoxide of iron, and expose

the mixture to heat with borax before the blowpipe; the colour of the globule will be *olive green*, and not blue.

A small hook of platina wire was used as the support in the above experiments, and is perhaps one of the best supports employed.

The existence of *cobalt* in the ore sent to you may be readily ascertained in the following way, viz. roast the ore, to expel the arsenic; put a globule of the roasted ore into a watch glass, and cover it with nitric acid; evaporate to dryness, and repeat the operation to convert the iron into peroxide; on careful evaporation the second time, a portion of a *peach-blossom coloured* or *pink coloured* residuum will be noticed. This is principally *nitrate of cobalt*, and often forms a circle round the glass: it is deliquescent. Now, to a small hook of fine platina wire, attach a *colourless* globule of glass of borax, and on fusing it with a small portion of the *peach-blossom coloured* residuum, the characteristic *blue* of cobalt appears. Again, fuse it with a portion of oxide of iron; the *blue* colour disappears, and the peculiar greenish hue, which is produced by the fusion of the ore itself with borax, is noticed. By the method described above, the cobalt existing in less than half a grain of the ore may be detected.

When the crystals of this *arsenical cobalt* (for I suppose we are entitled to call it so now, even if it contains 74 per 100 of iron,) are digested in dilute nitric acid, the solution, when concentrated, is of a *rose* colour; and the *decisive* test* which you have recommended, had been tried with all possible success; the green sympathetic ink is formed, by the addition of a solution of common salt to the nitric solution of the crystals.

It is evident that too great reliance has been placed on the appearance of the globule of borax, when a doubt has existed respecting the presence of *cobalt;* perhaps many crystals now called "ARSENICAL IRON," *from the results of fusion with borax*, will be found, on farther examination, to contain *cobalt;* and this substance may be found to be more widely distributed, than it is now supposed to be. Perhaps there is no better or easier method of examination, than that

* Viz. the formation of the green sympathetic ink.

pointed out above; viz. by roasting, treating with nitric acid, and subsequent fusion with borax.

With great respect and esteem,

your ob't serv't,

JAMES F. DANA.

PROF. SILLIMAN.

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ART. XXVI.—*Notice of the method of manufacturing the Alkaline Salts of Commerce.* By DR. GUSTAVUS A. ROGERS.*

THESE salts are known in market by the names of Pot and Pearl Ashes. The difference between the two salts depends on a difference in the process of manufacturing.—The pearl ashes generally bear a price in New-York of from five to fifteen dollars more per ton than the pot ash.

To obtain the pot ash, so called, it is necessary to put into the leeches in which the ashes are acted on by water, a quantity of quick lime. This is placed at the bottom of the tub. Where lime is plenty, from an half bushel to a bushel is put in each tub. Without this precaution, the "black salts," as the boilers term them, are very difficult to fuse. Indeed it is almost impossible to do it with any common fire, except such salts as are made in the spring, when the frost and snow are leaving the ground. The ley obtained is evaporated by a large fire, and the process is hurried as fast as possible. After two or three days, they cease to refill the kettles, and evaporate the mass to the consistence of West-India sugar. If it be intended to make the pearl ashes, the mass is removed from the kettles; but if the pot ashes are intended, it is not removed; but as great a heat is raised as the mere combustion of the best wood will produce, in the large arches over which the kettles are placed. The process requires from two hours to one half or three quarters of a day, as the salts are for purity. During the fusion, the impurities that are combustible are destroyed, exhibiting sparks of fire, and some gaseous matter continues to escape, which agitates the more fluid part. When it is completely in a state of fusion, it is perfectly at rest, and exhib-

* Furnished by request of the Editor.

its a most elegant appearance of liquid fire. It resembles exactly melted iron, and exhibits the same appearance when poured from one vessel to another. During this stage of the process, if a candle or lighted torch, be brought in contact, or nearly so, with the surface, the gaseous matter floating over it inflames, and burns over its whole surface, with a bluish flame, like hydrogen gas.

This substance, now in a state of fusion, is poured by means of large iron ladles into iron pots, or kettles, and allowed to cool in cakes. The cakes, when broken, exhibit a fracture like loaf sugar, being of a granulated structure. The appearance of the fracture, as to colour, is different in different parts of the mass; exhibiting in its course every shade of the rainbow, but less concentrated and glowing. This is the pot ash of commerce. It is more deliquescent than pearl ashes, and I should think more caustic. During the evaporation of the ley, a salt is precipitated, of a greyish colour, shaped much like crystals of sulphate of magnesia. This the boilers call nitre, and most of them are careful to scrape it out from the kettles by means of ladles, and to replace it on the leeches with the ashes, as they suppose it to retard the process of melting.

If it be intended to make the pearl ash, the mass obtained by evaporation, which in the language of the country is called "black salts," is taken from the kettles and exposed to a high temperature in a large oven-shaped furnace, under which is an arch so constructed that the flame plays back upon the salts. This process is carried on till the mass originally black becomes of a handsome white. The mass is kept in agitation by means of an iron rod. The substance described in the books as potash, is the substance termed by the manufacturer, "black salts," in which state, so far as I know, it is never seen in market. It is the substance I have described, which is exported from this country to Europe.

## Art. XXVI.—*Meteorological Notice;* By Martin Field.

[To the Editor.]

*Dear Sir,*

It has been generally remarked that, in the eastern States, the last winter was attended with many unusual phenomena. The frequency and severity of the storms, the sudden extremes of heat and cold, the violence of the winds, and the destruction of property by devouring floods, exceeded any thing of the kind, in any season within the memory of the oldest people living. The difference in the quantity of snow which fell, on the *high* and the *low* lands, was perhaps greater than was ever before known. In some parts of New-England, and especially upon the sea-coast, very little snow fell; and, excepting a few days, the earth was uncovered during the whole winter. But on the high lands in Massachusetts, Vermont and New-Hampshire, at the distance of about one hundred miles from the sea, though rains were frequent, there also fell a great quantity of snow.

In proof of the facts above mentioned, I send you an accurate statement of the depth of snow, hail and sleet, and the days on which they fell, at New Fane, Vt. from the 18th of October, 1823, to the 28th of April, 1824, which you will please to publish in your Journal, if you find it worthy of insertion, and oblige yours, &c.

MARTIN FIELD.

| | | | | Inches. |
|---|---|---|---|---|
| 1823. | Oct. | 19, 20, | snow | 8. |
| | | 26, 27, | snow | 22. |
| | Nov. | 25, | snow | 4. |
| | Dec. | 9, | snow | 5. |
| | | 11, | snow | 6.½ |
| | | 15, 16, | snow | 12. |
| | | 24, | hail and sleet | 1. |
| | | 25, | snow | 1. |
| 1824. | Jan. | 2, | hail and sleet | 1. |
| | | 3, | snow | 2. |

| | | | | |
|---|---|---|---|---|
| 1824. | Jan. 10, | snow, hail and sleet | 7. |
| | 12, | snow and sleet | 2. |
| | 18, | snow | 6. |
| | 31, | snow | 3. |
| | Feb. 4, | snow | 1. |
| | 16, | snow and hail | 4. |
| | 22, | snow | 8. |
| | 25, | snow | 3. |
| | March 12, | snow | 3. |
| | 16, 17, | snow | 10. |
| | 19, | snow | 4. |
| | 24, | snow | 2. |
| | April 27, | snow | 1. |
| | | | 116 inches, |

or 9 feet, 8 inches.

REMARKS.

The admeasurements were made, in every instance, immediately after the storms, and in situations where the snow had not been affected by winds; and the above table exhibits the depth of snow, on an average, in the vicinity. The greatest depth, during the winter, was on the 16th of December, which was 33 inches.

There was rain on twelve days, within the months of December, January, and February; but the quantity I did not ascertain. It was, however, very considerable.

*New-Fane, May 5th*, 1824.

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Art. XXVII.—*On the Causes of the coldness and dryness of the west and north-west winds of New England—from the travels of the late* President Dwight. Vol. 1. Letter III.

REMARK BY THE EDITOR.

A short, but ingenious memoir on this subject, was recently transmitted by a correspondent, for insertion in this Journal, but accompanied by a request that the piece might be suppressed, provided "others had made a similar explanation," which the writer remarks he had "not happened to observe." We presume, therefore, that *he* and probably *others* will consider it proper to preserve, in this place, the following more extended observations of Dr. Dwight, who was a careful observer of natural phenomena, and particularly attentive to meteorology.

President Dwight remarks in the first place that the extremes of our temperature and particularly of cold, are much greater than in the corresponding latitudes of Europe; that the changes are more sudden and considerable, that a change of thirty degrees in twenty-four hours sometimes occurs, and that in one instance he had known it to amount to forty-eight degrees. He then proceeds to discuss the various theories which have been proposed to account for these and other similar facts, and after stating his reasons for considering them all as imperfect or erroneous, he gives his own views as follows:

"The winds, which generate the peculiar cold of this country, are, in my own opinion, derived, principally, from a source, very different from all those, which have been specified; *and descend*, in most cases, *from the superior regions of the atmosphere*. My reasons for this opinion I will now proceed to state.

It is well known to men of information, that in the latitudes above 30°, the prevailing winds are those from the West. This is undoubtedly a part of those extensive atmospherical revolutions, which I have mentioned. The winds in, and near the torrid zone, blow generally from the East. By this phraseology I intend the points Westward, and Eastward, of the meridian. The atmosphere may be considered as preserving by these two great motions its own equilibrium. This general tendency of the winds to blow from the West is, in the American Atlantic States, not a little increased by their local circumstances. The ocean in the winter, is, for obvious reasons, warmer than the land; and therefore occasions a continual pressure of the land atmosphere towards it. At a moderate distance from the coast, the Gulf stream, an immense current of water, so warm as during the winter to send up a vast and very copious evaporation, both visible and invisible, and to occasion continual and very important changes of weather, runs from Cape Florida to Newfoundland, with a gradual divergency from the shore. The air over the ocean, and peculiarly over the gulf stream, will naturally ascend; being warmer, and therefore lighter, than that, over the land. That over the land, will of course move into the region, from which this ascent takes place; and thus will produce a Westerly wind. As this operation is continually going on; there must necessarily be a very frequent succession of these winds. Such is the regular state of facts. If these winds blow across the American Continent, it is easily conceivable, that they must of course blow, also across a considerable division of the Pacific Ocean. The consequence of these facts would be, that they would come to the Eastern shore, fraught with whatever degree of cold was accumulated by the atmosphere, over the region which lay in their progress. A farther consequence would be, that whatever warmth they acquired on the Pacific Ocean, they would communicate first to the countries along the Western shore; and then, in speedy succession, to all the countries between that and the Eastern. A third consequence would be, that they would be moist and chilly; and a fourth, that those, which blew from the North-West and North, would be colder than those, which blew from the West. But none of these facts, unless perhaps the first, actually takes place. These winds are all uncommonly dry. Those, which blow from the West, are colder than any other: and the warmth, which they could not fail to acquire from the Pacific Ocean, is never experienced on the Eastern coast. As these winds frequently blow in the winter from thirty to forty, and sometimes to fifty miles in an hour; they would pass over this continent, in the latitude of New-England, where it is about 2700 miles wide in two, three, and four days. In this period, especially when twice or thrice repeated, the warmth could not fail to be perceived. But in the year 1780 the wind blew from the West more than six weeks, without any intermission; and during the whole of this time was so cold, that the snow did not dissolve sufficiently to give drops from the southern eaves of houses. In 1791 a west wind began to blow on the 10th of November, and continued to blow till the 11th of January; the weather during the whole time being intensely cold for the season; and the frost being uninterrupted. The three last days the mercury stood at five, eight, and eleven, degrees below cypher. In 1787 the same wind began to blow about the 20th of November, and continued its progress, with only four short interruptions, until the 20th of the following March : somewhat more than one hundred days. During this whole period, the weather was, for the season, very cold. On the third Tuesday in February the mercury sunk to fourteen degrees below zero : lower than it is known to have fallen at any place on the sound, except once since the settlement of the country.

I began to form the opinion, *that these winds descended at times, from the superior regions of the atmosphere*, from the following occurrence. I was standing on Greenfield Hill, where I then lived ; (a natural observatory, commanding an extensive and unobstructed horizon,) and watching the phenomena of the heavens in a summer afternoon : when I was struck with the appearance of a very small, dark cloud, distant from me about four or five miles in the west. I perceived that it became, rapidly, more and more dark, and increased with equal rapidity in its size. Speedily after I fixed my eye upon it, it began to move with a considerable velocity towards the south-east ; enlarging its dimensions, and deepening its hue, every moment of its progress. Within a few minutes it emitted a flash of lightning, succeeded by a peal of thunder : and within a few minutes more, a stream of rain, continually increasing, descended from its skirts. The lightning and thunder soon became frequent, and the clouds speedily assumed all the usual appearances of a thunder-storm. The meridional line, upon which I stood, it crossed, several miles to the South : and, by the time that it had traversed half the breadth of the Sound, a distance of fourteen miles from Greenfield Hill, it extended over a fourth, or fifth, part of the horizon.

During the whole day the wind had blown from the south-west ; and *continued to blow in the same direction, on the surface, throughout the afternoon, without a moment's intermission.* But, had the wind, which carried the cloud, when it passed over the regions south-west of Greenfield, swept the surface ; the progress of the south-west wind must, for some time at least, have been entirely stopped.

This, however, was not the fact, even for a moment. Of course, during this part of its progress, *the south-west wind blew beneath the cloud:* while *that which drove the cloud, blew, in the first part of its progress, only in a superior region;* and did not strike the earth, until it came near to the sound. These phenomena, so far as concerns this subject, I saw several times repeated during my residence in Greenfield. Nor have I a doubt, that this is the most usual rise, and progress, of thunder-storms; almost all of which rise in the north-west, and are originated by a wind, blowing from that quarter, and continuing to blow, from one to four days, like those of the winter.

In the summer of 1809 a thunder-storm passed over New-Haven from the north-west with great rapidity. It continued, as I judged, from an hour to an hour and a half. But, although the clouds moved rapidly to the south-east, a south-west wind blew the whole of that day; and, while the thunder-storm was over head, blew with great violence. This plainly would not have been possible, had not the stream of air, which moved these clouds, proceeded through the atmosphere at some distance from the earth.*

On Wednesday evening, Oct. 15th 1799, *Mr. Day*, Professor of Mathematics and Natural Philosophy in Yale College, and myself being on our return from a journey of several weeks up the Mohawk, and the Hudson, lodged at Pittsfield. The weather, during the whole of our journey, as well as before, had been extremely mild; except that a very light frost, on the evening of the fourth, had changed in a small degree the annual foliage through a tract along the Mohawk of about fifteen miles. Throughout the day, on which we arrived at Pittsfield, a strong and warm south-west wind had blown unceasingly. At nine o'clock in the evening a furious blast came from the north-west; and in an instant changed the temperature of the air to a severe cold. A violent rain, accompanied by thunder and lightning, fell for an hour. At ten, the rain ceased; and we went out, to examine the face of the heavens. The clouds had become broken: and we discerned with perfect distinctness the inferiour stratum, moving rapidly from the north-west; a second, immediately above it, moving from

* I saw the same facts again repeated in the summer of 1810.

the south-west; and a third, still higher, moving from the north-east: the stream of air from the south-west having been forced from the surface by that which carried the thunder-cloud.

The next morning, the degree of cold was strongly indicated by the brilliant white of Saddle mountain, covered with snow; by the less perfect white of the Green Mountains, and the Taghkannuc; and by the icicles, which, not less than ten inches in length, we saw depending from the eaves of the houses on our route. This intense cold was produced within the compass of little more than an hour; during which time the north-west wind blew at the rate of from thirty to forty miles. The south-west wind of the preceding day was obviously a general wind; and spread over a great extent of country. The weather throughout the whole of the preceding summer, and the autumn to that time, had been warm. A north-west wind, therefore, had it blown along the surface for a considerable distance, would have been colder than the south-west, only because it was more violent: and this fact would have varied the temperature very little. The north-west air, which first visited Pittsfield, must have been that, which rested on the earth between this town and Albany; the next hour, the volume between Albany and Johnstown; and the next, that between Johnstown and Whitestown. The whole of this division of the atmosphere cannot have differed sensibly from that, which we found at Pittsfield, when we arrived. In this case, the cold, if it had existed at all, as it must have been the result of a wind blowing, for a considerable length of time, and over a great extent of country, would have come on gradually. But the actual cold was instantaneous, and intense. The storm brought with it the snow and frost; and deposited the whole mass of snow, which on Saddle mountain must by the appearance have been from six to twelve inches deep, within the compass of an hour. This wind, therefore, certainly came from the higher regions of the atmosphere.

"Similar facts I have observed in many instances: although I do not remember any in which the particulars were so strongly marked.

"On Christmas day, in the year 1794, a fresh wind blew from the south-east during the whole day, and was so warm as to be uncomfortable. The following evening, about 8 o'clock, a violent blast from the north-west began at Greenfield; and just about the same time at New-York. It was so cold as to freeze, during that night, *Mill River*,* at *the Narrows*, where the stream is rapid, so hard, that it was crossed on the ice the next day by foot passengers; a fact, which was not known to have taken place, when the frost had operated for so short a time, within sixty years. The same day, horses were led over the Hooestennuc, on the ice, at Derby. On the same day also, foot passengers walked across the Susquehannah at Havre de Grace; where the river is a mile and one fourth in breadth. Soon after, I was very credibly, and I presume correctly informed, that the same blast commenced at Norwich, and at Boston, about two o'clock in the afternoon. This could not have happened, if the wind had merely swept the surface of the earth: for Norwich lies seventy travelled miles eastward of Greenfield; and Boston one hundred and fifty-eight. From New-York Norwich lies eighty miles eastward, measured on a parallel of latitude, and fifty miles northward, on a meridian; and Boston one hundred and twenty eastward, and the same distance northward: the oblique distance, as travelled, being about two hundred and ten.

"This opinion is also strongly supported by the facts, that the westerly winds are generally much cooler than the temperature of the atmosphere immediately preceding; and that this change, in a great proportion of instances, exists almost instantaneously. These facts would, I think, be impossible from the mere movements of that volume of air, which rests on the surface.

"These winds are purer than any others; a fact universally remarked throughout this country. During their prevalence the lungs are feasted, and the frame invigorated, in such a manner as is never experienced at any other season. Their influence on plants, also, is entirely peculiar. It is customarily said by those who have long cultivated tobacco, that its leaves are perceptibly thicker, and heavier, after a north-west wind has blown two or three days, than at any other time; and such a season is considered by skilful cultivators as the best for cutting this plant. When grass

* In Fairfield.

has been mowed at such a season, I have observed the scythes to be covered with its juice. so thick and viscid, and adhering so tenaciously to the scythe, as to oblige the mowers to employ the whetstone, not for the sake of giving the scythe an edge, but to remove the glutinous substance with which it was covered.

"During the prevalence of these winds, wood burns more rapidly, and with a more vivid flame. The flame also makes, frequently, a small explosion, (if I may be allowed the term,) resembling strongly that of a musket, discharged at a very great distance.

"All these facts, as it seems to me, are easily explicable on the supposition, that the north-west winds have their origin in the superior regions of the atmosphere. If this opinion be admitted, we cannot, I think, be at a loss for reasons, why they are instantaneously, and in the winter, severely cold; why they commence with violence, and terminate suddenly; why they are remarkably pure, and healthy; why in a singular manner they facilitate combustion; why they are wholly free from terrene exhalations; why, in many instances, they condense clouds immediately vertical, some time before they are perceived to blow on the surface; why they carry clouds, at times, towards the south-east, without interrupting at all the blowing of a south-west wind; and why, in the month of March, during which the westerly winds almost regularly prevail, all kinds of wood shrink, and become dry, in a greater degree, than in the most intense heat of our summer sun.

"Particularly, the peculiar degree of cold, experienced in this country, seems to be explicable on this ground only. Every man, accustomed to read even newspapers, knows that the air, at a moderate distance from the earth, is usually much colder than near the surface. This fact has been so often proved by ascending high mountains, and by rising into the atmosphere in balloons; and is so evident from the ice and snow always visible, even under the equator, at great elevations, that few persons are ignorant of it. Every degree of cold experienced in this country, must naturally be expected from winds which have their origin in a superior region."

## Art. XXVIII.—*Observations on the Comet of* 1823–24.

[communicated.]

The Boston Journal of Philosophy and the Arts contains an article, first published in the Philosophical Magazine, exhibiting the elements of this comet, according to the European observations.

In a previous number of the same Journal, are given the elements of the same, as calculated by Mr. Colburn, of Waltham, Mass. Both of these are subjoined,—and, for the sake of comparison, the elements, as deduced at the time, at Yale College, from observations made between Jan. 4th and Feb. 5th, *by the graphical process of Professor Fisher ;* but laid aside and never corrected.

1. The first are by Mr. J. Taylor of the Royal Observatory, Greenwich. 2. The second are by Professor Nicolai Schumacher, Astr. N. N. 48. B. 3 ; giving the greatest error in A. R. +18″, in decl. +11″. 3. The third by Mr. Hausen, A. M. 48. B. 3. 4. The fourth by Carline. 5. The fifth by Dr. Brinkley. 6. The sixth by Mr. Richardson of Greenwich.

| | | | | |
|---|---|---|---|---|
| Passage of Perihelion. | 1. | 1823, Dec. | 9.3697 d. | Greenwich |
| | 2. | | 9.4380 | Manheim |
| | 3. | | 9.47193 | Altona |
| | 4. | | 9.4792 | Greenwich |
| | 5. | | 9.2168 | Greenwich |
| | 6. | | 9.4521 | Greenwich |

| | | | | |
|---|---|---|---|---|
| Longitude of the ascending node. | 1. | 302° 56′ 34″ | 4. | 303° 4′ 4″ |
| | 2. | 303 1 18 | 5. | 303 0 40 |
| | 3. | 303 3 22 | 6. | 303 1 43 |
| Perihelion. | 1. | 28° 43′ 54″ | 4. | 28° 26′ 8 |
| | 2. | 28 43 46 | 5. | 29 18 50 |
| | 3. | 28 29 55 | 6. | 28 20 6 |
| Log. nearest distance. | 1. | 9.3598242 | 4. | 9.3545000 |
| | 2. | 9.3579600 | 5. | 9.3689400 |
| | 3. | 9.3553934 | 6. | 9.3536855 |

| | | | |
|---|---|---|---|
| Inclination | 1. 75° 55′ 45″ | 4. 76° 12′ 50″ |
| | 2. 76 9 40 | 5. 76 1 40 |
| | 3. 76 11 22 | 6. 76 8 28 |

Motion retrograde.

*By W. Colburn.*

Passage of Perihelion, 1823, Dec. 8d. 14h. 06′ 52″; mean time, Boston.

| | |
|---|---|
| Longitude of ascending node, | 302° 37′ 41″ |
| Place of the Perihelion, | 271 39 11 |
| Log. nearest distance, | 9.3962088 |
| Inclination, | 75° 6′ 49″ |

Motion retrograde.

*By graphical process.*

Passage of Perihelion, 1823, Dec. 9.3978D. mean time, Greenwich.

| | |
|---|---|
| Longitude of ascending node, | 302° 56′ |
| Perihelion, | 28 49½ |
| Log. nearest distance, | 9.35926 |
| Inclination, | 76° 9′ |

Motion retrograde.

An extraordinary appearance attended this comet, during a part of its course—a faint stream of light extending toward the sun. It was noticed by several persons, on the evening of Jan. 23; (it had been previously seen by President Day of Yale College.) The comet being in the north, and its usual tail spreading upward obliquely, to the right, this was seen extending in an opposite direction, but evidently inclined a little downward, from the line of the first. The angle of the two might be 1½° or 2°. In brightness and length it was variable; being sometimes only visible near the body, but at other times being just seen to the distance of the tail itself; though narrower, and, as was imagined by some, even tending to a point. It was observed again, through a very clear atmosphere, on the morning of the 27th, when both were fainter than before, but retained, as well as could be judged, the same relative position. The appearance was noticed in other places; though it is not known that any one has before described it. It vanished a little before the tail of the Comet; after having been a few days visible.

*New-Haven, August 9th.*

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## MISCELLANEOUS.

ART. XXIX.—*Notice and Review of the* RELIQUIAE DILUVIANAE; *or Observations on the Organic Remains contained in Caves, Fissures, and Diluvial Gravel, and on other Geological Phenomena, attesting the action of an Universal Deluge.* By the Rev. WILLIAM BUCKLAND, B. D., F. R. S., F. L. S., Member of the Geol. Soc. London, Hon. Memb. Amer. Geol. Soc., &c. &c., and Professor of Mineralogy and Geology in the University of Oxford. Quarto, pp. 303—37 plates. London, 1823.

[Concluded from page 168 of this volume.]

THE second cavern visited by Professor Buckland was also in the vicinity of Kirkdale; being discovered a short time after the one we have so particularly described. This cave agreed in every respect with the one containing bones, except that the bones and the inferior stalagmitic covering, were wanting. The mud was six feet deep, and over its surface, in most parts, was spread a crust of stalagmite. Several other caverns and vertical fissures occur within one mile of the one just mentioned, and agree with it in every important respect. An open fissure was also, soon after, discovered in the limestone of Duncombe Park, destitute of diluvial mud, but containing bones of existing animals, which have probably fallen into it from time to time, since the deluge. The author thinks that similar fissures might have existed in antediluvian days, into which, graminivorous animals, from their habits, would be more likely to fall than beasts of prey. An instance of this occurs in a cave near Wirksworth, in Derbyshire, in which was found nearly the entire skeleton of a rhinoceros. This the author supposes was drifted into the cave along with the diluvial detritus; an open chasm having been accidentally discovered, in exploring the cavern, in a spot where it was not suspected to exist. Several other instances of caves with similar remains are mentioned, the circumstances of which indicate that the bones were either drifted into them at the deluge, or that the animals had fallen into them at an anterior period. In the same vicinity occurs the suite of caverns called the Foxholes, containing diluvial sediment; and the mouths of these cavities open at such a height in the hill, that it is impossible to refer the introduction of the mud, to the flood of any rivulet now existing in the vicinity. In several of the caves in Germany, also, in which exist similar phenomena, "the present entrance is often a hole in an absolutely vertical precipice, which it is impossible to approach, except by ropes or ladders." These facts supply an important link in the Kirkdale evidence; since in that cave, it is not demonstrably certain that the coating of mud might not have been derived from some former partial inundation.

A series of caverns were examined in the vicinity of Plymouth, in England, containing the bones of the same animals as that at Kirkdale. From a thorough examination of all the circumstances of their occurrence, Mr. Buckland concludes "that the animals had fallen during the antediluvian period into the open fissures, and there perishing, had remained undisturbed in the spot on which they died, till drifted forwards by the diluvian waters to their present place in the lowest vaultings with which these fissures had communication."

The Paviland cave is chiefly remarkable for the remains of a female human skeleton found in it. Along with this, lay the bones of various antediluvian animals, such as the elephant, rhinoceros, hyæna, &c. The various circumstances of the case, however, will not warrant us in supposing the human remains found here, to have been antediluvian: but they rather lead us to suppose this woman was buried here, with numerous trinkets, about the time of the invasion of England by the Romans; while the other organic relics may be referred to the deluge.

"The above facts," Mr. Buckland remarks, "are, I think, sufficient to warrant us in concluding, that in the period we have been speaking of, the extinct species of hyæna, tiger, bear, elephant, rhinoceros, hippopotamus, no less than the wolves, foxes, horses, oxen, deer, and other animals which are not distinguishable from existing species, had established themselves from one extremity of England to the other, from the caves of Yorkshire to those of Plymouth and Glamorganshire; whilst the diluvial gravel beds of Warwickshire, Oxford, and London show that they were not wanting also in the more central parts of the country; and M. Cuvier has established, on evidence of similar nature, the probability of their having been spread in equal abundance over the continent of Europe."—p. 96.

It has been known for a considerable time to Geologists, that the bones of various animals were found in several caves in Germany. It became an interesting enquiry, whether the circumstances under which they were found coincided with those at Kirkdale. With the genuine spirit of a persevering naturalist, Mr. Buckland resolved to make the tour of these caves, and he accomplished his purpose. The details he has given of those near Spa, in Westphalia, that of Scharzfeld, Bauman's Hohle, Biel's Hohle, Forster's Hohle, of Rabenstein, Zanlock, Gailenreuth, and Kirhlock, are in a high degree interesting, and between them all there is a striking agreement of circumstances, indicating clearly that they were once submitted to the action of a deluge, Alike striking is their agreement with the English caverns. "In every cave I examined," says the author, "I found a similar deposit of mud or sand, sometimes with and sometimes without an admixture of rolled pebbles and angular fragments of rock, and having its surface more or less abundantly covered over with a single crust of stalagmite; and in those among them, which had been inhabited as dens before the introduction of the mud and pebbles, the latter are always superinduced upon the remains of the wild beasts."

The principal difference between the English and German caves results from the fact, that the latter have had their mouths open since the deluge, and have been occupied as dens since that period. The bones, however, which in England are disseminated through the diluvial mud, are found in the same situation in Germany—viz. those of the bear, hyæna, elephant, rhinoceros, &c.: while the postdiluvian remains lie above this mud, except where they have been disturbed by collectors. In these caves, also, the bear, and not the hyæna, as in England, appears to have been the proprietor of such as were occupied as dens: and as this animal does not feed on bones, the remains in their dens are not fractured and gnawed as in the Kirkdale cavern.

"The facts I have enumerated," says the author, "in the above description, go to establish a perfect analogy, as far as relates to the loam and pebbles and stalagmitic incrustations in the caves and fissures of Germany and England, and lead us to infer an identity in the time and manner in which these earthy deposits were introduced, and this identity is still further confirmed by the agreement in species of the animals whose remains we find enveloped by them, both in caves and fissures, as well as in the superficial deposits of similar loam and pebbles on the surface of the adjacent countries; viz. by the agreement of the animals of the English caves and fissures, not only with each other, but also with those of the diluvial gravel of England, and of the greater part of Europe: and in the case of the German caves, by the identity of the extinct bear, with that found in the diluvial gravel of Upper Austria; and of the extinct hyæna with that of the gravel of Canstadt, in the valley of Necker; at Horden, near Herzberg, in the Hartz; at Eichstadt, in Bavaria; the Val d'Arno, in Italy; and Lawford, in Warwickshire. To these may be added the extinct rhinoceros, elephant, and hippopotamus, which are common to gravel beds as well as caves; and hence it follows, that the period at which the earth was inhabited by all the animals in question was that immediately antecedent to the formation of those superficial and almost universal deposits of loam and gravel, which it seems impossible to account for unless we ascribe them to a transient deluge, affecting universally, simultaneously, and at no very distant period, the entire surface of our planet." —p. 145.

In two of the German caves were found the remains of the human species; but they occur under such circumstances as show them to be of postdiluvian origin. We have already noticed the female skeleton discovered at Paviland: and human bones occur in six other caves in England—all of which, however, are thought by the author to have been deposited since the deluge. Indeed we think it quite clear, that the records of geology do not furnish a single instance of a fossil human bone, of antediluvian origin. The Gaudaloupe specimen (Cuvier's Theory of the Earth, p. 235,) seemed at first to be a pretty strong case: but we believe geologists all agree in reckoning it a postdiluvian production. Scheuchzer's celebrated "homo diluvii testis," has been shown by Cuvier to be a great salamander. The case described by Baron Schlotheim, and subsequently by Mr. Weaver, in the Annals of Philosophy for January 1823, of human bones discovered in the valley of Elster, in Saxony, is not perhaps so clearly referable to an epoch posterior to the deluge, although this is the prevailing opinion of naturalists. The instance described by Mr. Atwater, in the second volume of this Journal, of human bones found deep in the earth in Ohio, needs to have the question better settled than it now is, whether they really occur in diluvium or alluvium, before we can refer them to an antediluvian epoch.

A very remarkable fact is stated by Mr. Buckland concerning the cave at Kuhloch, in Germany. We give it in his own words.

"It is literally true, that in this single cavern, (the size and proportions of which are nearly equal to the interior of a large church,) there are hundreds of cart loads of black animal dust, entirely covering the whole floor, to a depth which must average at least six feet, and which, if we multiply this depth by the length and breadth of the cavern, will be found to exceed five thousand cubic feet. The whole of this mass has been again and again dug over, in search of teeth and bones, which it still contains abundantly, though in fragments. The state of these is very different from that of the bones in any of the other caverns, being of a black, or more properly speaking, dark umber colour throughout, and many of them readily crumbling under the finger into a soft dark powder, resembling mummy powder, and being of the nature of the black earth in which they are imbedded. The quantity of animal matter accumulated on this floor, is the most surprising, and the only thing of the kind I ever witnessed; and many hundred, I may say thousand, individuals must have contributed their remains to make up this appalling mass of the dust of death. It seems in great part to be derived from comminuted and pulverized bone; for the fleshy parts of animal bodies produce by their decomposition so small a quantity of permanent earthy residuum, that we must seek for the origin of this mass principally in decayed bones. Allowing two cubic feet of dust and bones for each individual animal, we shall have in this single vault the remains of at least two thousand five hundred bears, a number which may have been supplied in the space of one thousand years, by a mortality at the rate of two and a half per annum." pp. 137, 138.

The osseous breccia of Gibraltar, Nice, Dalmatia, Antibes, Pisa, and other places along the north shore of the Mediterranean, occurring in fissures in limestone, is the last instance produced by Mr. Buckland as analogous to the contents of the English caves and fissures. M. Cuvier, who has described the animals found in this breccia, was of opinion that it had been formed, and the bones enveloped, since the last general diluvial catastrophe which our planet has experienced. But in a recent edition of his grand work on fossil remains, he abandons this opinion, and adopts that of Mr. Buckland, viz. that this breccia was consolidated in the antediluvian ages, and is referable to the same epoch with the breccia and diluvium containing bones in the English and German caves and fissures. We think every candid person, who reads his details concerning the Gibraltar breccia, will adopt his opinion.

No instances of similar caves and fissures are quoted in this work, beyond the boundaries of Europe. It is then a question, which every geologist will eagerly put, whether any thing of the like kind does occur in other quarters of the globe. We have felt a deeper interest in asking whether our own country furnishes any such instances. But we have not had an opportunity, amid the pressure of other avocations, to examine as many of our public journals, and the works of travellers, as we could have wished, on this point. We think, however, that we have found some facts which, to say the least, render it extremely probable, that the American caves contain the same evidence of diluvial action, and of antediluvian animal existence, as the European caverns.

It s well known, that the most noted of the American caverns occur in our western States in a limestone, probably of the same character as those in Europe containing bones These American caves also contain, as is well known an abundance of stalactite and stalagmite ; but whether there exists in them all, one and only one layer of diluvial mud, we have not been able to ascertain from any account now before us. Many of them, however, contain large quantities of nitre. and we know not a more probable hypothesis than that which imputes its origin to the decomposition of animal substances. If we mistake not, we discover in the following extract of a letter from Dr. Brown, to the Editor of this Journal, inserted in our first Volume, at the 147th page, evidence of the existence of the black animal dust which Professor Buckland found in the cave at Kuhloch.

" I am much obliged to you for recalling my attention to that curious subject, (nitre caves,) as it has brought to my recollection a fact, which I believe I omitted to mention in my memoir, (viz.) the existence of a black substance in the clay under the rocks, of a bituminous appearance and smell. This I remember to have seen in a rock-house, near the Kentucky river, where very considerable quantities of sand-rock nitre had been obtained. This substance was found in masses of a few ounces weight, and in the crevices of the rocks near the basis of the side walls. The smell is not wholly bituminous, but resembled that of bitumen combined with musk. I am quite unable to account for the formation of the nitre, or the production of this black substance which sometimes accompanies it, both in Africa and America. Had I seen Mr. Barrow's travels, when I noticed the bitumen, I should certainly have paid more attention to it. But perceiving no relation between the rock nitre and the masses of this substance, my examination of it was much too superficial. I do not very well understand what Mr. Barrow's means by saying, that many waggon loads of animal matter lay on the *roof* of the caverns in Africa.* I saw no such matter on the *roof* of the

* The same was asserted to be the fact in regard to the European caves until Mr. Buckland examined them and found it to be a deception. Holes

rock-houses in Kentucky. Certainly the caverns have been the habitation of wild beasts, and great quantities of leaves, &c. have been mixed with the debris of the superincumbent rocks, but it does not seem probable, that much animal matter could be filtrated through a roof of rock, perhaps forty or fifty feet in thickness."

Dr. Brown quotes a passage from Barrow's travels, a part of which we here repeat.

"There was also in the same cave, (with the nitre,) running down the sides of the rock, a black substance that was apparently bituminous. The peasants call it the urine of the das. The dung of this gregarious animal was lying upon the roof of the cavern to the amount of many waggon loads. The putrid animal matter, filtrating through the rock, contributed no doubt to the formation of the nitre. The hepatic well and the native nitre rocks were in the division of Agster Sneuwberg, (South Africa,) which joins the Tacka to the south-west." *Barrow's Travels*, p. 291.

To the same point, in regard to the American caves, we quote the following paragraph from Rev. E. Cornelius' account of the cave at Nicojack, in the Cherokee country, as given Vol. 1. p. 321 of this Journal.

"The sides of the principal excavation present a few apartments which are interesting, principally because they furnish large quantities of the earth from which the nitrate of potash is obtained. This is a circumstance very common to the caves of the western country. In that at Nicojack, it abounds, and is found covering the surfaces of fallen rocks, but in more abundance beneath them. There are two kinds, one is called the "clay dirt," the other the "black dirt;" the last is much more strongly impregnated than the first."

In the cave at Kuhlock, Mr. Buckland found the pure black animal dust beneath a diluvial sediment of calcareous loam, which had been disturbed by digging, and which was mixed with the black earth. Now what is the "clay dirt" Mr. Cornelius mentions, but this diluvial sediment

had been dug into these animal remains, where they filled the cavity, and as some of the bones and mud remained adhering to the roof and sides, observers concluded the original roof and sides to be constituted of them: But Mr. Buckland declares this not to be true in a single instance; and probably Barrow's account is to be corrected in the same manner.

mixed with the animal dust, and therefore less prolific of salt petre—and what the "black dirt," but pure animal dust? We regret that he has not stated the relative situation of the two kinds. American geologists would do well to recollect a remark of De Luc, that "real and general advances will then only be made in the Science of nature when the dread of prolixity shall be overcome."

In Long's Expedition (Vol. 1. p. 33) it is stated, that the party visited a cave in the banks of the Ohio, not far from Shawneetown, called "Cave Inn," or "House of Nature." "In this cave, it is said, great numbers of large bones were sometime ago found, but we saw no remains of any thing of this kind."

From these facts, we infer, that in one or two important respects, the caves of North America, and South Africa are analogous to those of Europe—certainly they are alike we think in having been inhabited at a remote period by animals: and it is at least probable, that in America and Africa those animals were antediluvian. We are disposed therefore to extend to those quarters of the globe the following important conclusion, confined by Mr. Buckland to Europe.

"Another important consequence arising directly from the inhabited caves, and ossiferous fissures, the existence of which has been now shown to extend generally over Europe, is, that the present sea and land have not changed place; but that the antediluvian surface of at least a large portion of the northern hemisphere was the same with the present; since those tracts of dry land in which we find the ossiferous caves and fissures must have been dry also, when the land animals inhabited or fell into them, in the period immediately preceding the inundation by which they were extirpated. And hence it follows, that wherever such caves and fissures occur, i. e. in the greater part of Europe, and in whatever districts of the other Continents such bones may be found under similar circumstances, there did not take place any such interchange of the surfaces occupied respectively by land and water, as many writers of high authority have conceived to have immediately succeeded the last great geological revolution, by an universal and transient inundation which has affected the planet we inhabit." p. 162.

These conclusions, resulting as they do from legitimate premises, put to flight a host of hypotheses, erected on the assumption that the sea and land changed places at the deluge. Mr. Penn's airy castle which was erected to batter down the whole fortress of geology, and which we noticed in the commencement of our remarks, is absolutely blown *ni tenues auras* by this one paragraph of Mr. Buckland. There was no alternative for him, but either to acknowledge this to be the case, or to attack Mr. Buckland in his strong entrenchments. He has taken the latter course, and endeavored to prove in a "Supplement to the Comparative Estimate," "that the contents of the caves at Kirkdale, and other places, were of contemporaneous deposition with the rocks in which they occur, and the caverns themselves produced by the gases evolved, during the putrefaction of the animal bodies, within the substance of the strata, while in a state of softness!! How any person, who had either seen a cave, or read Mr. Buckland's book," adds the Edinburgh reviewer, "could form such an hypothesis, we are utterly at a loss to conceive."

The second proof of diluvial action adduced by Mr. Buckland, is the beds of diluvium spread over almost every part of the earth, and containing the bones of animals.

But here a difficulty meets us on the very threshold of this argument. Authors almost universally have made no distinction between alluvium and diluvium: indeed, they have described as alluvium, nearly all the unconsolidated strata. It is only when geologists happen to be very particular in their descriptions of the newer deposites, that we are able to ascertain when they describe alluvium, when diluvium, and when the unconsolidated tertiary formations. We believe the best geologists of the day agree in limiting the term alluvial to those deposites which result from causes now in action, and "to appropriate the term diluvium to those universal deposits of gravel and loam, to the production of which no cause at present is adequate, and which can only be referred to the waters of a sudden and transient deluge." This gravel and loam are always confusedly mixed together, and are thus distinguished from the older deposites of sand and gravel which occur in regular alternating beds. The ablest writers in Europe now adopt these distinctions, and would no more think of confounding them than to describe under one name gypsum and limestone. Some describe alluvium and diluvium as "the old and recent alluvial covers;" others as "fluviatile and diluvian detritus;" and formerly diluvium was called "geest." In Germany, diluvial loam is denominated "Dammerde," and in France, "Terrain d'attrissément." American geologists seem rather slow in adopting these important distinctions, although in enquiries like those of Mr. Buckland in the work before us, they are clearly indispensable, and in every respect essential to accuracy in geological descriptions.

Observers, however, every where, we believe, agree that such a deposite as diluvium exists. Indeed, who can doubt it, when it forms the principal cover of all known countries, and meets us at every step? What reflecting man, as he observes such immense quantities of rounded pebbles and large bowlders, not merely lining the margin of rivers and lakes, but spread over the loftiest hills, and often to the depth of more than one hundred feet, does not enquire by what agency they could have been thus rounded and transported to their present situations? It strikes every one that all this must have resulted from the agency of running water. But there is a general impression existing, that the present streams might have effected it all in the course of thousands of years. Yet whoever will attend to the subject minutely, will be satisfied that the cause is wholly inadequate to the effect. With the exception of a few mountain torrents, rivers have very little power to transport even common pebbles any considerable distance—much less to carry up to the pinnacles of the highest mountains, those huge bowlders which we find there insulated. The rock in Horeb, out of which Moses with his rod miraculously brought water for the Israelites, is a bowlder six yards square. The block, out of which was hewn the pedestal of the statue of Peter the Great, weighs more than one thousand five hundred tons; and the Needle Mountain, in Dauphiny, said to be a bowlder, is one thousand paces in circumference, at the bottom, and two thousand at the top. Huge rounded blocks of granite are found on the top of the Alps, and indeed of almost every mountain hitherto examined. Now how is it possible to suppose rivers to have transported them thither, to an elevation several thousand feet above the general level of the earth. But we have not room to discuss this point, and would refer our readers to the second Essay of Mr. Greenough, in his First Principles of Geology, as well as to the work under review. And Mr. Buckland refers us to a paper of Sir James Hall, in Vol. VII. of the Trans. of the Royal Society of Edinburgh, and says, "the whole of this paper is so very accurate and satisfactory, that I strongly recommend the perusal of it to the attention of every one who has the smallest doubts as to the evidence there is to prove that the surface of the earth owes its last form not to the gradual change of existing causes, but to the excavating force of a suddenly overwhelming and transient mass of waters." Any one who will thoroughly examine this subject, will be led, we think irresistibly to the conclusion, that the diluvium which meets us every where, and contains the bones of extinct species of animals, along with some that now inhabit the earth, must have been the result of such a catastrophe. Mr. Buckland has given us the details of all the important observations which have come to his knowledge, concerning diluvium in different parts of the earth. The facts in England, on the subject, indicate a current from the north, and in Scotland, from the north-west. Indeed, the waters of the deluge seem to have taken a southerly direction, over the greater part of Europe, and Mr. Buckland quotes from a memoir of Dr. Bigsby, to show that a northerly diluvial current has passed over the northern part of the continent of America. He might have found also a more extensive collection of facts to establish this point, in the Geological Essays of Mr. Hayden, published in 1820: and indeed, since Mr. Buckland has quoted from this Journal, where Mr. Hayden's work is reviewed, we are rather surprised that he takes no notice of it. Mr. Hayden does indeed confound alluvium, diluvium, and the older unconsolidated strata together; for he speaks of "alluvion and other formations alternating with each other." But this does not render unintelligible, or less valuable, the facts he has collected relative to the distribution of pebbles and bowlders. In regard to the immense regions of central North-America, the numerous scientific expeditions that have been performed by our countrymen under the patronage of government, contain enough to satisfy every one that the surface is overspread by a diluvial coat of loam, sand and bowlders, just as it is in New and Old England. We had marked several passages in the journals of Long and Schoolcraft on this point; but upon the whole, think it unnecessary to extract them.

The universal diffusion of diluvium then, we think must be, to every candid mind, conclusive evidence of an universal deluge. And this opinion is confirmed by the occurrence in almost every country of the bones of various extinct species of animals; such as the elephant, or mammoth, rhinoceros, bear, deer, tiger, hyæna, &c. It is only in diluvium that these are found, and they are obviously the same species as those occurring in caves and fissures, and appear to have been destroyed by the same catastrophe. The mammoth, or antediluvian elephant, especially, is found scattered almost every where, and in some countries in immense quantities. "There is not," says Pallas, in all Asiatic Russia, from the Don to the extremity of the promontory of Tchutchis, a stream or river in the banks of which they do not find elephants and other animals now strangers to that climate. These are washed out by the violent floods arising from the thaw of the snows, and have attracted universally the attention of the natives, who collect annually the elephants' tusks to sell as ivory." Our readers will not forget the remarkable instances of the hairy rhinoceros, found in the frozen gravel of Vilhoui, in 1771; and the elephant in the ice of Tungusia, in 1800; both the flesh and skin in a perfect state of preservation.

If then the existence of diluvium clearly points us to an universal deluge, we think the animal remains found in that diluvium evince as clearly that it must have been the same deluge that destroyed the animals in the antediluvian dens and fissures, and filled them with mud. In the words of Mr. Greenough, "the universal diffusion of alluvial (diluvial) sand, gravel, &c. proves that at some time or other an inundation has taken place in all countries; and the presence of similar alluvial (diluvial) deposites, both organic and inorganic, in neighbouring or distant islands, though consisting often of substances foreign to the rocks of which the islands are respectively composed, makes it highly probable, at least, that these deposites are products of the same inundation."

Geologists, in view of this subject, have made it a question, whether all rounded pebbles and bowlders, except those abraded and worn by rivers and other causes, now in action, were detached from the parent rock, and brought into their present shapes, by the waters of the deluge. We believe all will agree, that all these pebbles and bowlders, lying above the regular strata, were moved, and of course in some measure worn, by that catastrophe: and we think it almost equally evident, that all the abrasion they present, cannot be imputed to that event. This is obviously the opinion of Mr. Buckland. In describing the diluvial detritus in the vicinity of London, he says, "The quartzose pebbles which I have been tracing without interruption from Birmingham to London, had, as I have before mentioned, received their roundness before they were imbedded in the red sandstone formation; their form cannot therefore be referred to friction during their short transport by the diluvian waters. Indeed, instances are rare, where fragments, even of soft rocks, which have undergone no further attrition than that of these waters, have received such an extreme degree of roundness as is found in the hard quartzose pebbles we are considering." Again, he says, "Similar varieties of gravel, the one angular, the other completely rolled, and derivative from the pebble beds of the plastic clay formation, occur in the valley of the Thames near London. These rounded pebbles, like those from Warwickshire, had apparently received their attrition from the long continued action of violently agitated waters, during more early revolutions that have affected our planet; whilst the imperfectly rolled fragments are referable to the diluvial waters, which drifted them only from the neighbouring hills to their present place; and from the angular state of this and similar beds of diluvial gravel, we may infer that the inundation which produced them was of short duration."—p. 256.

Several years since, in a Review of Hayden's Essays in this Journal, Prof. Silliman gave us, definitely, his views in relation to pebbles and bowlders, which appear to us to be confirmed by succeding discoveries. "The attrition," says he, "of the common waters of the earth, and even that exerted during the comparatively short period of the deluge of Noah, would do very little towards producing so mighty a result, (the formation of pebbles and bowlders,) and we must assign this operation to the more recent periods of the prevalence of the great chaotic deluge, whose existence is distinctly recorded in the first chapter of Genesis, and equally admitted by all geologists."

It was a point of considerable importance with Mr. Buckland, to show, that geology furnishes evidences of the inundation of high mountains. For it was the opinion of Cuvier, and other eminent naturalists, in opposition to the scriptural statement, that the highest parts of the earth were not covered by the deluge, since fossil remains had been found only in the lower regions of the globe. Against such a supposition the author arrays the following facts, which seem to put the question at rest. "1st. The blocks of granite which have been transported from the heights of Mont Blanc to the Jura Mountains, could not have been moved from their parent mountain, which is the highest in Europe, had not that mountain been below the level of the water by which they were so transported." 2. "The Alps and Carpathians, and all the other mountain regions I have ever visited in Europe, bear in the form of their component hills, the same evidence of having been modified by the force of water, as do the hills of the lower regions of the earth;" (and we think we may add the same from the testimony of travellers, concerning the mountains of America, and other quarters of the globe,) "and in their valleys also, where there was space to afford it a lodgement, I have always found diluvial gravel of the same nature and origin with that of the plains below, and which can be clearly distinguished from the postdiluvian detritus of mountain torrents or rivers." 3d. Here Mr. B. adduces several facts, some of them new, concerning the occurrence of organic remains at high levels. The bones of the mastodon are found near Santa Fe de Bogota, seven thousand eight hundred feet above the sea; and in the kingdom of Quito, at an elevation of seven thousand two hundred feet, near the volcano of Imbaburra. And recently there have been discovered in Central Asia, in the Hymalaya mountains, the bones of horses and deer, and of bears we add, on the authority of the Quarterly Review, sixteen thousand feet above the sea. They were sent the last year (1822) to Sir E. Home, by Capt. W. S. Webb, who procured them from the Chinese Tartars of Daba. They are obtained from the avalanches, and of course come from a region of perpetual frost. The natives believe them to have fallen from the clouds, and to be the bones of genii. In this opinion they do not greatly differ from our English progenitors; who, not many centuries ago, thought the remains of the mammoth, tiger, rhinoceros, &c. to be the bones of antediluvian giants, or even of the fallen angels?

The conclusion to which we are brought by such facts as these, concerning the last grand diluvial catastrophe which our planet has experienced, can scarcely be better stated than in the words of Moses: "And the waters prevailed exceedingly upon the earth; and all the high hills that were under the whole heaven were covered."

The third and last proof of diluvial action exhibited by the work before us, is found in the excavation of vallies. This is intimately connected with the second argument; and Mr. Buckland treats of them together, except that he has added an appendix on the excavation of vallies. It is quite obvious that the immense quantity of rounded pebbles and bowlders, scattered over the earth's surface, must have been derived from the solid strata; and it is quite as obvious that the process by which this diluvial detritus was brought into its present form, must have produced vallies. Indeed, every body who looks at the innumerable vallies existing on the earth's surface, imputes them at once to the action of running water. But the general belief is, that existing streams, avalanches and lakes, bursting their barriers, are sufficient to account for all their phenomena, and not a few geologists, especially those of the Huttonian school, at whose head is Professor Playfair, have till recently been of this opinion. So long ago, however, as the time of Catcott, this subject was ably handled, although his views have been much neglected till of late. But it is now very clear to almost every man, who impartially examines the facts in regard to existing vallies, that the causes now in action, mentioned above, are altogether inadequate to their production; nay, that such a supposition would involve a physical impossibility. We do not believe that one thousandth part of our present vallies were excavated by the power of existing streams. We are aware that some mountain torrents do exert, within narrow limits, a powerful agency. We have seen hard, unstratified, quartzose masses, of several tons in weight, torn out of their beds by a mountain torrent, and removed a considerable distance. But in level countries, and where the stream has no great descent, it is found that rivers have not power to move except in a few extraordinary instances, even small pebbles. In very many cases of large rivers, it is found, that so far from having formed their own beds, they are actually in a gradual manner filling them up. We have an instance of this in the vallies in which run the Missouri and Mississippi, as described in Long's Expedition, Vol. I. p. 114. The author believes that the Missouri excavated its own bed, of an average depth of one hundred and fifty feet below the immediate banks, and three hundred below the great plains at a distance on either hand. Yet he says, "if we admit that this great valley with its numerous ramifications, has resulted from the operation of currents, wearing down and transporting to the ocean the solid materials of the earth's surface, it would appear necessary still further to acknowledge that this channel was once much deeper than at present; for we usually meet with thick alluvial depositions covering the rocks that line the bottom of the Missouri vlley. The manifest tendency of the Mississippi, at this time, upon its valley, is to fill up rather than to excavate; but it may be doubted whether this is equally, or even to any degree, the case with the Missouri."

Again; how happens it that the source of a river is frequently below the head of a valley, if the river excavated that valley? Rivers also sometimes change their beds; but if they excavated their own beds, how could they change them? And to suppose that rivers formed their own banks, is to suppose they were once without banks. The most powerful argument, however, in our opinion, against the supposition we are combating, is the phenomena of transverse and longitudinal valleys; both of which could not possibly have been formed by existing streams. But we cannot here enter minutely into this subject; and can only refer our readers to the works of Greenough, Conybeare, and Phillips, and Kidd, and to a paper of Sir James Hall, in the VII. Vol. of the Transactions of the Royal Society of Edinburgh, which Mr. Buckland recommends "to the attention of every one who has the smallest doubts as to the evidence there is to prove that the surface of the earth owes its last form not to the gradual action of existing causes, but to the excavating force of a suddenly everwhelming and transient mass of waters."

We must not, however, attribute the origin of all vallies to diluvial action. In primitive and mountainous districts especially, " the original form in which the strata were deposited, the subsequent convulsions to which they have been exposed, and the fractures, elevations and subsidences which have affected them, have contributed to produce vallies of various kinds on the surface of the earth, before it was submitted to that last catastrophe of an universal deluge which has finally modified them all."

Existing vallies, then, have been produced by three distinct classes of agencies. 1. By the present streams, the bursting of lakes, &c. 2. By the last universal deluge. 3. By the original construction of the strata, and diluvial actions previous to the last. It may be difficult, in all cases, to refer the origin of particular vallies to its proper period. It is sufficient, however, for the purpose of this argument, to show, that there exist cases clearly referable to all the agencies above mentioned. When, for instance, we find on the margin of a valley, diluvial pebbles and bowlders, evidently torn out of that valley, we can have no hesitation in ascribing its excavations to the last universal deluge.

Excavations formed by that catastrophe are called " vallies of denudation." Mr. Buckland has presented us with an account of several of this description, existing in Europe. But plates and maps are almost indispensable to a clear conception of cases of this kind ; and, therefore, we can only recommend to our readers the perusal of the Appendix to this work. The subject, we believe, has received in this country little or no attention. There can be no doubt, however, that these extensive regions furnish many interesting instances of vallies produced by diluvial action. They are to be sought after, with the greatest prospect of success, in our newest formations. We are acquainted with one clear instance of the kind, near Connecticut river ; but we cannot make it understood without a map and sections ; and if we mistake not, we discover, in the following extract, a description of a series of vallies of denudation.

"From Pittsburgh to Cincinnati, the prospect from the river is that of hills of moderate elevation, sometimes rocky and abrupt, but often sufficiently gradual in their ascent, to admit of cultivation to their summits. Their character, as to extent, direction, &c. seems to be determined by the number direction and magnitude of the streams which traverse them. They are the remains of what was formerly a continuous, and nearly horizontal stratum, with a large deposite of superincumbent soil, which the flow ng of water, during the lapse of ages, has channeled and excavated to its present form." *Long's Expedit.*, Vol. 1. p. 40.

Mr. Buckland presents us with the following summary of the evidence of an universal deluge, derived from the general diffusion of diluvium and vallies of denudation.

"1. The general shape and position of hills and valleys; the former having their sides and surfaces universally modified by the action of violent waters, and presenting often the same alternation of salient and retiring angles that mark the course of a common river: and the latter, in those cases which are called valleys of denudation, being attended with such phenomena as show them to owe their existence entirely to excavation under the action of a flood of waters."

"2. The almost universal confluence and successive inosculations of minor valleys with each other, and final termination of them all in some main trunk which conducts them to the sea; and the rare interruption of their courses by transverse barriers producing lakes."

"3. The occurrence of detached insulated masses of horizontal strata, called outliers, at considerable distances from the beds of which they once evidently formed a continuous part, and from which they have been separated at a recent period by deep and precipitous valleys of denudation."

"4. The immense deposites of gravel that occur occasionally on the summits of hills, and almost universally in valleys over the whole world; in situations to which no torrents or rivers that are now in action could ever have drifted them."

"5. The nature of this gravel, being in part composed of the wreck of the neighbouring hills, and partly of fragments and blocks that have been transported from distant regions."

"6. The nature and condition of the organic remains deposited in this gravel; many of them being identical with species that now exist, and very few having undergone the smallest process of mineralization. Their condition resembles that of common grave bones, being in so recent a state and having undergone so little decay, that if the records of history, and the circumstances that attend them, did not absolutely forbid such a supposition, we should be inclined to attribute them even to a much later period than the deluge: and certainly there is in my opinion no single fact connected with them that should lead us to date their origin from any more ancient era."

"7. The total impossibility of referring any one of these appearances to the effect of ancient or modern rivers, or any other causes, that are now, or appear ever to have been in action, since the retreat of the diluvial waters."

"8. The analogous occurrence of similar phenomena in almost all the regions of the world that have hitherto been scientifically investigated, presenting a series of facts that are uniformly consistent with the hypothesis of a contemporaneous and diluvial origin."

"9. The perfect harmony and consistency in the circumstances of those few changes that now go on, (e. g. the formation of ravines and gravel by mountain torrents; the limited depth and continual growth of peat bogs; the formation of tufa, sandbanks, and deltas; and the filling up of lakes, estuaries, and marshes,) with the hypothesis which dates the commencement of all such operations at a period not more ancient than that which our received chronologies assign to the deluge."

"All these facts, whether considered collectively or separately, present such a conformity of proofs, tending to establish a recent inundation of the earth, as no difficulties or objections that have hitherto arisen are in any way sufficient to overrule." pp. 226, 227.

If to these we add the evidence derived from the phenomena of caves and fissures, and also the traditions of almost every nation and tribe under heaven to the occurrence of an universal deluge, it must require a strange degree of scepticism to doubt the fact, even if the Mosaic history were not in existence. Include that history among the proofs, and they absolutely rise to a moral demonstration.

It will be seen by the preceding analysis, that the work of Mr. Buckland has contributed essentially to enlarge the boundaries of geological science. The following are briefly the principal points he has been the first to establish.

First, he has proved, in opposition to the prevailing opinion of modern geologists, that the sea and land did not change places at the deluge.

Secondly, he has shown, that the remains of tropical animals, found in the diluvium of high northern latitudes, were not drifted thither from remote climates, but that the animals actually lived and died in the regions where their remains are found.

This discovery makes it almost certain, we think, that a great and a sudden change in the climate of northern latitudes took place at the time of the deluge. And if so, we see why it is, that perpetual frost covers those parts of the mountains of Ararat, where the Mosaic history represents the olive as growing, whose leaf was brought back by the dove sent by Noah out of the ark.

Thirdly, Mr. Buckland has presented us with a detailed account of the habits of antediluvian animals. We believe the most sanguine geologist never anticipated so much from his science, on this point, as this work exhibits. We not only learn their existence, but seem to be introduced among them, and observe their mode of life, whether in dens or roaming in the forests. It is chiefly comparative anatomy that has achieved such triumphs; and we cannot but anticipate from this science still more brilliant results, when we hear a man of scrupulous accuracy speaking with confidence of the "teeth of water rats," "the left ulna of a lark" of the "coracoid process of the right scapula of a duck," inhabitants of the antediluvian world.

Mr. Buckland has also made it more satisfactory to our mind than any previous writer, that man did not inhabit those regions of the world that have hitherto been scientifically examined, previous to the deluge: and we are therefore directed in search of human remains, to that quarter of the globe which the scriptures declare to have been the cradle of the race.

To American geologists this work has opened a wide field. With the clew in our hands which Mr. Buckland has furnished, the examination of our vast and numerous caves examine them. Our diluvium needs also to be limited and promises brilliant results to the man who first chances to explored, and our denuded diluvial valleys ought no longer to be neglected. The interesting enquiries before us, that seem capable of determination, are, where the phenomena of our caves, fissures, and diluvium, coincide with those in Europe? what were the character and habits of our antediluvian animals? and whether man existed on this continent before the deluge?

European geologists, however, must not expect that the answers to these enquiries will be sent to them in the magnificent style of execution of Mr. Buckland's works. Our geologists, with a few exceptions, are unable to meet the expence of fine type, paper and engravings. The same cause prevents them from devoting so large a portion of their time to geological enquiries as they could wish. Better times, however, seem to be dawning among us, and geology begins to be fostered in most of our colleges and by wealthy individuals. We think the circulation of Mr. Buckland's work would tend to make converts to the science, as much as any thing we have seen; and we conclude with the wish, that it may speedily be republished in this country with such a reduction in style as will multiply its readers an hundred fold.

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## Art. XXX.—*On the Forts around Boston, which were erected during the War of Independence;* by J. Finch, F. B. S., &c.

Every Fort made use of to defend the heroes of the revolutionary war has acquired a title to the respect, the gratitude, and the veneration of all friends to liberty in every part of the world. In future ages, they will enquire where the fortifications are, which were thrown up around the town of Boston, which held a British army besieged during eleven months, and finally compelled them to carry their arms and their warfare to other lands. Impelled by curiosity, let us visit these lines, which will be so celebrated in history—where the standards of liberty were unfurled, and freedom proclaimed to the vast continent of America—where the first entrenchments were raised against the forces of Britain—and from which, as from a barrier of iron, their armies recoiled. There cannot be any nobler monuments than these on the earth; if they do not yet boast

"La Gloria di una remotissima antichita,"

every passing day, every hour, every moment, is conferring this quality upon them.

Nearly half a century has elapsed since these lines were erected, and it is desirable to have some record by which posterity may know, how much they have suffered, during that period by the war of the elements, and by the hands of men. The first cause of destruction has been trifling, but the storms of a thousand years would not have achieved the injury which has been committed by the industrious farmers. Wherever these works were an impediment to cultivation, they have been levelled to the ground, and fortresses, which were directed by a Washton, or built by a Putnam, or a Greene, have been destroyed, to give room for the production of Indian corn, or to afford a level pasture for cattle. It would redound to the high honor of the state of Massachusetts. if some plan were devised, by which the forts, which still remain, could be saved from the oblivion which apparently menaces them.

Annexed to Marshall's Life of Washington is a Map of the country around Boston, in which the situation of the various forts and batteries is represented, and a stranger will find it a guide to many of the positions; but on an attentive examination he will perceive that the map is rather inaccurate in some of the details.

1. *At Breed's Hill*, that blood-stained field, the redoubt thrown up by the Americans is nearly effaced; scarcely the slightest trace of it remains; but the entrenchment, which extended from the redoubt to the marsh, is still marked by a slight elevation of the ground. The redoubt thrown up by the British on the summit of the hill, may be easily distinguished.

2. *Bunker Hill.* The remains of the British fort are visible, the works must have been very stong, and occupied a large extent of ground—they are on the summit and slope of the hill looking towards the peninsula.

3. *Ploughed Hill.* The works upon this hill were commenced by the Americans on the night of August 26th, 1775, and received more fire from the British than any of the other forts; in a few days more than three hundred shells were fired at these fortifications. A small part of the rampart remains, but the whole hill is surrounded by the mounds and fosse of the ancient fort, which has been nearly obliterated.

4. *Cobble or Barrell's Hill* was fortified, and occupied as a strong post, in the war of the Revolution, by General Putnam, and, in consequence of its strength, was called Putnam's impregnable fortress. Every fort which was defended by that General might be considered as impregnable, if daring courage and intrepidity could always resist superior force; yet this title seems to have been more exclusively given to the one noticed above. It was commenced on the night of November 22nd; and the activity of its fire is well known to those who have studied the details of the siege of Boston. This fort has been destroyed; but the position is easily identified. In Marshall's map, the entrenchment, which is placed between this hill and the creek, should be removed to the southern shore.

5. *Lechmere Point Redoubt*, one hundred yards from West Boston bridge, displays more science in its construction, and has a wider and deeper fosse than most of the other fortifications. It was commenced on Dec. 11th, 1775, and it was several days before it was completed, during which time it was much exposed to the fire of the English in Boston. Two or three soldiers of the revolutionary army were killed at this redoubt, and the Prunus virginiana, with its red berries, marks the spot where they were probably interred. Upon one angle of the Fort where the cannon were pointed with most destructive effect, a church is now erecting, and when I visited the spot, the carpenters were busily engaged in preparing the woodwork in one of the bastions. The glacis, the coun-

terscarp, the embrasures, the covered way, and the batteries, are fast disappearing. Diggers of gravel on one side, and builders on the other, were busily employed in completing the destruction of the strongest battery erected by the army of America, and were thus achieving, without opposition, that which an enemy could not effect.

A causeway made across the marsh, the covered way which crosses the brow of the hill, and the lines which flanked Willis' Creek, are still perfect, and may be traced with great facility.

6. *Winter Hill Fort* appears to have been the most extensive, and the entrenchments more numerous, than any of the other positions of the American Army. The fort on the hill is almost entirely destroyed; only a small part of the rampart still remains perfect.

A redoubt situated upon Ten Hill Farm, which commanded the navigation of the Mystic river, is complete, as are also some slight entrenchments near.

A redoubt, situated between Winter and Prospect Hill, has been completely carried away, and a quarry has been opened on the spot. In the general orders, issued at Cambridge, guards were directed to be stationed at White House Redoubt, and this I believe was the post intended. General Lee is said to have had his head quarters in a farm house immediately in the rear of this redoubt.

7. *Prospect Hill* has two eminences, both of which were strongly fortified, and connected by a rampart and fosse; about two huudred yards are quite entire; they are ornamented with the Aster, Solidago, Rosa, &c.; and those, who feel any curiosity about these lines, will be much gratified by the view here afforded. The forts on these hills were destroyed only a few years ago, but their size can be distinctly seen. On the southern eminence a part of the fort is still entire, and the south west face of the hill is divided into several platforms, of which I cannot exactly ascertain the use. There are also evident marks of the dwellings of the soldiers. The extensive view from this hill, the walk on the ancient ramparts, and the sight of the various stations occupied by the American

army will render this hill, at a future period, a favorite resort.

8. *Forts* marked No. 3, on Marshall's Map, near the S.W. of Prospect Hill have some of their bastions entire, but the surface is cultivated, and part of the outline destroyed.

9. *The Cambridge Lines*, situated upon Butler's Hill, appear to have consisted of six regular forts, connected by a strong entrenchment. The most Northerly of these forts is perfect, with the exception of one of its angles destroyed by the road, it appears as if just quitted by the army of America, its bastions are entire, the outline is perfect, and it seems a Chef d'œuvre of the military art. The state of preservation in which it is found, and the motives which led to its erection, all confer a high degree of interest upon this fortification. May it continue uninjured for a long period of years, with no other foe but the assaults of time !

A square fort may be seen near the southern extremity of these lines, in fine preservation, it is in a field within two hundred yards of the road to Cambridge. As it was near the head quarters of the army, it must have been often visited by General Washington, and this circumstance alone would render it an object of interest ; but the proprietor appears to have wanted no inducement but his own mind to preserve this monument of times which are gone. The eastern rampart is lower than the others, and the gateway with its bank of earth still remains.

The other forts and batteries of this line of defence, which constituted the firmest bulwark of the American army, are all levelled with the ground, and the intrenchments which were raised and defended by warriors, are now employed in the peaceful pursuits of agriculture.

10. *The second Line of Defence* may be traced on the College green at Cambridge, but its proximity to the Public Halls may have produced some inconvenience, and it has been carefully destroyed.

11. *A semicircular battery*, with three embrasures, on the northern shore of Charles river, near its entrance into

the Bay, is in a perfect state of preservation. It is rather above the level of the marsh, and those who would wish to see it, should pass on the road to Cambridge, until they arrive at a cross road, which leads to the bank of the river; by following the course of the stream, they may arrive at this battery, without crossing the marsh, which is its northern boundary and difficult to pass. Marshall places two batteries in this situation, but I could find only the one noticed above.

12. *Brookline Fort*, or, as it is called in the annals of the Revolution, the Fort on Sewall's Point, was very extensive, and would be still perfect, were it not for the road which divides it into two nearly equal parts, with this exception, the ramparts, and an irregular bastion, which commanded the entrance of Charles river, are entire. The fort was nearly quadrangular, and the fortifications stronger than many of the other positions of the American army.

13. *A Battery*, on the southern shore of Muddy river, with three embrasures, is only slightly injured. The ramparts and the fosse were adorned, when I saw them, with the beautiful leaves and the red fruit of the sumach, and with the dark red foliage of the oak.

14. *A Redoubt* placed by Marshall to the westward of this position could not be discovered, nor three others, placed on the map between Stony brook and the Forts at Roxbury: perhaps the researches were not sufficiently accurate.

Two hundred yards north of the lower Fort at Roxbury, near the spot on which the meeting-house now stands was an intrenchment which, I am informed by Gen. Sumner, was levelled many years ago.

15. *Forts at Roxbury.* If it is possible that any person should feel indifferent about the fortresses which achieved the independence of the Eastern States of America, a visit to these Forts will immediately recall to his mind all those associations which are so intimately combined with that proud period of American history. The lower Fort

at Roxbury appears to have been the earliest erected, and by its elevation commanded the avenue to Boston over the peninsula, and prevented the advance of the English troops in that direction. It is of the most irregular form, the interior occupies about two acres of ground, and as the hill is bare of soil, the places may still be seen whence the earth was taken to form the ramparts. This fortification has not been at all injured, and the embrasures may still be noticed where the cannon were placed which fired upon the advanced lines of the enemy.

On a higher eminence of the same hill is situated a quadrangular fort, built on the summit of the rock, and being perhaps their first attempt at regular fortification, it was considered by the militia of unparalleled strength, and excited great confidence in that wing of the army stationed at Roxbury. An admirer of the poetry of Ossian would here fancy himself surrounded by the scenes which he describes ; he would immediately recognize

> The gray Sandstone, peeping from the earth,
> Covered with many a variegated moss,

and the bold masses of detached rocks which he might imagine were the monuments of the heroes of the war of independence. To confer, if possible, additional interest upon this hill, and the fortresses of the right wing of the American army, the plants which adorn them are numerous and some of them rare. Accompanied by a distinguished botanist we noticed in a short space of time more than fifty varieties of shrubs and plants. In November the leaves of the Anemone nemorosa were still to be seen, and the Dianthus armeria was in flower. We perceived the Aquilegia canadensis, Myrica cerifera, Saxifraga vernalis, Sarothra gentianoides, Antirrhinum canadense and linaria, Aster many varieties, Podalyria tinctoria, Chrysanthemum, Ranunculus, Polytrichum, Juncus tenuis, Polygonum tenue, Erigeron canadense, Verbascum the Physcia or Barreri chrysopthalma and many others. The ramparts of the lower fort were covered with the bright yellow flowers of the Tanacetum, and the Polypodium vulgare displayed its golden seeds. The rocks are shielded from the storms of winter by a covering of the Lycopodium rupestre, and the Lichen rangiferinus or rein-deer moss. If you should pay little attention to the flowers, yet the higher order of plants cannot fail to attract your notice. The whole of the hills except the interior of the Forts, is covered with a profusion of shrubs among which are the Rosa eglanteria or sweet briar with its red fruit, and the Ligustrum with its black and shining seeds; the Celastrus scandens which informs the European that he is at a great distance from his native plains, and the Berberis which induces him to believe that he is at home. The Juniperus virginiana has taken quiet possession of a great portion of the ground, and let us hope it may never be molested in its dominion. A few oaks and the Platanus occidentalis adorn the higher fort. Let the botanist in the spring visit this spot, and while gathering the flowers, offer up a wish, that the ramparts which protect them may never be disturbed.

16. *The Roxbury lines*, about three quarters of a mile in advance of the forts, and two hundred yards north of the town, are still to be seen on the eastern side of the peninsula, and may be distinguished by any person going by the nearest road to Dorchester, over Lamb's Dam.

17. At this period it may be proper to mention the British fortifications. The lines situated upon the Neck are almost as perfect at the present day as when first erected, with the exception of that part destroyed by the road. They may be seen to great advantage on the western side of the isthmus, about a quarter of a mile south of the Green Stores. There appear to have been two lines of entrenchments carried quite across the peninsula, and the fosse, which was filled at high water, converted Boston into an island. The mounds, ramparts, and wide ditches which remain, attest the strength of the original works. The small battery on the common, erected by the British, may perhaps remain for a long period of years, as a memorial of ancient times.

18. *The Dorchester Lines.* Of these, some very slight traces may be distinguished.

19. *Forts on Dorchester Heights.*

We now hasten to the last forts, the erection of which terminated the contest in this portion of the eastern States of America.

On March 3d, 1776, the following order was issued at the camp at Roxbury: "It is expected that every man, in every station and department, will now exert all his power for the salvation of America. Freedom and glory—shame and slavery, are set before us: let us act like men, like christians, like heroes,—and form a character for the admiration of posterity."

On March 4th. "Brig. Gen. Thomas is to take the command of two thousand one hundred men, which are to be paraded at six o'clock this evening; with which he is to proceed to Dorchester point, and there to throw up such works on the two commanding eminences, as he, with the advice of the engineers, shall think most proper for the defence of the ground, and annoyance of the enemy; and defend the same. By order of Maj. Gen. WARD.

J. WARD, A. D. C.

It is to be regretted that the entrenchments thrown up by the army of the revolution, on the Heights of Dorchester, are almost entirely obliterated by the erection of two new forts in the late war. But some traces of the ancient works may be seen on both hills; the old forts were constructed with more skill, and display more science than the recent works, the ramparts of which are even now falling down; and we would gladly see them destroyed, if from their ruins the ancient works could re-appear.

20. A noble octagonal fort, and two batteries, which may be seen, in perfect preservation, upon the promontory, were erected after the departure of the English from Boston, and do not require a place in the present essay. The fort is situated at the point; one battery is in the rear of the house of industry, whose inmates will probably soon destroy it, and the other upon a rising ground immediately below the Heights of Dorchester.

21. At *Nook Hill*, near South Boston bridge, may be seen the last breast-work which was thrown up by the forces of America, during this arduous contest. Its appearance on the morning of March 17, 1776, induced the departure of the British troops from Boston in a few hours, and thus placed the seal to the independence of the New-England States. But those who would wish to see this entrenchment, must visit it soon. The enemy have attacked it on three sides, and are proceeding by sap and by mine; part of the fosse is already destroyed, and the rampart nods to its fall.

If these fortresses should be regarded with indifference, let us consider that the seige of Boston was one of the most prominent features in the war of the Revolution. The forces of England were, in the commencement of the contest, besieged, and the plans for the Independence of America were matured under the shelter of these ramparts.

In a military point of view it presents conspicuous features: an island, or rather a peninsula, besieged from the continent. Accomplished generals, and brave and disciplined troops on one side, and undisciplined, but numerous forces on the other. At the same time, the army of England did all that men, in such a situation could attempt. If they had obtained possession of any part of the lines, by the sacrifice of an immense number of lives, still no advantage could have been gained by advancing into a country where every man was a foe, every stone wall a rampart, and every hill a fortress. When we examine the extent of the lines, (more than twelve miles,) the numerous forts covering every hill, redoubts and batteries erected upon every rising ground, ramparts and entrenchments defending every valley, we are surprised at the immensity of the works constructed, and the labour required to complete them. Nothing but the enthusiasm of liberty could have enabled the men of America to construct such works. In history they are equalled only by the lines and forts raised by Julius Cæsar to surround the army of Pompey, of which the description in Lucan's Pharsalia will justly apply to the lines before Boston:

Franguntur montes, planumque per ardua Cæsar
Ducit opus; pandit fossas, turritaque summis
Disponit castella jugis, magno que recessû
Amplexus fines; saltus nemorosaque tesqua
Et silvas, vestaque feras indagine claudit.

Lib. VI. 38—43.

Or the relation of the same siege in Cæsar De Bello Civili Lib 3, may be considered as more applicable.

Should the inhabitants of New-England. at some future day, take a pleasure in preserving the forts which were erected by their ancestors, defended by their valour, and which they would have laid down their lives to maintain; the hills on which they are situated should be adorned with trees, shrubs, and the finest flowers. The laurel planted on the spot where Warren fell, would be an emblem of unfading honour; the white birch and pine might adorn Prospect Hill; at Roxbury, the cedar and the oak should still retain their eminence; and upon the Heights of Dorchester, we would plant the laurel, and the finest trees which adorn the forest, because there was achieved a glorious victory without the sacrifice of life.

Many centuries hence, if despotism without, or anarchy within, should cause the republican institutions of America to fade, then these fortresses ought to be destroyed, because they would be a constant reproach to the people; but until that period, they should be preserved as the noblest monuments of liberty.

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Art. XXXI.—*Observations on the Language of Signs, read before the New-York Lyceum of Natural History, on the 23d June,* 1823. By Samuel Akerly, M. D., and Professor in the New-York Mechanic and Scientific Institution.

Communicated for the American Journal of Science.

This paper has been a good while on hand because it has never been in our power to reprint it, without excluding articles which had a prior claim. Since its publication in New-York, the author has forwarded it to us anew in MS. with some additions, and as the subject is both curious and useful, we do not hesitate to insert it notwithstanding it has already appeared *substantially* in a weekly Journal.*—Ed.

*Mr. President and Gentlemen of the Lyceum:*

In compliance with the duty, which you have assigned to me for this evening, I was about to continue the inquiry in relation to that class of animals, called *Zoophytes*, which I commenced at a former meeting; but as my attention has been forcibly arrested by that part of Major Long's expedition to the Rocky mountains, which treats of the *language of signs* employed by the aborigines of our western territory, I beg you will indulge me in some observations on a subject which may appear foreign to the objects of the Lyceum of Natural History. It may, however, be considered as a branch of Anthropology, and accordingly within the purviews of the society; and if we adopt the maxim,

"Nil humani a me alienum puto,"

then I shall not be accused of travelling out of the record, where there are so many other topics connected with the natural sciences demanding the attention of its votaries.

The elucidation of a sign language is peculiarly attracting to me, as connected with the interest of the institution in this city, for the instruction of the Deaf and Dumb, over which I have a superintending care. I therefore hope to fix your attention for a few minutes on a subject which, although novel in this society, may be made agreeable, and, I hope, interesting to its members.

The Indians, Tartars, or Aboriginal inhabitants of the country, west of the Mississippi, consist of different nations or tribes, speaking several different languages or dialects of the same language. Some of these tribes have stationary villages or settlements, while others wander about the country, resting in their skin tents or lodges, and following the herds of bisons or buffaloes, upon which they principally depend for support. These tribes are not able to hold

* The New-York Minerva.

communication with each other by spoken language, but this difficulty is overcome by their having adopted a language of signs, which they all understand, and by means of which, the different tribes hold converse without speaking.

This circumstance may be considered as something novel in the history of man ; for although temporary signs have been occasionally resorted to by travellers and voyagers, where spoken language was inadequate, yet we know of no nation, tribe, or class of human beings, possessed of the faculty of speech, besides the Indians of this country, who have adopted any thing like a system of signs, by which they could freely express their ideas.

During the last autumn and winter Mr. John D. Hunter, the white Indian who has been restored to civilized society, frequently visited the school for the Deaf and Dumb in New-York. I was unable to account for the interest he appeared to take in that Institution, not being aware at the time, that a sign language was used as a medium of communication between the tribes west of the Mississippi, among whom he had resided from his infancy ; and it was not until I had read the account of the expedition of Major Long and his party to the Rocky mountains, that I could explain his frequent visits. He observed every thing with that apparent indifference peculiar to the Indians of this country and yet his repeated calls at the school were the indications of a more than common interest, excited by seeing instruction imparted through the medium of signs, to those who could not hear.

Philosophers have discussed the subject of a universal language, but have failed to invent one, while the savages of America have adopted the only one which can possibly become universal. The language of signs is so true to nature, that the deaf and dumb, from different parts of the globe, will immediately on meeting, understand each other. Their language, however, in an uncultivated state, is limited to the expression of their immediate wants, and the few ideas which they have acquired by their silent intercourse with their fellow-beings. As this manner of expressing their thoughts has arisen from necessity, it is surprising to me how the Indians have adopted a similar language, when the intercourse between nations of different tongues is most usually carried on by interpreters of spoken language.

If we examine the signs employed by the Indians, it will be found that some are peculiar and arise from their savage customs, and are not so universal as sign language in general ; but others are natural, and universally applicable, and are the same as those employed in the schools for the deaf and dumb, after the method of the celebrated Abbé Sicard.

In comparing a few of these signs, it will be seen wherein they agree. Among them is found the sign for *truth.*

*Truth,* in spoken language, is a representation of the real state of things, or an exactness in words comformable to reality.

In the language of signs, *truth* is represented by words passing from the mouth in a straight line without deviation. This is natural and universal, it is the same as was adopted by the Abbé Sicard, and is used in the schools for the deaf and dumb in the United States. It is thus described in Major Long's expedition, as practised by the Indians.

" *Truth.*—The fore-finger passed in the attitude of pointing, from the mouth forward in a line curving a little upward, the other fingers being carefully closed."

A *lie* on the other hand is a departure from rectitude, a deviation from that straight course which inculcates truth. The Indians represent a lie by the following signs.

" *Lie.*—The fore and middle fingers extended, passed two or three times from the mouth forward, they are joined at the mouth, but separate as they depart from it, indicating that the words go in different directions."

This sign is true to nature, and radically correct, though in the instruction of deaf mutes we simplify the sign by the fore finger passed from the mouth obliquely or sideways, indicating a departure from the correct course.

" *House or Lodge.*—The two hands are reared together in the form of the roof of a house, the ends of the fingers upwards."

This sign is true and natural, though we add to it, by placing the ends of the fingers on each other before they are elevated in the position of the roof, to indicate the stories of which a house in civilized life is composed.

" *Entering a house or Lodge.*—The left hand is held with the back upward, and the right hand also with the back up, is passed in a curvilinear direction down under the other, so as to rub against its palm, then up on the other side of it. The left hand here represents the low door of the skin lodge, and the right the man stooping down to pass in."

This sign, though peculiar, is natural as respects the mode of living of the Indians, but is not universally applicable. It corresponds with the sign for the preposition *under*.

The sign for an object discovered, as distinguished from the simple act of seeing, is made by the aborigines with much nicety and precision, and may with propriety, be adopted in a universal language.

*Seeing*.—The fore finger in the attitude of pointing is passed from the eye towards the real or imaginary object."

*Seen or discovered*.—The sign of a man or other animal is made, after which, the finger is pointed towards and approached to your own eye ; it is the preceding sign reversed."

The Indian sign for a *man*, is a finger held vertically, which differs from the deaf and dumb sign. Their sign for a *bison*, is the same as the deaf and dumb sign for a cow, viz.

" The two fore fingers are placed near the ears, projecting so as to represent the horns of the animal."

Now when a party of Indians, are out on a hunting, or warlike expedition, they may *discover* a man, the scout of a hostile party, or an herd of buffaloes. The sign for *discovery* in such a case will be different from that of the simple act of seeing.

In general we cast our eyes upon an object with indifference, and in seeing, simply distinguish a man from an animal, a tree from a shrub, a house from a barn ; or we determine the relative shape, size, or distance of an object. This is done by the *coup d'eil*, and therefore the act of seeing, in the universal language of signs, is to direct the finger from the eyes to the object.

But when we discover an object, we look and look again, and then in the true natural language of signs it comes to our eyes, as the Indians have correctly represented it, because we have repeatedly directed the eyes to the spot where the discovery is made, and not seeing it the first, second, or third time, the object clearly comes to our eyes, and hence the distinction between sight and discovery is founded in the universality of sign language. For instance, —suppose a mineral is presented to this society and laid upon the table. I cast my eyes upon it, and simply *see* it, without marking its distinguishing characteristics. I look at it again and observe it is an earthy mineral. It is brought nearer, and I see it is limestone, and upon taking it up to see more particularly, I find it to be granular limestone, or white marble of the primitive kind, and I soon become convinced that I have correctly determined its geological character by turning it over, when I *discover* in its fracture a small nodule of quartz, and a fine chrystal of tremolite. Thus the discovery is *brought to light*, and is directed to my external vision, and is thence conveyed to the intellectual sight where it is retained after the object is removed.

Again, when the Indians are in search of game, as before observed, it is easy to imagine how, in the *discovery* of an herd of deer, or bisons, or a war party of an enemy, the objects come to the visual organ, and hence arises the proper characteristic sign, which is natural and universal. In these instances the sight is constantly in operation, and yet hours and days may pass without seeing any thing interesting to them, but suddenly a *discovery* is made of game or of an enemy from behind a hill, a tree, or out of a ravine, whither the eyes had before been frequently directed. Thus, too, we see the object strikes the eye, and as it were emerges from obscurity, and gives the true and characteristic distinction in the language of signs between *seeing* and *discovering.*

To *see*, is a radical word in sign language ; from which may be derived the words to look, to gaze, to behold, as well as to discover. These are all sensible actions of the visual organs, or in the language of Sicard, " operations of the organic eye ;"* and he defines them thus.

| | | |
|---|---|---|
| To see is a simple sensible action, | | to see, |
| To look is a double | do. | to see, see, |
| To gaze is a triple | do. | to see, see see, |
| To behold is a quadruple | do. | to see, see, see, see, |
| To discover is a quintuple | do. | to see, see, see, see, see. |

* Theorie des signes.

Hence we easily derive the natural signs to express the ideas conveyed by these words. To *look*, is a repetition of seeing with intention *to seek or search for* an object, and the action is accordingly more intense than simple sight, and its sign is represented by a repetition of the sign of seeing.

To *gaze* is a still more eager or earnest operation of sight than looking, and its definition is a triple sight, but the sign of seeing need not be used, since the action is to be made apparent by the expression of the countenance: to gaze, to look intently. There are several modifications of this action, as, To gaze from ignorance—to gaze with inquiry—to gaze with astonishment—to gaze with admiration—to gaze with horror. To stare is also a manner of gazing, and is that impudent action of the eyes by which a modest person is put out of countenance.

*Behold* will have a different sign signification when considered as an interjection or a verb. When an interjection, it will be expressed by a sudden emotion, followed by an intent gaze of inquiry, which settles into the action of the verb *to behold*, in which you see, see, see, without being satisfied, inasmuch as you come to no conclusion, nor make any discovery.

*To view* is another operation of sight, by which we survey an object on all sides, and examine it with care to obtain a correct idea of its shape, size, use, &c. The sign expression is therefore a compound action, as we look steadfastly at the object while we move about or near to it, to satisfy our curiosity in its examination.

The signs for *eating*, *drinking*, and *sleeping*, are naturally and universally the same, and cannot be mistaken. They are thus described in the account of the expedition:

" *Eating*.—The fingers and thumbs are brought together in opposition to each other, and passed to and from the mouth four or five times, within the distance of three or four inches of it, to imitate the action of food passing to the mouth."

"*Drinking*, or *Water*.—The hand is partially clenched, so as to have something of a cup shape, and the opening between the thumb and finger is raised to the mouth as in the act of drinking. If only the idea of water is to be conveyed, the hand does not stop at the mouth, but is continued above it."

"*Night*, or *Sleeping*.—The head with the eyes closed, is laterally inclined for a moment upon the hand. As many times as this is repeated, so many nights are indicated; very frequently the sign of the sun is traced over the heavens from east to west, to indicate the lapse of a day, and precedes the motion."

In the work from which the preceding signs are taken, no other divisions of time are explained, except different periods of day, by the passage of the sun through an arch in the heavens under the word sun, in which the fore-finger and thumb are brought together at the tip, so as to form a circle, and held up towards the sun's track.

In the school for the Deaf and Dumb, we distinguish the periods of a year, the seasons, a month, a week, a day, a night, and parts of a day or night, as dawn, sun-rise, morning, noon, evening, midnight. A year may be represented by a great circle in the air, indicating a revolution of the earth about the sun; but this sign is rather philosophical than natural. It may more naturally be represented by tracing with the finger the course of the sun's declination from the summer to the winter solstice, and back again. But that which is easiest understood, and the most natural, is by the sign for one hot and one cold season.

Spring is represented by the springing up of the grass, and the expanding of blossoms; summer by the heat; autumn by the ripening of fruits; and winter by the cold.

A week is represented by seven days; or the hands placed together before the breast in the attitude of prayer, indicating the return of the Sabbath.

To indicate a day, the left arm is bent, and held before the body to represent the horizon, and a semi-circle is traced above it, beginning at the elbow and ending at the hand. An artificial horizon being formed, it is easy to designate the parts of the day by showing where the sun would be at such periods, as dawn, sun-rise, morning, noon, afternoon, sun-set, evening, night, midnight.

The sign for a month is one moon, and the Indians use the correct natural sign.

"*Moon.*—The thumb and finger open, are elevated towards the right ear."—*Dunbar's Essay. Transacs. Amer. Philos. Soc.*

The Indian sign for *good,* for *death*, and *pretty*, are nearly the same as those of the deaf mute.

"*Good.*—The hand held horizontally, back upwards, describes with the arm a horizontal curve outwards."

"*Death.*—By throwing the fore finger from the perpendicular, into a horizontal position towards the earth, with the back downwards."

"*Pretty.*—The fingers and thumb so opposed as to form a curve, are passed over the face nearly touching it, from the forehead to the chin, then add the sign of good."

The signs for *theft*, *exchange*, *riding on horseback*, *fish*, *be quiet*, *fool*, and *snake*, are the same as those employed in the tuition of the deaf and dumb.

"*Theft.*—The left fore-arm is held horizontally a little forward or across the body, and the right hand passing under it, with a quick motion, seems to grasp something and is suddenly withdrawn."

"*Exchange.*—The two fore-fingers are extended perpendicularly, and the hands are then passed by each other transversely in front of the breast, so as nearly to exchange positions."

"*Riding on Horseback.*—The index and middle finger of the right hand, are straddled over the left index finger, representing the rider and the horse; these are then jolted forward to represent the trotting motion of the horse."

*Be quiet*, or be not alarmed, or have patience.—The palm of the hand is held towards the person.

"*Fish.*—Hold the upper edge of the hand horizontally, and agitate it in the manner of a fan but more rapidly, in imitation of the motion of the tail of the fish."

"*Fool.*—The finger is pointed to the forehead and the hand is then held vertically above the head, and rotated on the wrist two or three times."

"*Snake.*—The fore-finger is extended horizontally and passed along forward in a serpentine line. This is also used to indicate the Snake nation of Indians."

The Indian sign for a *squaw* is natural, but would not answer for a universal sign for a woman; it is, however, applicable to the general habits of the natives west of the Mississippi."

"*Squaw.*—The hands are passed from the top down each side of the head, indicating the parting of the hair on the top, and its flowing down each side."

Perhaps the characteristic of long hair peculiar to women, would form as universal a sign for a female as any that could be adopted; or the other sign, extracted from Mr. Dunbar's essay, viz.

"*Woman.*—The finger and thumb of the right hand partly open, and placed as if laying hold of the breast."

The Abbé Sicard, however, has a sign for a woman taken from the hat string as it passes from the hat to the chin where it is tied. This sign is simplified and the hand is drawn on one side of the face only, and then elevated to a proper size for a *woman*, and a less for a *girl*.

A *man* is designated by touching the fore part of the hat, and then placing the hand at the proper height. The same sign is used for a *boy* with the hand less elevated.

The sign for *brother* is compounded of the sign for a *man*, and that of *equality* or *the same*.

*Sister* is also compounded of the sign for a *woman* and the sign for *the same*. The latter sign is natural and universal, and is employed alike by the Indians and the deaf and dumb. It is described as follows:

"The same, or similar to what went before—Place the two fore-fingers parallel to each other, and push them forward a little."

The definition of a *brother* in the language of the deaf and dumb would then be, a man or boy the same, or equal to myself or of the same parents; and a *sister*, a woman or girl the same as myself, or of the same parents."

The Indians have expressed these relations to one another by signs, in a manner equally as natural and intelligible, viz.

"*Brother.*—The sign for a man, succeeded by placing the ends of the fore and middle fingers of one hand together in the mouth."

"*Sister.*—The sign for a squaw, after which place the two fingers in the mouth as for brother."

These signs evidently mean the man or woman, the boy or girl, who have sucked as I have, and are analogous to the signs of the deaf mute for brother and sister, though somewhat different.

In the two excellent volumes of travels, entitled, "Long's expedition to the Rocky Mountains," compiled by Dr. Edwin James, one of the party, is found a collection of 150 or more words defined by signs, as used by the Indians. I have selected some of these for comment and comparison with the signs of the deaf and dumb. There are others that are natural and expressive, but I shall not go into any further examination at present, presuming that you have had enough of the subject for this evening. As, however, I intended to enter into the subject of *sign language* in general, the remarks elicited by the foregoing must be reserved for a future occasion.

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Art. XXXII.—*Notice of a Geological and Agricultural Survey of the district adjoining the Erie Canal, in the State of New-York—taken under the direction of the Hon. Stephen Van Rensselaer. Part I.* By Amos Eaton.

The fame of the great Canal, in the State of New-York, and of the distinguished individual to whom, more than to any other man, it owes its existence, have gone forth throughout the civilized world. While the friends of the internal commerce and improvement of the United States are rejoicing in the prospect (no longer problematical,) of the inexhaustible stream of wealth which will soon flow through one of the most magnificent channels that has ever been opened by man, the friends of liberty in every country, are equally gratified, by the proof, thus exhibited, that that energy of free Institutions is able to execute enterprizes which have heretofore been considered as the peculiar achievements of arbitrary power.

Scientific undertakings are, usually, of a later date than those which relate to commerce and the arts. It would therefore have hardly been expected, that almost as soon as it was ascertained that the Erie canal would be successfully prosecuted, a project should be set on foot to execute a great survey of the country through which it passes, for the purpose of investigating and describing the mineralogy, geology, and agricultural resources of this extensive region. The public have learned, not so much with surprise as with admiration, that an individual,* not less distinguished by his princely munificence, than by the judicious selection of the objects on which it is bestowed, has incurred the whole expense of this survey, occupying a period of several years, and calling into requisition the united labours of an experienced geologist, Mr. Amos Eaton, already advantageously known as a public teacher, and as a professional author, and of Messrs. M. H. Webster and J. Eights—the latter as a draftsman, and the former as a naturalist, and collector of specimens. If we are not misinformed, this survey has already cost a good many thousands of dollars, and from the style in which the first part of the report is published, it is apparent that no expense has been spared in the undertaking. This part of Mr. Eaton's report forms a volume of one hundred and sixty pages, octavo, handsomely printed on good paper, and illustrated by two elegant sections, or geological profiles. The first, exhibiting the structure of the country from Boston harbour to Lake Erie, a distance of five hundred and fifty miles, is ornamented by four perspective views, of interesting scenes on the canal; and forms a folded map more than four feet and a half in length. The other profile was furnished by the Rev. Edward Hitchcock, a geologist of well-known and well-deserved reputation, and extends from a little west of Plainfield, Massachusetts, to the harbour of Boston. This section, which is on a somewhat larger scale than the other, is subsidiary to it, and is substantially included in it. Strictly speaking, the country exhibited in this section is not included within the canal survey, which terminates at Albany—but it was very justly considered as a desirable object, to continue the section from Lake Erie to the ocean, thus presenting, probably, the most extensive geological *profile* that has ever been formed *from actual observation*, Mr. Hitchcock's section is accompanied by a concise description, furnished by him, not (as we understand) with a

*The Hon. Stephen Van Rensselaer, of Albany.

view of having it published in *its present form*, but merely as *materials** contributed towards the completion of the great design.

It is not our object to present an analysis or review of Mr. Eaton's Report, (especially as it is yet incomplete,) but merely to announce this part of it, in the respectful terms which it deserves. We confess we regret any unnecessary innovations in geological nomenclature, or any deviations from the present highly improved state of the science, on the eastern continent, *unless where new facts and discoveries imperiously demand such a course.* If we were, however, disposed to criticism, we should be restrained by the obvious propriety of waiting until the evidence can be examined by impartial judges, and we fully concede the right to be heard with candour, and to be judged with fairness, to the laborious and faithful geologist who has travelled more than three thousand miles on foot, and seven thousand more in other modes, in order to acquire a knowledge of the facts which he describes, and the power of observing and describing them; at the same time, we are always gratified, and especially in the case of scientific works, when assertions and opinions are announced, not magisterially, but with reserve, and with a respectful deference to the views of others; this course is dictated equally by interest and duty, and always conciliates more favour than it concedes. That author gains little to himself who treats lightly or contemptuously the opinions even of those whose opportunities of making original observations have been necessarily less extensive than his own, and whose studies in the sciences of nature have been pursued less in the field than in the cabinet. With respect to geologists, however, most of those of the present day do, in fact, combine both methods of study, and some of them have travelled extensively, and have traversed even oceans and continents, in pursuit of geological knowledge.

Mr. Eaton's survey bears every mark of the fidelity and vigorous effort which have marked his former geological reports, and if he is ready to manifest a preference for his own opinions, he has shewn himself equally candid in re-

*For the more full explanation of which, he very properly, refers to his extensive communications in former numbers of this Journal.

nouncing or modifying them, when farther research has shewn them no longer tenable.

We have great confidence in the general correctness of Mr. Eaton's opinions, and statements of facts in this report, and they exhibit a view equally pleasing to the geologist and to the political economist. The former will be gratified in contemplating the most important geological formations, prevailing with great uniformity through a vast extent of country; and the latter will learn with satisfaction, that they embrace a multitude of useful things, such as slates, and limestones and marbles, of many varieties, sandstones and mill-stone grits, beds of Iron ore and of plaister of Paris, rich deposites of salt, and strong presumptive evidences of mineral coal. The salt, the plaister, the hydraulic lime, and the iron ore of this region, are deposites of inestimable value. How happy was the discovery of hydraulic lime in inexhaustible quantity, and of superior excellence, in the very places where it was wanted, for the massy sub-aqueous masonry of the locks, bridges, culverts, and aqueducts; and who can estimate the importance, to future generations, of the salt and of the iron ore, which, with profuse bounty, are spread by the Creator over this favoured region. We have been very strongly impressed with the unparalleled magnitude of the deposite of iron, which, according to Mr. Eaton's observations, extends, for more than two hundred and forty miles. We know not that the world affords a similar instance. Mr. Eaton's book will form a very valuable guide to the geological traveller, through the region which it describes. Every such traveller will keep it in his hand, and thus opportunities will constantly be afforded, of examining the correctness of the author's observations, of enlarging them in some instances, and of pursuing them more in detail, and of correcting errors, should any have been committed, for in a survey, so extensive and arduous, it would be surprising, should no errors be hereafter discovered;—but Mr. Eaton, by mentioning, with great particularity, the places upon which his conclusions are founded, has put it in our power to review his labours at leisure. Additional contributions to science, agriculture, and the arts, may confidently be expected in a region, which is already found to be prolific in important geological facts, and in vast stores of the most useful minerals.

We cannot conclude this hasty and imperfect notice without adverting again to the interesting contrast, (more than once mentioned already in this Journal) afforded by the present state of the mineralogical and geological knowledge in this country, in comparison with what it presented within the memory of many of its present cultivators.

Not many years have elapsed since but few persons knew the names even of the most common rocks and stones; and none had pretended to observe, much less to describe, the leading geological features of the country. Cabinets did not exist, nor was instruction any where to be obtained—now cabinets are numerous and extensive, Professors are found in most of our literary institutions; active and enlightened observers are scattered all over our extensive territory, and surveys and descriptions are published of limited and extensive districts, of states and of the whole empire. Our countrymen have not been slow to perceive the important bearings of these sciences on individual and national wealth, and the most important results may be confidently anticipated from the constant progress of observation and discovery.

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## INTELLIGENCE AND MISCELLANIES.

### I. Foreign.

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

#### 1. *Biographical Notice of Haüy.*

At the public session of the Academy of Sciences (June 2d. 1823) a distinguished savant pronounced a merited eulogium on the illustrious Hauy. He brought into view the labours of the natural philosopher, the mineralogist, and especially those of the professor: and animated his audience with an account of a life, at once simple, pure modest, and always occupied in some good work. On this occasion Mons. Cuvier has added to the ordinary charms of his style, a *naiveté* of expression, and a feeling quite in harmony with his subject. Haüy was one of those men who appear from time to time in the world to support our courage and to preserve us from the misfortune of acquiring a contempt for human nature. Their history is more instructive than that of whole nations, of the monarchs who govern them, of the wars which they maintain, of the alternations of success and reverses which compose their annals. The occurrences of private life present us with lessons better adapted to our wants. We there remark the happy influence of good dispositions, more precious even than the virtues, and the imitation of which is the more attractive as it seems to be more easy. We there learn, that with perseverance and labour, an upright mind, without extraordinary gifts, may rival genius itself, and render to science services no less important. And indeed according to M. Cuvier, genius is nothing more than a correct and persevering mind. This opinion may be contested. The word *genius* certainly designates the highest degree of human intelligence, the greatest power of memory and imagination joined to rapidity of thought. The man of genius perceives almost at a glance and with the same clearness a multitude of objects, and traces the relations between them ; whereas an ordinary mind, however just and persevering, discovers only a more limited horizon, sees objects only in succession, and suffers those to escape which can be known only by an immediate comparison of the two extremities of a long series of images or ideas.

M. Cuvier has distinguished in Haüy the philosopher from the man. We shall have frequently to speak of the philosopher, of his works, of the part which he took in the discoveries with which science has been enriched during the last half century and of what appertains to him among the labours of its numerous disciples : at present, we shall borrow from M. Cuvier only the traits by which he describes the pupil, the professor, the man of study enclosed in a prison, the academician loaded with literary honours, and in all, the amiable soul of Haüy, with his candour and universal benevolence.

René-Just Haüy honorary canon of Notre-Dame, member of the Academy of Sciences, and of the greater part of those of Europe, was born on the 28th of February 1743, at Saint-Just a little village in the department of l'Oise. He was the elder brother of the late Mr. Haüy, so well known as the inventor of a method of instruction for the blind. The father of these two children, who were destined to extend the bounds of science, and enlarge its applications, was a poor weaver, who, according to all appearances would never have been able to give his sons any other profession than his own, if some generous persons had not come to his assistance. There was then at St. Just an Abbey, in which the young Haüy attended with assiduity to the religious ceremonies that were practised and shewed much taste for the sacred music of the church. He drew the attention of the Prior who sent for him, interrogated him, and struck with the extraordinary intelligence of the child, had him instructed by some of the religious incumbents of the Abbey. The progress of the scholar was so rapid that his masters engaged his mother to take him to Paris, where he would certainly find the means of continuing his studies. The courageous mother followed this advice, notwithstanding that difficulties of all kinds presented themselves, and persevered through all the trials which she had to sustain in supporting herself and her son in a great city, where she found herself without resources. The first relief which she obtained after a long period of expectation, was a place for her son as one of the infant Choristers in a church in the Fauxbourg St. Antoine. The young Haüy was able to improve upon the simple instruction which he received in that employment; he became a good musician. At length his protectors obtained for him a purse in the college of Navarre, and it is from his entrance into this college that we must date the commencement of his regular studies. His conduct secured the esteem and attachment of his professors; and when he ceased to be a scholar, though still very young, his masters judged him to be worthy of sharing with them in their labours. At the age of 21 he was regent of the fourth, and some time after, he passed as regent of the second to the college of Cardinal Lemoine. Nothing, until then, had directed his attention to the natural sciences, but he had attended the course of Brisson in the college at Navarre, and acquired some taste for experimental physics. Among his new *confreres* in the college ef Lemoine was Lhomond, a man of profound knowledge, and yet more modest and pious than he was learned. This person had limited himself to the instruction of the sixth, and had composed works only for Children; but they were remarkable for an uncommon clearness, and a simplicity of tone conformable to the character of the author.

The young Haüy soon became the friend of the respectable Lhomond, entrusted him with the secrets of his conscience, and felt for him the tenderness of a son. He took care of his business, comforted him in his sufferings, and accompanied him in his walks. Lhomond loved to herborize, but Haüy had yet no idea of botany. The industrious friendship of the young professor enabled him to fill up, in a very short time, this blank in his information, in order that he might be more agreeable and useful to his friend. At the first herborization, he could name the plants, and assign them their botanical characters; very soon he was on a level with his companion, and from that time every thing was common between them, even to their amusements.

The College of Cardinal Lemoine is near the Garden of Plants; and it was natural that Haüy should often choose it for his promenade. Seeing one day a crowd of auditors pressing in to the attendance of a lecture of Daubenton, on mineralogy, he wished to hear this professor, and was charmed to find, in this part of natural history, subjects of theory more analogous to his taste for the physical sciences, than the pursuits of botany. The comparison of these two varieties of the productions of nature, excited in his mind a train of reflections which led the way to his discoveries in crystallography. How is it, said he, that the same stones and the same salts should show themselves in cubes, in prisms, in needles, without the change of a single atom in their composition, while the rose has always the same petals, the gland the same flexure, the cedar the same height and developement? He was occupied with these ideas, when examining one day some minerals at the house of his friend, M. Defrance, he awkwardly, though luckily, let fall a beautiful group of prismatic crystals of calcareous spar. Some fragments broken from the group, presented the appearance of a new and regularly formed crystal, with smooth surfaces. Haüy discovered with surprise that this form was precisely that of rhomboidal crystals of Iceland spar. "*The mystery is explained,*" cried he. In fact, his whole theory of crystallography, a monument as imperishable as the truths of geometry, is founded on this observation; but because this discovery was altogether geometrical, it was necessary that it should be explained and perfected through the medium of geometry. Haüy felt on this occasion also, that his studies had been imperfect. But he was not discouraged. He perceived what he stood in need of in order to continue his researches upon the structure of crystals; invented a method of measuring and describing them, and not till then did he venture to speak of his discoveries to his master, to whose lessons he had modestly and silently attended. It may readily be conceived that Daubenton was eager to accept and to make known such valuable labours. M. de Laplace, to whom he communicated them, hastened to encourage the author to bring them before the Academy of Sciences. But it was not easy to induce the modest Haüy to leave his happy obscurity to shew himself at the house where the Academy held its sittings, and in the midst of this society of distinguished men. He yielded, however, to the solicitation, and went to the house as to an ecclesiastical ceremony, clothed with the costume prescribed by the canons. It was found necessary to have recourse to the authority of a doctor of the Sorbonne, to persuade him that he might, with a safe conscience, wear the same garb as the other ecclesiastics of that day. It is probable, however, that the Academy would have received him, whatever dress he might have chosen to appear in. On the 12th of February, 1783, he was admitted as an adjunct in the class of Botany.

While Haüy was pursuing these peaceful labours, the Revolution burst upon the nation. The Bastile was destroyed, and the monarchy soon after shared the same fate: but all this did not disturb the naturalist from the train of his occupations, nor induce him to participate in the general movements. As he refused to take the oath to the ecclesiastical constitution prescribed at that period, he was deprived of all his perquisites, and found himself as poor as at the period when the place of an infant chorister was the object of his ambition. This poverty did not shield him from imminent dangers. Very ignorant of all that was passing around him, he saw one day his modest retreat invaded by men, who demanded of him whether he had any fire arms. "I have no other than this," said he, drawing a spark from his electric machine. They seized his papers, which contained nothing but mathematical calculations, overturned his collection, which was his only property; and finally shut him up with other priests in the Seminary of St. Firmin, which had been converted into a prison. In thus exchanging one cell for another, he was not very uneasy in his new habitation. Calm under all circumstances, and seeing himself in company with many of his friends, he only thought of sending for his drawers, that he might put his crystals in order. Happily, he had friends without who knew better than he what was preparing for those who had incurred the popular displeasure. One of his pupils, afterwards his colleague, *Geoffroy de Saint Hilaire*, member of the Academy of Sciences, lodged then in the College of Cardinal Lemoine. As soon as he was informed of the fate of his master, he ran instantly to implore all those who he thought might have some influence, to endeavour to save him. An order was at length obtained for his deliverance. M. Geoffroy ran with it to Saint Firmin; but he was late. Haüy was so tranquil that nothing could induce him to go out on that day. The next day he was taken out almost by force,—and the day after was the 2d of September!

It is very remarkable that after the massacre from which Haüy had been so providentially rescued he met with no further disturbance. One day only he was compelled to appear at the review of his battallion, but he was soon dismissed *on account of his bad figure.* This was nearly all that he knew, or at least all that he saw of the Revolution. At the time at which the convention was acting with the greatest violence, he was named one of the commissioners of weights and measures, and keeper of the cabinet of mines. When Lavoisier was arrested, when Borda and Delambre were deposed, Haüy alone could write in their favour, and he hesitated not to do it: he, an unregistered priest, performing every day his ecclesiastical functions! At such an epoch, his impunity was more surprising even than his courage.

At the death of Dauberton, the public voice designated Haüy as his successor. The votes of the Academy were, however, in favour of Dolomieu, probably on account of the extreme modesty of Haüy. But the former was at that time under arrest, contrary to the rights of nations, in the dungeons of the Neapolitan government; and the only evidence of his being alive was a few lines written upon the margin of a book with a splinter of wood, and the smoke of his lamp, which the ingenuity and humanity of an Englishman had bribed the gaoler to transmit to his friend. These lines, as well as his works, pleaded powerfully in his favour, and the member who urged his election with the greatest zeal was Haüy himself. It might have been expected that such testimonials of esteem, rendered by such men, would have softened the rigour of Dolomieu's treatment; but how many persons are there in power, who when blinded by a momentary passion, take no pains to inform themselves of the opinion of their fellow-creatures, until they discover it in the indignation of posterity! Dolomieu was released from his dungeon only by virtue of an article in a treaty of peace, and a premature death, occasioned by the treatment he had been subjected to, but too soon restored to Haüy the appointment he had so generously renounced. From this time, instruction in mineralogy acquired a new life. Collections were quadrupled, and arranged in an order conformable to the most recent discoveries. The mineralogists of Europe assembled to witness so many objects so well exposed, and to hear a professor so clear and elegant, and withal so complaisant. His native benevolence displayed itself on every occasion to those who wished to be informed. He admitted them to his chambers, opened to them his cabinets, and refused no explanations. The most humble students were received like the most learned and august personages; for he had pupils of all ranks.

The University, at the time of its foundation, thought it an honour to place Haüy on the list of one of its faculties. He was not required to deliver lectures for he was supplied with an adjunct well worthy of him in M. Brongniart, at present member of the Academy of Sciences, and his successor in the Museum of Natural History. But Haüy was unwilling to receive a title without fulfilling the duties which it implied. He accordingly invited the pupils of the Normal school to attend him at his rooms, and by amiable and diversified conversation, he initiated them into his secrets. His college life was thus agreeably renewed, he almost sported with the young people, and never sent them away, without an ample collation. Thus passed his days. Religious duties, profound researches, and acts of benevolence, particularly in relation to young people, occupied his whole time. As tolerant as he was pious, the opinion of others never influenced his conduct towards them. As pious as he was faithful to his studies, the most sublime speculations could not divert him from any of the prescriptions of the ritual, and upon all worldly objects he placed just the value which they might be expected to hold in the eyes of a man penetrated with such sentiments. From the course of his pursuits, the most beautiful gems which nature produces came under his observation; and he published a treatise especially upon them, but without regarding them in any other light than as crystalline forms. A single degree, more or less, in the angle of a *schorl*, or a *spath*, would undoubtedly have interested him more than all the treasures of the two Indies: and if any room can be found for reproaching him with too strong an attachment to any thing, it was to his opinions on this subject. He devoted himself to his theory, and when objections were made to it, a degree of impatience was excited, which troubled his repose. It was the only occasion which could influence him to forget his inherent mildness and benevolence; and it must be acknowledged that this disposition was not without its effect. But at the same time that he was paying this tribute to the weakness of humanity, he was occupied with what he regarded as the true interests of science, and suffered himself to be vexed only by obstacles which, in his estimation, were opposed to the triumph of truth.

Such services deserved a reward, and he was at different times pressed to make known what would be most agreeable to himself. All his views were limited to the request that he might be put into a situation to collect his family around him in order that they might take care of him during his age and infirmity. This desire was immediately satisfied by granting to the husband of his niece some little station in the department of finance. Who could believe that a recompense so well merited as this, would disappear on the first political change, and that the friends of Haüy should be able to obtain no other reply to their solicitations, than that "there was no connection between the public contributions and crystallography."

This trial was not the only one which this illustrious savant had to support. A short time afterwards, the state of the finances occasioned him to lose a pension which he could badly dispense with. His brother who had been invited to Russia to spread a knowledge of the method of instructing the blind, returned from that country without a fulfilment of any of the promises that had been made him, and in a state of health so enfeebled as to render him a charge to his family. It was thus that towards the end of his days, Haüy found himself reduced to the same necessitous condition that he had more than once experienced. His religious resignation would have become of indispensable importance to him, if his young relations had not concealed from him with the greatest care, the embarrassments of his worldly affairs. The less he had it in his power to testify his gratitude to them, the more earnest were they to bestow upon him every delicate attention. The love of his pupils, and the respect of all Europe contributed also to console him. Intelligent men of all ranks who came to Paris, were anxious to express their regard for him and almost at the close of his life, we have seen the heir of a great kingdom (the Prince Royal of Denmark) take various opportunities of conversing with him at his bed side, and evincing in the most feeling terms, the interest which he took in his welfare. But the best support which he experienced in this period of trial, was, that in the midst of his glory and of his fortune, he had never abandoned his college habits, nor those of his native village. His hour of rising, of taking his meals, and of going to bed, had never been changed; he took every day nearly the same exercise, walked in the same places, and even in his walks, found some occasion for the exercise of his benevolence. When he saw a stranger in difficulty with respect to the way, he conducted him himself or sent him a ticket of admission to the collections; numerous are the persons who have received these agreeable marks of attention, without doubting the hand from which they have sprung. His antique dress, his simple manners, his language, modest in the extreme, were not calculated to emblazon his reputation. When he spent a short time in his native village, none of his old neighbours would have suspected that he had become a considerable personage. One day, in a walk upon the boulevard, he met two soldiers who were about to settle a dispute by fighting; he immediately inquired into the cause of their quarrel, and succeeded in reconciling them; and that he might insure the continuance of their tranquillity, he went with them to a beer house and sealed their reconciliation in the manner of a soldier.

Science and humanity were deprived of this worthy man on the 3rd of June, 1822, at the age of 79. He left his family but one inheritance—his valuable and magnificent collection of crystals, which the donations of almost all Europe, during 20 years, had placed above all those which have hitherto been found.

*Rev. Encyc.*

2. *Spinning Machine at Dunfermline, Scotland.*—Mr. Hatton of this town, has, for more than a year past, kept *two mice* constantly employed in spinning sewing thread, by means of a machine similar to the tread mill. Each of these little animals spins every day from one hundred to one hundred and twenty threads, in performing which they have to move about ten and a half miles.

The expense of maintaining each mouse is a half-penny for five weeks, and comparing this, with the quantity of work done, it appears that each mouse earns about six shillings sterling per annum. Mr. Hatton proposes to hire an old edifice one hundred feet long and fifty wide, in which he may employ ten thousand mice machines. If this enterprize should succeed, it is estimated that the annual gain will be about £2,300 sterling, clear of all expense and interest. *Edinburgh Starr.*

3. *Royal Encouragement.*—The Emperor of Russia has sent to *M. Melchior Gioja*, author of *Nuovo projetto delle scienze economiche* a bill of exchange for 20,000 francs,

with a request to receive one hundred copies of his work which is in 8 vols. 4to. It is with such munificence that monarchs may powerfully contribute to the progress of the human mind, when their favours fall upon the works of real merit. *Rev. Encyc.*

4. *Preparation of Potassium and Sodium.*—Prof. Brunner, in a communication addressed to Prof. Pictet, states very clearly the result of various experiments in the preparation of the alkaline metals; by which it appears that the agency of iron is not necessary in the decomposition of potash and soda, but rather injurious, the metallic bases being as easily obtained by charcoal alone.

His apparatus consists of an oval shaped wrought iron bottle, half an inch thick, and capable of holding about a pint. It is provided with a neck, into which screws a bent gun barrel. To preserve the barrel from the destructive effects of the fire, he wraps tightly and closely around it an iron wire. A common air furnace is provided, wide enough to contain both the iron bottle and the bent gun barrel after they are joined. The end of the barrel passes through a circular opening in the bottom plate of the furnace, (the front of the furnace projecting outwards sufficiently for this purpose,) and dips into a cylindrical copper vessel, containing naptha which has a tight cover, with an opening in it to receive the barrel

From the upper part of this vessel a tube projects on one side for the purpose of allowing the gas to escape, and to this another tube may be adjusted, if the operator chooses, which shall dip into a vessel of naptha or quicksilver. The apparatus is probably supported within the furnace by iron braces. The furnace of Prof. Brunner is covered by a piece of tile, and the front of it he says is formed of one half of a black lead crucible, divided vertically, and with the bottom removed.

In his first experiment, after washing the iron bottle and gun barrel with very dilute sulphuric acid, and heating the bottle red hot, he introduced in small portions alternately four ounces of caustic potash in a state of igneous fusion, and a mixture of six ounces of iron turnings, grossly pounded, and one ounce of pulverized charcoal. The whole is mixed as intimately as possible with an iron rod.

Over this mixture he introduced two ounces of iron turnings. From these ingredients he obtained two and a half gros of potassium, in the form of brilliant buttons swimming in the Naphtha.

In the second experiment, eight ounces of subcarbonate of potash, mixed with six ounces of iron turnings and two ounces of charcoal, and these covered with one ounce of iron turnings, yielded two gros and twenty grains of potassium.

In the third experiment six ounces of subcarbonate of potash were heated with three ounces of charcoal, without any iron, and three gros of potassium were obtained.

In the fourth experiment, to obviate the inference that the iron of the apparatus might have effected the reduction, he heated the same mixture in an earthen retort. The same indications of the formation of potassium were manifested, by the production of inflammable gasses, &c., but at the moment when the potassium was expected, the retort broke. On putting the neck of it, when cold, into water, inflammation ensued, proving that the metal had been produced.

Upon trying the experiment with iron alone, without charcoal, not an atom of potassium was obtained, though the process was kept up for two hours, and the fire raised as high as it could be, with such an apparatus.

It appears, therefore, that with a common air furnace, such as are used for melting small quantities of metal, and with an iron bottle and gun barrel, potassium may be obtained by the agency of charcoal, and at a heat which does not endanger the safety of the apparatus. In this method also the subcarbonates answer the purpose better than the caustic alkalies.

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5. *The two electricities* may be distinguished from each other by turning the electric current, as it issues from a point, upon the tongue. The taste of the positive current is acid, and that of the negative current is more caustic and alkaline.

*Manuel de Chimie par Berzelius.*

6. *Leyden Jar.* When water has been quickly frozen in a Leyden bottle, the outside coating of which is not insulated, the bottle receives a weak electric charge ; the outside becomes negative and the inside positive. If the water be quickly thawed, the electric action is reversed, the inside becomes negative and the outside positive.

*Grothus.*

7. *Chemical effects of Magnetism.* According to professors Hanstein and Maselsmann this effect may be shewn as follows. Bend a glass tube into a syphon, and place in the angle a portion of mercury not sufficient to close the connection between the two legs ; then introduce a solution of nitrate of silver until it rises in both branches. Then place the branches of the syphon in the magnetic meridian and the Arbor Dianæ will form much more rapidly and in more perfect crystals, than if the branches be placed in the direction of east and west. The crystallization is in the first case most perfect in the northern branch. If while the syphon is in a plane perpendicular to the meridian, an artificial magnet be brought near it, the silver will be deposited more abundantly, and in this case the south branch is more active than the north.

Murray has made an experiment analogous to this by putting an iron rod into very dilute nitrate of silver. If the rod be not magnetized the silver is not reduced, but as soon as a magnet is brought to touch it, the reduction takes place. A magnet covered with varnish will equally effect the reduction, but in this case he finds, in opposition to Hanstein and Masselsmann that the strongest action is at the north pole. Ludecke has observed that when a glass vessel, filled with a concentrated saline solution (e. g. acetate of lead, or muriate of ammonia, or sulphate of protoxide of iron) is placed on a horse-shoe magnet ,it will be found, in the course of a few hours, that the crystals will form between the two poles a well marked circular spot, which, by the more intense magnetic force in that region is deprived of crystals, while they are thickly deposited all around. *Idem.*

8. When *Hydrogen gas*, (obtained from iron filings and dilute sulphuric acid,) is passed through pure alcohol, the

hydrogen loses much of its odour, and the alcohol, when water is added to it, becomes milky, and in a close vessel it deposites, in the course of a few hours, an odoriferous volatile oil, which was contained in the gas, and which gave it its well known smell. *Berzelius.*

9. When *Hydrogen gas* is substituted for azotic gas in the mixture which constitutes atmospheric air, and this mixture is respired by men or other animals, it very soon throws them into a profound sleep, without appearing to have any injurious effect, especially if a little common air is admitted to the mixture; but if in this composition of air carbonated hydrogen is substituted for azote, the mixture when respired is highly deleterious. *Idem.*

10. *When a few drops of fuming nitric acid* are let fall into a flask of sulphuretted hydrogen, the hydrogen becomes oxidized at the expense of the nitric acid and forms water, while the disengaged sulphur appears in the solid form. If the flask be closed with the finger, so that the gas, which becomes warm, cannot escape, the heat increases sufficiently to cause the gas to burn with a beautiful flame, and slight detonations are produced which repel the finger from the orifice of the flask. This experiment may be made without the least danger, with a flask whose contents are 4 or 5 cubic inches. *Idme.*

11. *Single blocks of Stone.* The enormous columns of granite, destined for the portico of the new church now building in the place d'Isaac at St. Petersburg, are very remarkable. In order to form a proper estimate of their size, we will here state the comparative magnitudes of the largest blocks known, both ancient and modern. 1st. The column of Alexandria commonly called Pompey's pillar, which holds the first rank. It is of a single block of Red granite, in height 67 feet 4 inches 11½ lines. 2d. The columns of the Church d'Isaac just mentioned, in height 56 feet. 3d. The columns whose ruins are near mount Citorio at Rome, height 52 feet 4 inches. 4th. Columns of the portico of the Pantheon, height 46 feet 9 inches 11 lines. 5th. Columns of the cathedral of Casan, at St. Petersburg, height 42 feet. 6th. Two columns of the

church of St. Paul, at Rome, without the enclosure, height 38 feet 4 inches. 7th. The columns near the Baths of Dioclesian, and those of Caracalla now placed at Florence, near the *pont Trinité*, of the same height as the preceding. *Rev. Encyc.*

To these may be added a beautiful columnof white marble about 40 feet long, taken from a quarry on the south side of the Alps, and now lying by the side of the Simplon Road ; it was destined by Napoleon for the ornamental improvements of Milan.

12. *Bibliotheque Royale, de Paris.*—This library contained in 1791, only 150,000 volumes; at present it includes more than 450,000. In 1783, it numbered only 2,700 port folios of engravings, and now there are 5,700. Its annual increase is 6,000 French works, and 3,000 foreign, which permits us to hope that in fifty years, this magnificent establishment will have doubled its literary and scientific treasures.—*Idem.*

13. *Proportion of the Sexes.*—From a careful examination of the register of births in the city of Paris, from 1670 to 1821, it appears that the number of male children is always superior to that of females. The exact proportion during the last 77 years is 795,350 to 763,936, which is about 26 to 25, or more accurately, 1041 to 1000. This includes foundlings, among which there are doubtless fewer male children enumerated than are actually born. Taking this fact into consideration, the proportion will be as 22 to 21. Similar observations have been made at London and Naples. In the former of these cities, the proportion of males to females is as 19 to 18, and in the latter as 22 to 21. It appears that in Paris the number of natural children has been for some time on the increase. The number of those which are acknowledged by their parents, was in 1821 about two fifths of the whole. Assistance was given in Paris at the public expense, in 1819, to 85,150 individuals, and in 1820, to 86,870, which is nearly in the proportion of 1 to $8\frac{1}{2}$ of the whole population. The medium number of deaths in the hospitals and alms-houses, is 1 to 7. The medium expense of maintenance for each individual is from 110 to 123 francs per annum. The number of

indigent females is about one half more than that of the other sex. There are in Paris 26,801 houses, containing 224,922 families, and upon an average, the number of fires, or conflagrations, (including chimnies,) is 585. About 1,000 houses are built annually.—*Rev. Encyc.*

14 *On the Capillary Action of Fissures, &c.*—M. Dobereiner has remarked a singular effect produced apparently by fissures. Having filled a large glass flask with hydrogen, and left it standing over water, it was observed some days after, that the water had risen in it above one third of its capacity. The only cause for this effect that could be assigned was, the existence of a very minute fissure in the glass. Filled a second time, and left over water, the fluid had risen in it above an inch and a half in twelve hours, and in twenty-four, had risen two inches and three quarters, during which time the barometer and thermometer had not sensibly altered. In other experiments, vessels of other forms were used, and the water uniformly rose in those having fissures.

When one of these vessels filled with hydrogen was covered by a bell glass, or when the vessels were filled with atmospheric air, oxygen, or azote, instead of hydrogen, no change took place.

M. Dobereiner considers the effect as due probably to capillary action. He suggests that all gases may be considered as consisting of solid atoms, of various sizes, enveloped by atmospheres of heat, also very different, and tha hydrogen, though it has the largest atmospheres of heat, has the smallest atom, and is thus permitted to escape by fissures which retain the other gases. "Probably," he says, "fissures may be formed, which will permit azote to pass, but not oxygen, and others again, which will let the oxygen out, but not carbonic acid gas."

Another experiment, which seems related to this subject, is as follows:—A thermometer tube had been drawn out very fine in the lamp, and it being desired to have it filled with alcohol, the point was immersed in that fluid, and the bulb heated till no more bubbles of air escaped: the tube was then cooled, but no alcohol entered. When again heated, an abundance of bubbles of air passed out through the alcohol, though when re-cooled, no alcohol would enter.

Upon examining the tube with a lens, nothing was seen which could prevent the entrance of the alcohol; on withdrawing the tube from the alcohol, the external air entered with a hissing.

M. Dobereiner conceives that the diameter of the tube was so small that the alcohol could not enter, but only the air which it contained.

15. *Leghorn Straw Plait.*—The Dublin Society, having offered premiums for the best imitations of Leghorn Plait, awarded three prizes to successful candidates. Not less than twenty-four specimens were exhibited from widely remote parts of Ireland. The finest specimen was made from *Avena flavescens*, or yellow grass, by Miss Collins of Plattin, near Drogheda. The second was made of *Cynosurus cristatus*, or crested dog's-tail grass, by Miss Grimley, of Kiltenon, near Newton, Mount Kennedy. The third of *Agrostis vulgaris*, or common bent grass, by Miss Campbell, of Londonderry.

16. *Difference of crystalline forms of the same substance.*—M. Mitscherlich, who first observed the remarkable fact that a body may affect two different crystalline forms, has, in a memoir on this subject, quoted sulphur as an instance. Natural crystals of sulphur are furnished by some calcareous strata, and by volcanoes. Artificial crystals may be obtained either by evaporating a solution of it in carburet of sulphur, or by fusion of the sulphur and slow cooling. On fusing native sulphur it gives the same crystals as common sulphur. The primitive form of the crystals of sulphur, either natural, or obtained as above by evaporation, is an octaedron, with a rhombic base; but the primitive form of the crystals obtained by fusion is an oblique prism, with a rhombic base.

17. *Plate electrical machines.*—A variation in the construction of the plate electrical machine has been devised and practised by M. Metzger of Siblingen in Schaffhouse, which would seem to be a real improvement. Considering that the effect desired in using the machine, was first highly to excite the glass, and then to collect the electricity from it, M. Metzger concluded that the distance be-

tween the rubber and the points of the conductor in machines of the common construction was injurious in its effects, not only in causing the dispersion, in part, of the electricity excited, but by uselessly wasting the exciting surface. Plates were therefore mounted in a very compact and perfect manner, with three pairs of rubbers placed at equal distances from each other; the conductor also had three arms, furnished with points a little in advance of each pair of rubbers, to collect the electricity in the usual manner. The rubbers were not attached to a surrounding frame, but to brass arms, which, proceeding from a socket through which the axis passes, diverged from equal distance from each other, towards the periphery of the plate. The machine has a very compact and neat appearance, and its various smaller parts are contrived with much judgment.

In some comparative experiments made with a plate twenty-two inches in diameter, the superiority of three pair of cushions over two pair was very manifest. In the following table the first column expresses the length in inches of the rubbers; the second, the length of the spark when two pair of rubbers were used; and the third, the length of the spark when three pair of rubbers were on the machine.

| | | |
|---|---|---|
| 6 inches. | 12 inches. | 18 inches. |
| 7 " | 14 " | 21 " |
| 8 " | 16 " | 24 " |
| 9 " | 18 " | 27 " |
| 10 " | 20 " | 30 " |

18. *Electricity on separation of parts.*—In the waterproof cloths manufactured by M. Mackintosh of Glasgow, where two pieces are cemented together by caoutchouc dissolved in petroleum, the adhesion is such that when the two are torn asunder in the dark, there is a bright flash of electric light, similar to that produced by separating plates of mica, by breaking Rupert's drops, or by breaking barley sugar, or sugar candy. Upon trying this experiment with different substances, it was found that flashes of light were distinctly produced, by tearing quickly a piece of cotton cloth. *Edin. Jour.*

19. *Electric Light.*—Having a metallic wire covered with silk, form it into a close flat spiral, taking care that the revolutions touch each other. Their number may be arbitrary—more than twenty-four have not been used. The properties of this spiral when it forms part of the voltaic circuit are well known, but pass through it a charge of common electricity, such as may be taken by two square feet of coated surface, moderately charged, and a vivid light, somewhat resembling that of an artificial fire-work, will occur, originating from the centre of the spires, it may be seen very distinctly without darkening the chamber where the experiment is made. M. Leopold de Nobili, who describes this experiment, considers the phenomenon as perfectly new. If the wire be folded backwards and forwards, so as to form a rectangular surface, then the electric discharge only produces a faint light at each corner, and this he considers as the light produced by the escape of the electricity into the atmosphere; but the light from the spiral is said to be so vivid and distinct, that once seen, its dissimilarity from the former must be instantly evident. He has therefore called it electro-magnetic light, because of its relation to the magnetic state of the spiral, thinks that it might be made continuous if a sufficiently powerful voltaic battery were used, and has but little doubt that the aurora borealis is such a light, elicited by the magnetic state of the earth.

20. *White Copper.*—According to M. Keferstein, a metallic composition resembling silver has been employed under the name of white copper, for a long time, at Suhl, in ornamenting fire-arms. M. Brandes, by analysis, found it to be an alloy of copper and nickel. M. M. Keferstein and Muller have recently sought out the origin of this substance, and have ascertained that it is found in the scoria of some ancient copper works, formerly attached to mines now abandoned. The white copper which had formerly been rejected as useless, is now obtained by fusion, for the purpose above stated.

21. *Prussian Blue.*—Mr. Badnall, of Leek, has taken out a patent for improvements in dyeing with Prussian Blue. The improvement consists in preparing the Prussian Blue,

by mixing it in fine powder with strong muriatic acid, and stirring it until the whole becomes a smooth homogeneous mass, of a semi-gelatinous consistence. We notice it here merely to remark on the circumstance that an agent in which Prussian Blue is insoluble, should be found useful in enabling it to combine with silk, cotton, wool, &c. The pure ferro-prussiate of iron is soluble in water, but the addition of a small portion of muriatic acid immediately precipitates it; wash away the acid by pure water, and the pigment becomes soluble again; re-acidify, and it re-precipitates.

22. *Test for Morphium.*—M. Dublane, a druggist of Paris, states that he finds the tincture of nut-galls a very sensitive test of the presence of morphium in fluids, whether it exist free or in combination with acetic or sulphuric acid.

23. *Cafeine.*—Cafeine is a crystallizable principle discovered in 1821, in coffee, by M. Robiquet, whilst searching in it for quina.

M. M. Pelletier and Caventou obtained this substance at the same time, but did not complete their researches. M. Robiquet read a memoir on this subject to the Société de Pharmacie of Paris, which has not been published. It is, however, known to be a new principle, white, crystalline, volatile, and slightly soluble.

24. *Hatching of Fish.*—The Chinese have a method of hatching the spawn of fish, and thus protecting it from those accidents which ordinarily destroy so large a portion of it. The fishermen collect with care, on the margin and surface of waters, all those gelatinous masses which contain the spawn of fish; after they have found a sufficient quantity, they fill with it the shell of a fresh hen's egg, which they have previously emptied, stop up the hole, and put it under a setting fowl. At the expiration of a certain number of days, they break the shell in water warmed by the sun: the young fry are presently hatched, and are kept in pure fresh water till they are large enough to be thrown into the pond with the old fish. The sale of spawn for this purpose, forms an important branch of trade in China.

25. *Products of the Combustion of certain Coal Strata.*—In the neighbourhood of Aubin (Aveyron) there exist certain coal strata, some of which are worked, and others are burning, having been on fire for thirty or forty years. It has been remarked as singular, that no muriatic acid, or ammonia, occurs in the products of this combustion. Much sulphurous acid escapes, and various portions of sublimed sulphur, and acid aluminous efflorescences have been collected; but on chemically examining these and other products obtained, neither muriatic acid nor ammonia have been observed. The coal nevertheless contains an abundance of azote, and on distillation affords carbonate of ammonia.

* * * * * * * *

26. *Letter from the Chevalier de Martius to the Editor.*

REMARK.

The following letter was received, just as the last pages of this number were going to the press. As the Editor is very desirous to promote the laudable wishes of his correspondent, he publishes the entire letter with the exception of a few passages.

This course appears to be proper, as the communication relates to the interests of science at large.—Ed.

*Munich*, 13*th Feb.* 1824.

Sir—

Being a diligent reader of your excellent American Journal, I cannot but desire to establish an intercourse between us, which, I hope, will prove useful both for you and me. My principal study is Botany, but I am also fond of Geology, and wish to further these two sciences by their mutual influence. In a tour through a great part of Brazil, performed in the years 1817—1820, I had often occasion to explore the relation of geological facts with others interesting to the Botanist. I beg your permission, Sir, to send you two short dissertations on such objects, which I consider only as precursors of larger communications. My friend and companion, Dr. de Spix and I published some months ago, the first volume of our travels from Rio de Janeiro through S. Paulo, to the centre of the gold-mines. Besides this Mr. de Spix has published a description (in folio) of the new monkies, and another one (in 4to) of the new serpents of Brazil, and I, the first cahier of Genera et Species Palmarum (in folio) and of Nova Genera Plant. Brazil. (in 4to.) You will oblige me very much by acquainting your countrymen with these publications. If you wish to have, from time to time literary notices of new German books, I shall send them to you with great pleasure, especially the bulletins of our Royal Academy, and the Flora, a botanical Gazette, published by the Royal Society of Botany at Ratisbonne, by the latter you will be able to judge of the condition of Linnæus' *amabil. scient.* in Germany.

I have no correspondence with any botanist of your extensive and rich country, and should feel grateful to you, sir, if by your mediation, I could enter into a correspondence with some gentlemen willing to communicate the riches of the North American Flora in exchange for African and European plants and seeds. I beg you, sir, to communicate this project to your learned countrymen. I intended to give in the last Cahier of my Genera and Species plantarum, a Synopsis of all the Species of Palms till now known, and should be very glad to get by your mediation, the flowers and fruits of the American ones.

The flowers may be sent dried, or yet better in glasses filled with brandy, a manner by which I preserved my collection of more than one hundred Brasilian Palms. To facilitate this sending, I beg you to give me the name of one of your European correspondents, to whom I may direct larger packets with books plants and minerals. If this should not be convenient to that gentleman, I wish you might send all which is destined to me, under the following directions.

A Son Excellence, Monsieur le Comte de Bray Ministre de Sa Majesté le Roi de Baviére, á Paris ,or

A Monsieur le Baron de Cetto, Chargé d'affaires de Sa Majesté le Roi de Baviére, a'Londres.

These two gentlemen being duly advertised by a few lines from your hand will forward all you send me, to my direction.

I beg you, sir, to pardon the liberty I take, and accept the expression of the highest esteem of

Sir,

Your most obt. humble servant,

Le Chevalier de Martius.

P. S. You will see by the memoirs I send you with this letter, that I differ in the explanation of antediluvian plants, in some points from Mr. Brongniart, whose treatise was printed quite in the same time as mine. I cannot be convinced that Equisetums should have composed such a considerable part of that primitive Flora, but it seems almost sure to me, by the examination I made of many trunks of the Flora antediluviana, that the forms of Cycas and Zamia, or related ones, appear in it. Palms are scarcely to be remarked in ancient formations of strata, but they are in those of the Braunkohle and the newest formed chalk.

27. *Geographical Society at Paris.*—A society has been recently formed in Paris the object of which is the increase and diffusion of Geographical knowledge. It will be unnecessary to discuss the merits of this undertaking. As long as Geography is so intimately connected with other branches of human learning, and while many parts of our globe are still unexplored, and others but imperfectly known, the importance of such an attempt will be obvious.

This society is patronized by the French Government, and includes among its members some of the most distinguished men of that nation.

In order more effectually to accomplish the object of their association, the society propose to award premiums from the funds in their possession for the best treatises on such subjects as they may propose for consideration, and although scarcely three years have elapsed since their incorporation, they already offer premiums to the amount of 7700 francs. The largest of which is a gold medal of the value of 3000 francs for " a manuscript and detailed relation of the ancient Cyrenaique founded upon the personal observations of the author, and accompanied by a geographical chart." The society in their circular, after briefly stating the advantages which may be expected to result from such an association, call upon the liberal and enlightened men of all nations to aid them in their design, by contributing such information (upon Geography or subjects connected with it) as may be in their power; whether founded upon their own observations or those of others. Any well attested facts of this kind, will find a place in the journals through which the proceedings of the society are to be made public, and due credit be given to the authors.

In an age as enlightened as ours, when so great a proportion of human talent and learning is devoted to the interests of science and to the extension of knowledge, it cannot be doubted that the above object will meet with general approbation—and if we cannot claim the honour of having originated the plan, we may at least, pursue the most honorable course which remains—that of giving it an effectual and cordial support.

28. *French Periodical Journals.*—The vast quantity of scientific matter which annually issues from the press in the metropolis of France is truly a subject of astonishment: and not only does much credit to the learned men of that city, but is alone sufficient to enstamp a character of scientific research upon the present age. Much praise is due to the editors of the various periodical Journals of Paris, not only for their industrious and successful investigations, but for the harmony and fraternal feeling prevailing among them. Though it would seem that many of them must have rival interests—still, they seem entirely devoted to the interests of science, and the asperities of party or personal feeling are not allowed to disgrace their pages.

1. The "*Revue Encyclopedique*," was noticed in the 3rd. Vol. of this Journal. It may now be remarked that the reputation of the work appears to be daily extending, and its usefulness consequently increasing. It is still characterized by industry, candour, liberality, judicious selections and important original matter; and in point of richness of variety, both of the entertaining and useful, it is unparalled by any similar work.

2. The "*Journal de Physiologie experimentale*," edited by M. Magendie was briefly noticed in this Journal, Vol. V. p. 185. Nothing need be said of the talents and indefatigable research of Dr. Magendie, which have justly placed him among the first, if not at the head of the physiologists of the present day. This Journal, no inconsiderable part of which is from the pen of its editor, is devoted to a very important subject, is very ably conducted, and has acquired an extensive and well earned reputation.

We subjoin a notice of several journals, the publication of which has been recently commenced.

1. *Bulletin Universel des Sciences et de l'Industrie.*—No periodical work was ever commenced on so magnificent a plan, or engaged such weight of talent, as seems pledged for the support of this Journal. For the information of those who may consider as visionary the plan of supporting a periodical journal, amounting annually to 17 octavo volumes, it may be remarked, that the plan has already gone into successful operation. The Bulletin is divided into 8 sections, which may be considered entirely independent of each other—each section constituting a distinct monthly journal. Each section is under the immediate charge of one principal editor, (redacteur principal,) or more, and of a number of associates, (collaborateurs.) The Baron de Ferussac has the general superintendence of the work. The plan of conducting this journal, it is thought, must very happily combine the advantages of individual responsibility, and of associated labour.

It is intended that the work shall be a *Methodical Repertory* of facts relative to the subjects of which it treats, and a *Monthly Review* of the successive labours of the human mind throughout the world.

Perhaps no better pledge for the success of the work can be given, than the following names, selected from the long list of collaborateurs.

M. M. Ampère, Béclard, Brόngniart, Chaptal, Chevreul, Cuvier, Cloquet, Counte dè Lacépède, Darcet, Dulong, Dumeril, Dupin, Dupont, Edwards, Geoffroy-Saint-Hilaire, Girard, Klaproth, Kunth, Lacroix, Laennec, Lisfranc, Magendie, Orfila, Pinel fils, Richard, Spurzheim, Tessier, Thenard.

The Bulletins of the several sections being entirely distinct, subscribers may take the whole work, or only a part.

The following is a summary of the several sections, and their prices.*

| Number of the sections. | Subjects of the sections. | Number of Pages per No. | Number of Vols. per annum. | Price per annum. At Paris. | Price per annum. For foreign countries, *port franc.* |
|---|---|---|---|---|---|
| 1 | Mathematics, Physics and Chemistry. | 64 | 2 | 15 francs | 20 francs |
| 2 | The Natural Sciences and Geology. | 96 | 3 | 22 | 29 |
| 3 | Medical Science. | 96 | 3 | 22 | 29 |
| 4 | Agriculture, &c. | 64 | 2 | 15 | 20 |
| 5 | The Arts. | 64, &1 pl | 2 | 18 | 24 |
| 6 | Geography, Polit. Econ'y, Voyages. | 80 | 2 | 18 | 24 |
| 7 | History, Antiquities, Philology. | 64 | 2 | 15 | 20 |
| 8 | Military Science. | 48 | 1 | 11 | 15 |
| | Total. | 576 | 17 | 136 | 181 |

2 *Annales des Sciences Naturales.*†—We know not who are the editors of this journal: but from the character of the first number it is presumed that the work is entrusted to skilful hands. No other recommendation will be required than the fact, that among the contributors to the first num-

* Journals, Periodical Reviews and Memoirs, or Transactions of learned Societies, will be received in exchange for one section or more of the Bulletin. Packages may be forwarded, *post paid*, to M. Anth. J. Girard, merchant, New-York, addressed, *A la Direction du Bulletin universel des Sciences et de l'industrie, rue de l'Abbaye, n.* 3, *à Paris.*

† The first number of this, and those of the three subsequently named Journals, have been transmitted from France to the Editor of this Journal.

ber are M. M. Prevost, Dumas, Ad. Brongniart, Richard, Geoffroy de Saint-Hilaire, and Kunth. The prospectus, after speaking of the influence of periodical Reviews, alludes in particular to the happy results which the *Annales de Chimie et de Physique,* conducted by M. M. Gay Lussac and Arago, have effected in the two sciences to which that journal is devoted, and proceeds to remark that the proposed journal of Natural History will have for its model the *Annales de Chimie et de Physique,* to which work it may be considered as a *complement.*

This journal will appear in numbers of one hundred and twelve pages each, the first of every month, dating from January, 1824. Many plates will be necessary in this department of science, and in order to give them proper dimensions, they will compose a quarto atlas, separate from the text. The price of the journal (with the atlas,) will be in Paris 36 francs: for foreign countries, *franc de port,* 44 francs.

3. *Archives Gènerales de Médecine.*—This work was commenced in Paris, Jan. 1823, and is to be continued in monthly numbers of 7 or 8 sheets (112—128 pages) each. Price in Paris 26 *francs* per annum. It is conducted by an association of physicians. The committee of publication (commission de redaction) for the year 1823 were *M. M. Bèclard, Bousquet, Breschet, Coutanceau, Desormeaux, Esquirol, Georget, Guersent, Orfila, Raige-Delorme and Rayer.*

4. *L'Asclèpiade.*—This *Journal of Medicine, Chirurgery and Pharmacy,* conducted by an association of physicians and surgeons of the large towns of the kingdom is published at *Marseilles.* The publication commenced in Jan. 1823, and a number containing 4—6 sheets (64—96 pages) is to be published every month. Price per annum in France 15 *francs,* for foreign countries 18 *francs.*

5. *Journal Médical de La Gironde.*—This work was commenced under the direction of a society of Medicine and Pharmacy, Jan. 1824, at Bordeaux, and is published in monthly numbers—six numbers to form a volume containing more than 400 pages. Price per annum 15 *francs* at Bordeaux.

We are gratified to observe by the appearance of the two last named journals that different departments of France are beginning to be represented by medical journals, the management of which has hitherto been confined almost exclusively to the Metropolis.

29. *English Opium.*—The poppy (Papaver somniferum) is recently cultivated in England, with much success, for the manufacture of opium. Messrs. Cowley and Staines of Winslow in the season of 1822 raised 143 pounds of excellent opium from 11 acres and 5 poles of land; for which they received a premium from the "society instituted at London for the encouragement of Arts, Manufactures, and Commerce." A medal has been given by this society to J. W. Jeston, Esq. Surgeon, for an improvement in collecting the juice of the poppy. His improvement consists in collecting the juice immediately after it exudes from the capsule, instead of allowing it to become inspissated on the capsule. The capsule is scarified with a sharp instrument gauged to a proper depth, when the juice is scraped off with a kind of funnel-form scoop fixed into the mouth of a phial. When one phial is filled the scoop is removed to another, and the juice is evaporated in shallow pans. Some varieties of the poppy are much more productive than others.

The opium raised in England has been used for everal years by physicians and surgeons, who pronounce it superior to the best Turkey and East Indian Opium.

*Trans. Soc. Man. and Com.* Vol. 41.

30. *Improved Crucible.*--The fragility of the earthen ware crucibles (technically called melting pots) commonly used by brass founders and other workers of metal, and the expensiveness of the plumbago pots have induced Mr. H. Marshall, of New Castle upon Tyne, to attempt an improvement in the manufacture of the earthen ware pots.

"Mr. Marshall's pots are made of a mixture of Stourbridge clay, potsherds, and pulverized coke, well incorporated together by beating; and, instead of being *thrown* on the potter's wheel, the pot is made by pressing the above composition into a brass mould of the proper size and figure, by means of a core worked by a powerful screw-press. Thus the vessel acquires a great and equal degree of solidity throughout; while the intermixture of coke with the clay, by giving a certain porosity of texture, renders it much less liable to crack on transition from heat to cold, than those melting pots composed entirely of earthy ingredients."— *Ibid.*

31. *Copper of Great Britain and Ireland.*—The quantity of pure Copper produced in all the mines of Great Britain and Ireland, during the year ending 30th June 1822, amounted to 10844 tons.

*Edinb. Phil. Jour. Vol. VII.*

32. *Combination of Alcohol with Oil of Turpentine.*—M. Vauquelin has found that if 100 parts, in volume, of volatile oil of turpentine, and 20 parts of Alcohol, are mixed together, they are not separable by rest, but form a homogenous body—an effect which rises from a solution of the alcohol in the oil. This compound does not become turbid by water.

*Ann. de Chimie Vol. XIX. p.* 279.

33. *Action of Cork on Chalybeate Waters.*—Mr. Wurza, on examining some bottles of chalybeate waters, was surprized to find no iron in them; and on seeking the cause of this circumstance he discovered it in the astringent nature of the corks, which had combined with the metallic substance. He advised, when chalybeate waters are kept in bottles, that the corks should be first well steeped in the waters, in order that the astringent matter they contain may be saturated with the iron.

*Lond. Med. and Phys. Jour.*

34. *Uninflammable Clothes.*—M. Gay Lussac announced in the sitting of the Academy of Sciences, 6th Nov. 1820, that Linen dipped in a solution of phosphate of ammonia became incombustible.

M. M. Merat-Guillot, father and son, apothecaries at Auxerres, have since shown that the acidulous phosphate of lime posseses the same property. In fact, linen, muslin, wood, paper, straw, impregnated with a solution of this salt at 30° or 35° of concentration, (126 to 130,) and dried, became absolutely uninflammable, and consequently unfit to communicate fire. They carbonize or char when they are exposed to a very intense flame, but the carbonization does not extend beyond the focus of heat in which they are plunged.

*Jour. of Science &c.* 1822.

35. *Animal Electricity.*—Mr. Glover has published the following method of receiving the electrical shock from a cat. Place the left hand under the throat, with the middle finger and the thumb slightly pressing the bones of the animal's shoulder—then gently passing the right hand along the back, sensible electrical shocks will be felt in the left hand. *Phil. Mag. Vol. X.*

36. *Silk Worm.*—In a communication to the society for Arts and Manufactures, (Vol. 4. p. 163) it is stated by Miss Henrietta Rhodes, that one line of the silk worm, when unwound, measured 404 yards, and, when dry, weighed 3 grains. Hence it follows that one pound avoirdupois of the thread as spun by the worm, may be extended into a line 535 miles long, and that a thread which would encompass the earth would weigh no more than 47 pounds.

37. *Preservation of Fish by Sugar.*—Dr. MacCulloch in a letter to Dr. Brewster states that fish may be preserved in a dry state, and perfectly fresh, by means of sugar alone, and even with a very small quantity of it. I have thus kept salmon, whitings, and cod, for an indefinite time, and with the best effect. The sugar gives no disagreeable taste. If desired as much salt may be used as to give the taste that may be required ; but this substance does not conduce to their preservation.

In the preparation it is barely necessary to open the fish, and to apply the sugar to the muscular part, placing it in a horizontal position for 2 or 3 days, that this substance may penetrate. After this it may be dried, and it is only further necessary to wipe and ventilate it occasionally to prevent mouldiness. A table-spoonful of brown sugar is sufficient in this manner, for a salmon of five or six pounds weight : and if salt is desired, a tea spoonful or more may be added. *Edinb. Phil. Jour. Vol. VII.*

38. *Ductility of Glass.*—Mr. Deuchar, in a paper read before the Wernerian Natural History Society, gives an account of several curious circumstances connected with the ductility of Glass, shewing that the most attenuated threads retain the character and shape, twisted angular or tubular, of the mass from which it is spun, illustrating his remarks by an experiment, proving the passage of quicksilver through the most minute threads.

*Ibid.*

39. *Blowing Sand.*—On the 29th of March, 1821, in N. Lat. 11° 3′, W. Long. 22° 5′, it was observed by a gentleman going to the East Indies, that sand in considerable quantities was found adhering to the upper rigging of the ship. This must have been blown from the shores of Africa, the nearest point of which was at least 300 miles distant from the ship. *Ibid.*

40. *Aurora borealis in Faroe and Shetland.*—Mr. Trevelyan observed, that the Aurora borealis in Faroe and Shetland was often seen very low, not more than 40 or 50 feet above the level of the sea; and he learned that in both countries it is frequently heard. In Faroe Mr. T. met one person who stated, that when the colour of the Aurora borealis is dark red, and extends from west to east with a violent motion, he had experienced a smell similar to that which is perceived when an electric machine is in action.

*Ibid.*

41. *Passage from Asia to America.*—That public spirited nobleman Count Romanzoff, who fitted out, at his own expense, the expedition under Kotzebue for circumnavigating the globe, has sent out travellers to cross the ice from the eastern coast of Asia to the western coast of America. *Edinb. Phil. Jour. Vol. VIII.*

## II. Domestic.

1. *American Geological Society.*—Since the last notice, a box of minerals, illustrating the mineralogy and geology of Rhode-Island, has been presented to the Society by Doct. Samuel Robinson, of Providence.

William Maclure, Esq. President of the Society, has forwarded part 1st of Conybeare & Phillips' Geology of England and Wales, the fourth number of Magendie's Journal de Physiologie experimentale et pathologique, Nos. 44, —5—6—7—and—8, of the Revue Encyclopedique, 3 Nos. of the Journal de Physique for January, July, and August, 1822, and also Greenough's magnificent Geological Map of England, all of which have been received.

Professor Buckland's splendid work, the Reliquiae Diluvianae, has also been received from the author.

*Omission.*—Two valuable boxes of specimens from the northern lakes, and various other parts of the United States, forwarded by Major Delafield to the Society in 1823, have not been acknowledged till now, an omission which was not before observed.

2. *Effect of changes of temperature on the impelling power of moving water.*

York (Pa.) 18th August, 1824.

To the Editor.

*Sir*—A singular circumstance has been observed in this vicinity lately, which has given rise to considerable discussion. The opinions entertained respecting it by those who have turned their attention to it, are various; nor has any one been able to account, satisfactorily, for it. This induces me to trouble you with a brief narration of it, believing that every fact of the kind will be, by you, deemed worthy to be added to that stock of knowledge, which observation has been gleaning and treasuring up for the scrutiny of science.

At the mouth of a creek which empties itself into the Susquehannah, a short distance south of the Columbia bridge, there stands a saw-mill, which cuts an immense quantity of timber. The owners, as well as several of the workmen who attend the mill, state it as a fact that at *night*, in the course of a given time, with the same head or quantity of water, and without any alteration being made in the gearing, or machinery of the mill, the saw cuts much more timber, than it does in the same time in *daylight*;

and further, that it cuts more in a given time in *winter* than it does in *summer*. The owners, from being accustomed to the motion and tone of the saw in the course of the day, say they can readily perceive an increase of strokes and a greater force in the saw, at night; but how to account for it they know not. It has become matter of much speculation and dispute among the mechanics, workmen, and floaters of lumber on the Susquehannah.—A gentleman, who deals largely in lumber, and who sometimes attends to the floating of rafts himself, states, that a raft will float nearly a third faster in the *night*, than in the *day*. The two facts are probably referable to the same cause; and the discovery of that cause is desirable.

Respectfully your Obedient Servant.
SAMUEL WAGNER.

REMARK.

No other explanation of the facts stated above occurs than that which is implied in the title given to this fragment. It would be interesting to know, whether other persons have noticedthe same facts, and whether the mills have been observed to move more slowly as the water approaches the freezing point, which ought to be the fact, as between 40° and 32° water grows lighter, although growing colder, according to a remarkable, but now well established exception in the case of this fluid.—*Ed.*

3. *Dreadful Effects of an Excessive Use of Sulphur.*—Professor Olmsted, in a geological excursion in the county of Wake, North-Carolina, met with the following fact, which we present in his own words: "At Mrs. Thomson's, where I dined, I saw a fellow-creature whose sufferings made me truly thankful even for my own imperfect health. He was a son of Mrs. T. and nearly fifty years of age. When I came into the porch, he was sitting before the entrance in an elbow chair, surrounded with pillows, with no clothing but a frock of linen, that came half way down his knees. The ghastly image of death was imprinted on every part of his emaciated frame. The bones of his arms and legs were hardly covered with flesh, and the joints of the knees, and the largest joints of the fingers, were

increased to an enormous size. His knees were drawn together beyond the power of separation, shortening the left leg so that nothing but the toes reached the floor. The hands were forcibly and irremovably fixed to the breast, the distorted fingers being bent backwards, forming an arch over the swollen mound at the joints. A little motion with the ends of the fingers was all the sufferer could produce; and I was much impressed with the insensibility of man to his ordinary blessings, when I saw this poor invalid call several times for a servant to come and brush off a fly that was biting his leg unmolested. On his back was a large running sore, which his friends were uncertain whether to ascribe to disease, or to the effects of lying so long in a horizontal and immoveable posture. The daily dressing of this sore, which was performed while I was present, gave him so great pain, that he was unable to sit up a moment after it was completed. Three servants took him up with all possible care, and laid him on the bed; while the excruciating misery which this gentle movement produced, filled the mouth of the sufferer with groans and entreaties. Here he lay, bewailing his lot in a hollow, piteous tone, and crying, "Oh that thou wouldst hide me in the grave, that thou wouldst keep me secret, until thy wrath be past!" On enquiring the cause of his sufferings, I was told that, three years ago, being afflicted with rheumatism, he took the advice of a quack to attempt its cure by enormous doses of sulphur. With this view, he mixed a pound of sulphur with five quarts of water, and stirring it, took half a pint three times a day, until he had taken six pounds of sulphur. Soon after, commenced the pain and distortion of his limbs, which had subjected him to increasing and excruciating sufferings ever since.—*Communication to the Editor.*

4. *Peculiar form of some of the Beryls of Haddam, Conn.*—A correspondent, distinguished by his accurate discrimination of minerals, and especially of the peculiarities of crystals, remarks of some beryls, which he obtained from one of the quarrymen at Haddam that "they are different in form from any that he has ever seen or heard of." "One specimen, he remarks, has part of a hexahedral prism—the facettes of which are alternately broad and

narrow, so that a transverse section, in a direction perpendicular to the axis, presents a surface nearly triangular, but then, this prism is surmounted by a pyramid truncated at the apex : a larger crystal and some smaller ones are *pyramids only* without prisms—the proportion of the diameter of the base to the perpendicular height is as 20 to 30 and the diameter of the truncating surface near the vertex is as 8. "Now" continues our correspondent "I never before heard of pyramidal truncations, although in the emerald we see the terminal edges, bevelled or truncated, and the apex of the pyramids is truncated like that of the beryls in question."

Among the numerous specimens of Beryl in the collection of Col. Gibbs there are only two which have a slight truncation of the terminal edges, presenting the *commencement merely* of a pyramid ; but among the Haddam beryls we have often observed the peculiarities mentioned above, still we cannot doubt that the specimens are true beryls although they have not been analysed.—*Editor.*

*August* 9, 1824.

5. *Medicinal properties of the waters of the Mississippi—mineral impregnation of the well water of Henderson, Ohio.*

Extract of a letter to the Editor.

"My health being much enfeebled, necessity compelled me to take a trip to New Orleans for the sake of using the water of the Mississippi river. The effect was salutary and the voyage a pleasant one. The Mississippi water when freely drank, produces powerful effects—when filtrated it is very clear, and may be drunk in large quantities without burthening the stomach. It certainly possesses some properties not common to other waters, but its qualities I believe have never been examined by chemists. My ill health I attributed to the water of Henderson. It is strongly impregnated with some mineral. The common opinion is, that it is impregnated with copperas. The ground on which Henderson and the country adjacent stand, has, from 40 to 60 feet beneath the surface, a substratum of mineral coal, the best for fuel and the forge that I ever saw. This coal is washed bare on the banks of the Ohio and Green rivers—intermixed is a mineral of a bright green and yellow hue, which is used for the same purposes as copperas. Families that die woollen or cotton cloth collect a quantity of this coal, put it into a proper vessel to which they add water and boil till the water has extracted the mineral from the coal. In this water they immerse the articles to be dyed. Copperas too has been manufactured from this coal, in some small quantities, and sent abroad for market.

Through this coal all the waters in and about Henderson probably pass, and thereby acquire strong mineral properties, which give them a particular taste and render them pernicious to health."

6. *A System of Universal Geography*, on the principles of Comparison and Classification; illustrated by Maps and Engravings. Modern Geography, by William C. Woodbridge, A. M. late Instructor in the American Asylum. Ancient Geography, by Emma Willard, Principal of the Female Seminary at Troy. Hartford: published by Oliver D. Cooke & Sons. 1824.

The principal object of the authors, in preparing this work, was to give to Geography that scientific arrangement which has been so successfully applied to other branches of study. Most works on this subject have presented little more than a collection of facts, grouped by an imperfect method, and so little connected by any associating principle, as to overload the memory and fatigue the mind. Little or no use has hitherto been made, by the greater number of writers, of the important principles of classification, in reducing geography to the form of a science, and thus increasing the facility of acquiring and retaining its details. Mr. Woodbridge divides the subject into Physical, Political and Statistical Geography. Under the first head are given general views of the structure and natural divisions of the earth—its rivers, mountains, climates, productions, &c. Political Geography is a description of the state of men in society, including an account of their government, religion, knowledge and arts. Statistical Geography is a description of states and empires, with their extent, population and resources. The manner in which these subjects are treated shows extensive research. and under the two first heads particularly, is contained much valuable information—much that is new, and found in no other geography, though properly belonging to the science. The style is perspicuous and concise, and the matter is so much compressed as to occupy but one volume of moderate size.

The work is accompanied by an atlas, on a new plan, exhibiting, in connexion with the outline of countries, their climate and productions, their prevailing religion, forms of government, and degrees of civilization, with the comparative size of towns, rivers and mountains. The plan is ingenious, and the information thus communicated through the medium of the eye, will make a much stronger and more durable impression on the mind, than that received by mere description, while it is also acquired with more interest and pleasure.

We think Mr. Woodbridge has succeeded well in his design, and deserves the thanks and the patronage of the community. The Ancient Geography is on the same general plan with the modern. We have not examined it very minutely, but from the established reputation and long experience of Mrs. Willard as a teacher, we doubt not that it is worthy of the approbation of the public.

7. *The New-York State Horticultural Society.* A society to be known by this name has recently been formed in the city of New-York, the object of which is "the improvement of Horticulture in all its branches, and also the extension of the knowledge of indigenous and foreign plants, especially such as are useful and ornamental."

It is intended "to establish a garden of from ten to twenty acres, in the vicinity of the city, for the express purpose of horticultural improvement, and, as far as practicable, the general advancement of botanical science."

"The propagation of fruit trees will especially engage the attention of the Society." The garden will have "a portion appropriated to ornamental flowers, and also a particular section set apart for a distinct *Flora* of the United States."

"It is also contemplated to erect suitable buildings for Lecture Rooms, and a Botanical Library and Cabinet; and ultimately to establish a Professorship of Botany and Horticulture."

The officers for the year 1824 are,

Hon. Stephen Van Rensselaer, *President.*

Philip Hone, } *Vice-Presidents.*
John Torrey, M. D. }

John Low, *Treasurer.*

John Griscom, } *Corresponding Secretaries.*
Isaac M. Ely, }

Lambert Suydam, } *Recording Secretaries.*
Charles Mowatt, }

The council, consisting of thirty resident, and twenty non-resident members, combine much of the wealth, talent and influence of the city and state. From the respectability and influence engaged in this object, we can hardly doubt that the institution will become a distinguished ornament to the city, and an honour to the country at large.

8. *Journal of the Academy of Natural Sciences of Philadelphia.*—This Journal continues to be very ably supported. The 3d volume, containing 480 pages, is completed, and the first number of the 4th volume has appeared this month, (July, 1824.) A very considerable part of the work is devoted to the *Animal Kingdom*, a portion of nature until lately much neglected in this country. Two very elaborate papers, published in continuation, are conspicuous in the several last numbers. 1st. "Descriptions of Coleopterous Insects, collected in the late expedition to the Rocky Mountains, performed by order of Mr. Calhoun, Secretary of War, under the command of Major Long; by Thomas Say, Zoologist to the Expedition:" and 2d. "Observation on the Nomenclature of Wilson's Ornithology; by Charles Bonaparte."

The following is the list of officers for the year 1824.

*President*—William Maclure.

*Vice-Presidents*—Zaccheus Collins, George Ord.

*Corresponding Secretary*—Reuben Haines.

*Recording Secretary*—William H. Keating.

*Curators*—Thomas Say, C. A. Lesueur, J. P. Wetherill, Isaac Hays, M. D.

*Treasurer*—Jacob Gilliams.

*Librarian*—Jacob Pierce.

*Auditors*—W. S. Warder, J. M. Brewer, R. E. Griffith, M. D.

*Committee of Publication*—Thomas Say, Isaac Hays, M. D., Isaac Lea, R. E. Griffith, M. D., W. H. Keating.

P. S. Some items of Domestic Intelligence are excluded to give place to the following notice of a letter to the editor, dated Hamburgh, May 20th, 1824, received just as the last form of this number was going to the press.

*An Exchange of Objects of Natural History, and of Ingenious Artificial Curiosities*, has recently been opened in Neueburg, No. 43, Hamburgh, by Charles Henry Bescke, a native of Philadelphia. By his connexions in the East and West Indies, Brazil, the Canary Islands, and various other parts of the world, this gentleman has been enabled to make an extensive collection of Birds, Amphibious Animals, Insects, Shells, Corals, &c.; also, Minerals, Dried Plants, Seeds, and ingenious Artificial Curiosities. He is desirous to form a connexion with some amateurs and collectors of the United States. He will receive *in exchange* any Natural Products; and will pay money for good skins of the quadrupeds and birds of this country, and for well preserved insects and butterflies. These articles may be forwarded to some house in Hamburgh, to be delivered to him, or directly to him. If an exchange be requested, he is willing to make up the first package, if the objects of which it is to consist be specified. He will exchange or sell either collections or single specimens, and will endeavor to establish reasonable prices. He would like to receive in the autumn, a quantity of living crysalides of butterflies, which, being enwrapped in cotton, generally come safe to hand. For these, he would send in return, European ones, or other natural products, as might be desired.

An institution of this kind, it is thought, may be very beneficial in facilitating the acquisition of specimens of the objects of Natural History, and it is hoped that the gentleman may receive merited encouragement.

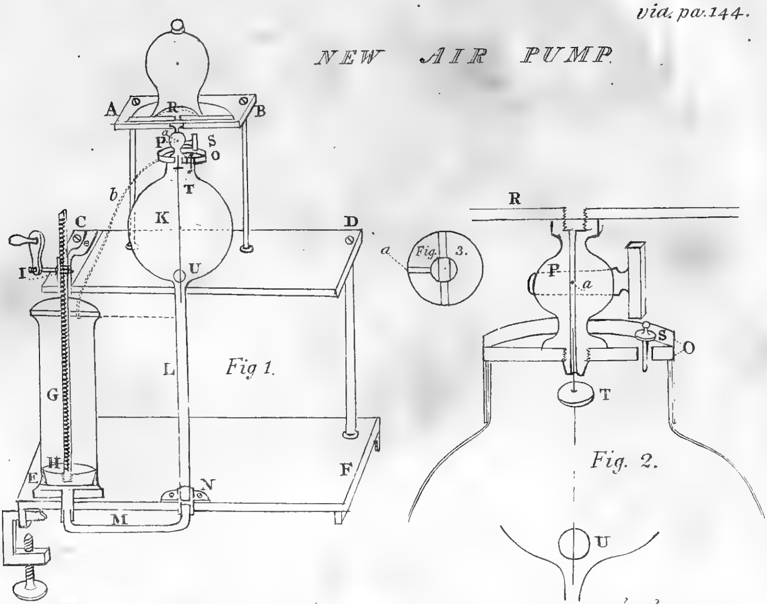
Remark.—We have received a printed report of the survey for a canal in the State of New-Jersey; but a notice of this, and of various other domestic articles, which were intended for this number, is necessarily postponed.

# INDEX TO VOL. VIII.

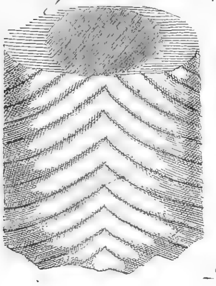
PLATE, 2.

*vid. pa. 144.*

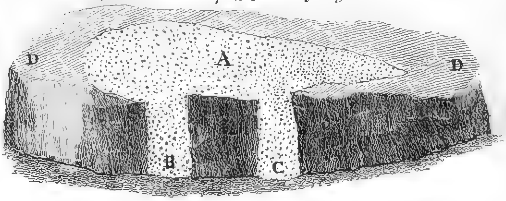
NEW AIR PUMP



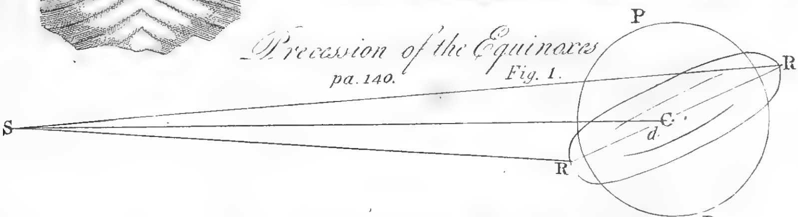

*Organic Relic.* pa. 85.



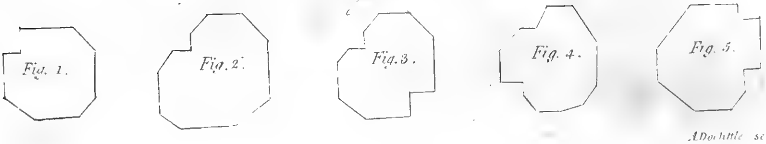
*Singular position of Granite.* pa. 5.




*Precession of the Equinoxes* pa. 140. Fig. 1.




*Crystals.* pa. 91.

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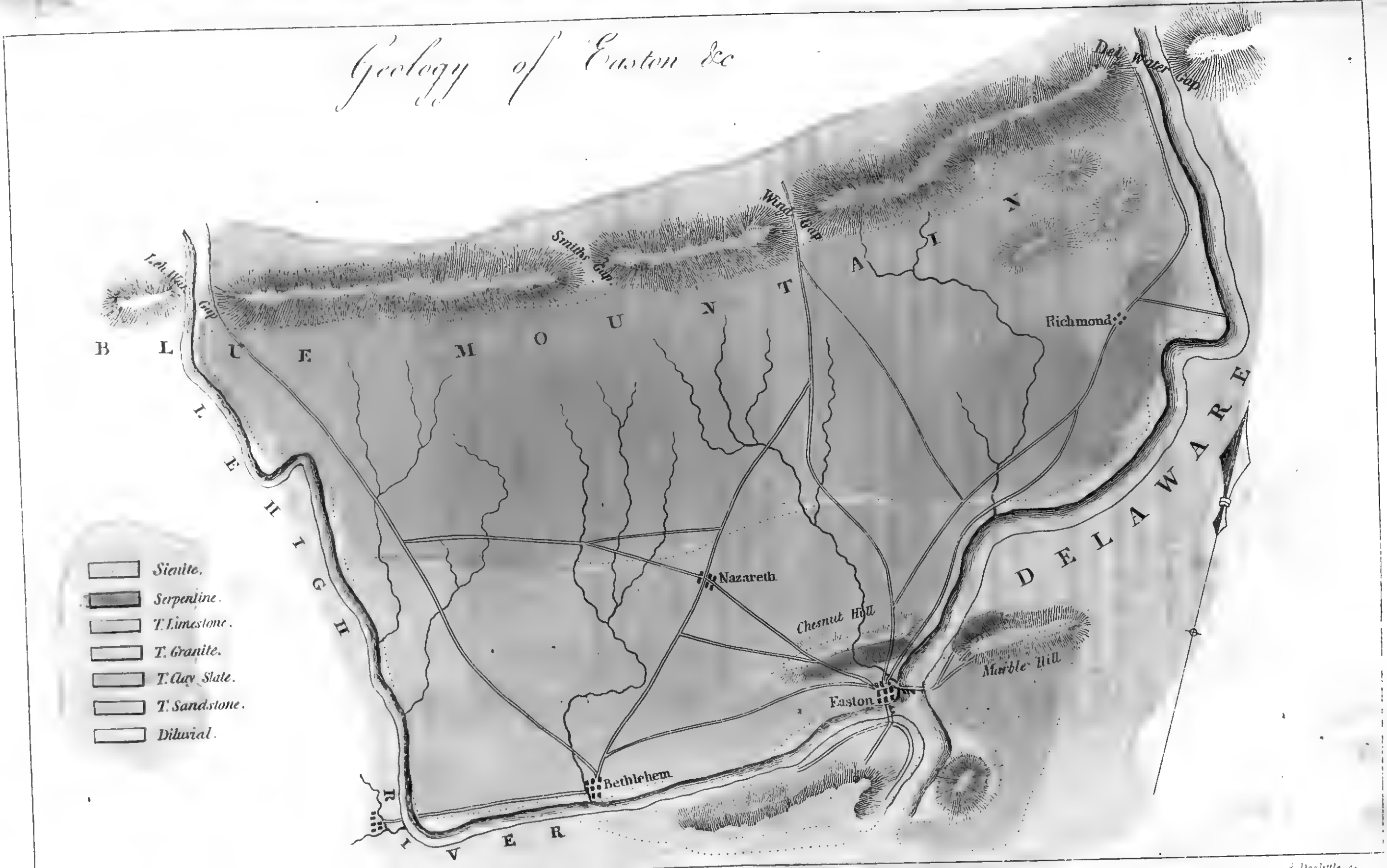



A. Doolittle sc

# Granite veins.

Fig. 1.

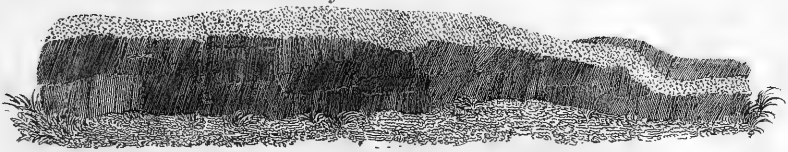


Fig. 2.

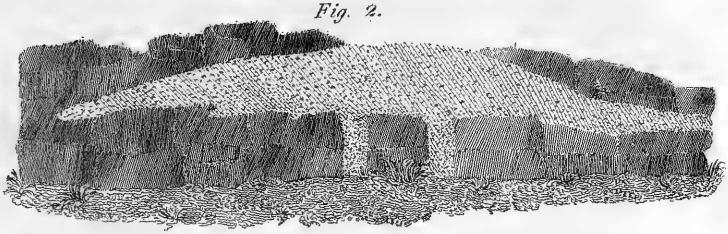


Fig. 3.

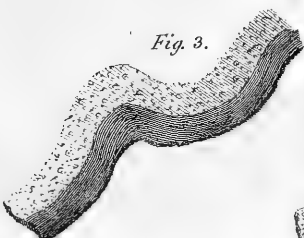


Fig. 4.

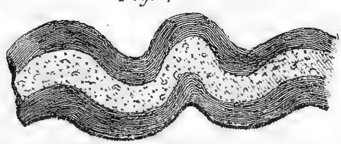
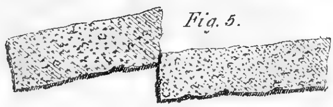
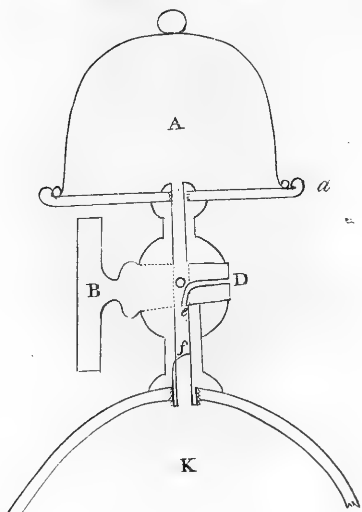


Fig. 5.



Dana's Air Pump.



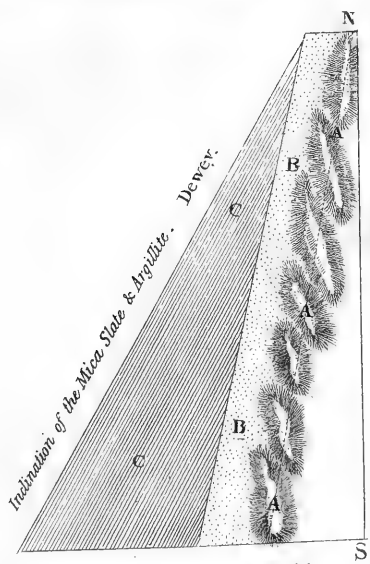




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PLATE III
pa. 271.

# PROF^R DEBUTTS' NEW GALVANIC INSTRUMENTS.

Fig. 1.

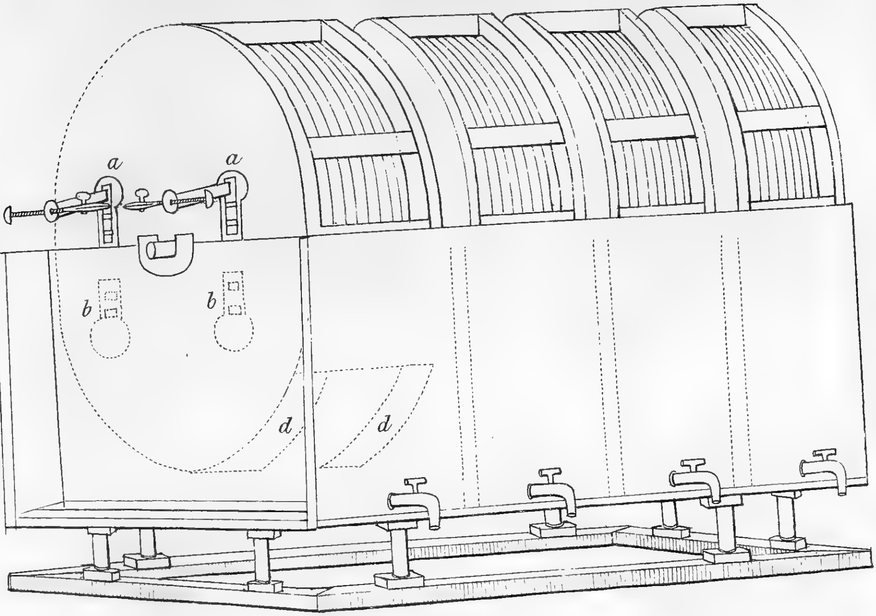
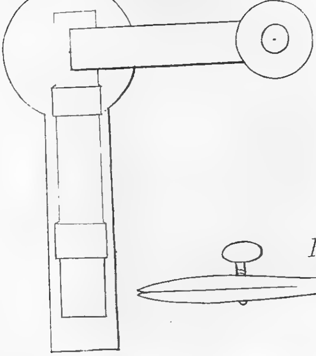



Fig. 3.



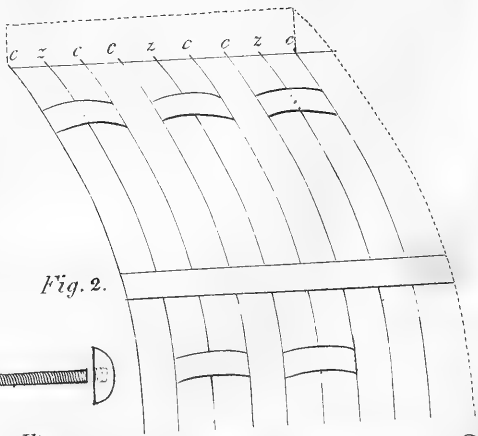
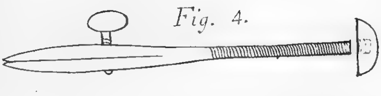



Fig. 2.

Fig. 4.



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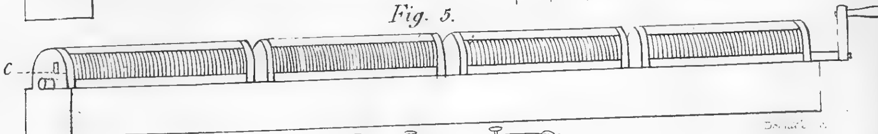


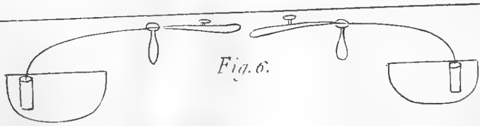
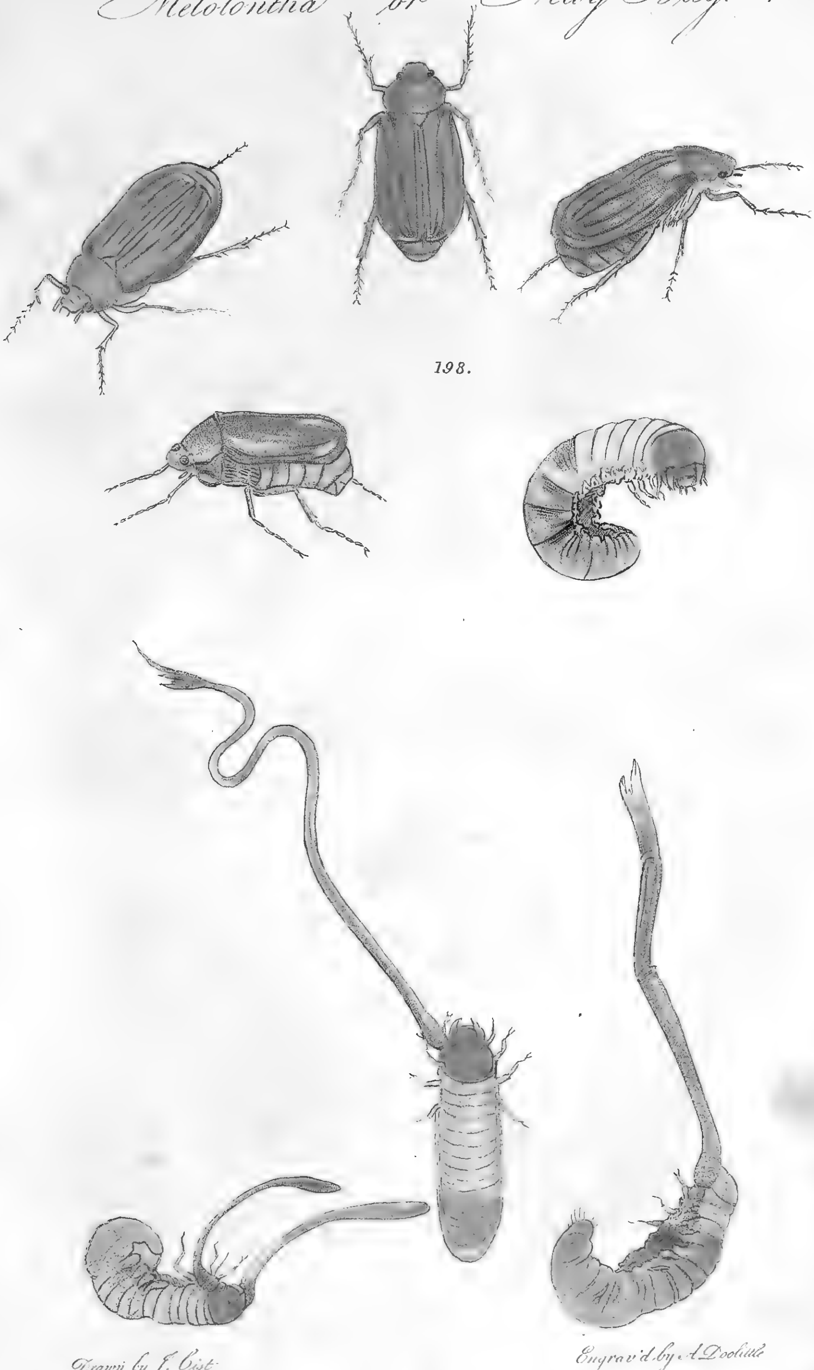



Fig. 6.

PLATE IV. pa. 269.

*Melolontha or May Bug.*



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Drawn by J. Cist. Engrav'd by A. Doolittle

Gen

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VOL. VIII. No. 1.—May, 1824.

NEW-HAVEN;

PRINTED AND PUBLISHED BY S. CONVERSE, FOR THE EDITOR.

SOLD BY THE PUBLISHER; BY E. LITTELL,

PHILADELPHIA, AND TRENTON, N. J.; AND

By Howe & Spalding, New-Haven; Davis & Force, Washington, (D. C.); Huntington & Hopkins, Hartford; Cummings & Hilliard, Boston; Goodale Glazier & Co Hallowel, Maine; A. T. Goodrich & Co. New York; Caleb Atwater, Circleville, Ohio; Thomas J Ray, Augusta, Ga.; Whipple & Lawrence, Salem, Mass.; Edward J. Coale, Baltimore; B. D. Plant, Columbia, S. C.; Miller & Hutchins, Providence, R. I.; Thomas R. Williams, Newport, (R. I.); William T. Williams, Savannah, Geo.; Luke Loomis, Pittsburgh, Pa.; Daniel Stone, Brunswick, Me.; Professor D. Olmsted, Chapel Hill College, N. C.; John Miller, No. 69, Fleet-street, London.

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## INTELLIGENCE AND MISCELLANIES.

### I. Foreign.



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## ERRATA IN VOL. VII.

*In the article* Caricography.

Page 271, line 10, for *C. stipata*, C. muhlenbergii, read *C. stipata.* C. muhlenbergii; or, the comma should be a period.

278 5 & 6, dele, "scarcely sheathing the peduncle except the lowest."

*In the article* Rain Gage.

| | | | | | |
|---|---|---|---|---|---|
| Page 327, | line 2, | (from bottom,) | for 252525, | read | 25252.5. |
| 328, | 6, | (from top,) | 222.525, | | 252.525. |
| 329, | 10, | (from bottom,) | 14000, | | 140000. |
| 330, | 7, | (from top,) | 126262.5 500, | | 126262.500—00. |
| — | 14, | (from top,) | 1010.10.04, | | 1010.10—.04. |

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## TO CORRESPONDENTS.

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