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Page 145, line 11 from top, for *a fish*, read *the fist.*
" 147, Art. 8 is substantially repeated on page 156.

Correction.

Page 64, line 12 from top, after *and*, read *except being below*.
" " " 3 from bottom, for *dividing*, read *multiplying*, and after *by*, read 100 *and dividing by*.

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Page 138, line 13 from top, for *Gienofleiche* read *Geinsfleiche.*
" " " 17 " " for *blocks* read *blacks.*
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" 145, " 11 from top, for *a fish,* read *the fist.*
" 147, Art. 8 is substantially repeated on page 156.

Correction.

Page 64, line 12 from top, after *and,* read *except being below.*
" " " 3 from bottom, for *dividing,* read *multiplying,* and after *by,* read 100 *and dividing by.*

Rev. Sayrs Gazlay, of Salem Bridge, Waterbury, Conn. is the author of the article on the bones at Big Bone Lick, Kentucky.

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Page 363, 10th line from bottom, before *scientific* read *un.*
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Page 264, under *construction,* first line after diameter, read *and 9 inches long.*

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Article I.—*Of the Phenomena and Causes of Hail Storms.* By Denison Olmsted, Professor of Mathematics and Natural Philosophy in Yale College.

Showers of hail present themselves to us under two very different forms. Sometimes they consist merely of frozen drops of rain, unaccompanied by any extraordinary appearances; and are easily accounted for, by supposing that the air happens at that time to be colder than the region of the clouds, and that the drops of rain are congealed in falling through it. But in those *storms*, whose mysterious causes we are now desirous of penetrating, the hail stones are of great and sometimes enormous size, and are associated with the most impressive and sublime phenomena of nature.

To pass over many statements on record of hail stones of a magnitude almost surpassing belief,* we have authentic statements of such as exceeded one foot in circumference,† and those larger than a hen's egg are of yearly occurrence.

To account for these extraordinary hail storms, is considered as one of the most difficult problems in meteorology. There is little to be found on this subject in systematic works; but the accounts of the facts lie scattered up and down in scientific journals, and in the transactions of learned societies. After comparing a great number of these descriptions of hail storms, the following propositions appear to me to embrace the most important facts.

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* It is related, that during the wars of Lewis the XII, in Italy, in 1510, there was for some time a horrible darkness, thicker than that of night; after which the clouds broke into thunder and lightning, and there fell hail stones of one hundred pounds weight. (Encyc. Perth. II, p. 14.)

† Halley, Phil. Trans.

1. Hail storms, when violent, are characterized by the meeting of all the elements of storms; the clouds are very black; they are strongly agitated, and fly swiftly through the air, or more frequently rush towards each other, attended by high winds and terrific thunder and lightning.*

2. Hail storms, of the foregoing character, are confined chiefly to the temperate zones. They rarely occur in any form in the torrid zone;† and when they do, it is chiefly on high mountains. Hail is indeed frequent in the polar regions; but it is of the ordinary kind before mentioned, and is therefore not the subject of our present inquiry. Of all places in the world, the South of France is most remarkable for frequent and violent hail storms. During the year 1829, an insurance company was formed in France for the special purpose of affording protection against their ravages.

3. The most violent hail storms occur chiefly during the warmer half of the year, and most frequently in the hottest months.

4. The hail stones that fall during the same storm, are found to be much smaller on the tops of mountains than in the neighboring plains.

5. Though hail stones are of various forms, yet they frequently exhibit in the centre a nucleus which is white and porous, while the other parts consist of concentric layers of ice, either transparent or of an opake white, or alternately transparent and opake.

6. A shower of hail during the warmer season of the year, is often followed by cooler weather; in spring and fall particularly, hail is a well known precursor of cold.

Whatever may be the remoter cause of this phenomenon, we can be at no loss for the immediate cause, namely, *a sudden and extraordinary cold in the region of the clouds, where the hail stones begin to form:* Nor can there be any doubt, that the degree of cold by which the nucleus is congealed, must be very intense,—far below 32°, or the freezing point of water,—since this nucleus, as there is every reason to believe, rolls up to the final size of the hail stone, by

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* Phil. Trans. Vols. IV, and V.

† Rees says never; but the Ed. Encyc. Art. Phys. Geog. says, 'at an elevation not less than 1500 or 2000 feet.' V. Tilloch's Mag. Vol. XLIII, p. 191.

congealing upon itself the watery vapor which it meets with in its descent to the earth. But, although the presence of such an intense degree of cold is implied in the formation of hail, yet the great question before us is, *what is the origin of this cold itself?* Among the different suppositions which have been made, or which may be made, there are only two that are worthy of notice. One is, *that the cold is generated by the immediate agency of electricity;* the other, *that it is derived from the region of perpetual congelation.*

In the first place, *what reason have we to believe, that the cold which produces hail is generated by the agency of* ELECTRICITY? Were we to confine our attention to the whimsical reasons, or to the gratuitous assumptions, on which most writers upon electricity proceed, in ascribing to it the power of producing such an extraordinary degree of cold, we should conclude at once that the hypothesis was without foundation.* But it is still proper to inquire if we cannot discover a connexion between some known property of electricity, and the sudden production of an intense degree of cold. It is a known property of electricity, *to rarefy air*, and rarefaction produces cold. When we strongly electrify a Leyden jar, the air is frequently so much rarefied as to rush out from any opening in the cover with a hissing noise. In like manner, the air which supports and envelops thunder clouds, being strongly electrical, might be conceived to be powerfully rarefied, and the temperature proportionally reduced. The power of a sudden rarefaction of the air to precipitate in the form of hail, the moisture contained in it, is strikingly exemplified in the apparatus employed for raising water at the mines of Chemnitz in Hungary. The only point to be attended to at present is, that a quantity of air previously confined under the pressure of a column of water 136 feet in height, is suddenly permitted to escape, and has its temperature so much reduced by the enlargement of the volume, that the moisture present falls in a shower of hail.†

Another argument in favor of the supposition that hail owes its origin to electricity, is derived from the protection against hail-storms

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* See, especially, Priestley's History of Electricity, p. 371—Malté Brun, Phys. Geogr. Vol. I.—Van Mons, in Nicholson's Phil. Jour. XXIV, 106.

† Lib. Useful Knowl. Art. 'Hydraulics,' p. 18. The same views with respect to the origin of the cold of hail storms are expressed in this Journal, Vol. XV, Morveau also has the same idea. (Journal de Phys. IX, 64.) Idem. XXI, 146.

alleged to be afforded to vineyards in France, and the neighboring countries, by erecting among them long pointed poles, or *hailrods*, (paragrêles,) as they are called. Could the fact be fairly established that places furnished with such hail rods are protected from the ravages of hail-storms, while other places in the midst of them, and all around them, are laid waste by these destructive visitations, it would go very far to prove that hail is produced by the agency of electricity. This point therefore requires to be considered with attention.

It is now more than 50 years since it was first proposed by men of science in France, to avert the calamities which that kingdom sustains in a very peculiar degree, from hail-storms, by erecting conductors, with the view of drawing off the electricity that was supposed to generate the storms. The land proprietors, however, did not display the expected eagerness to avail themselves of the proposed security, and a writer complains that for thirty years afterwards, not a single landholder had put the experiment in practice.* But as late as the year 1821, the Linnæan Society of Paris† revived the interest in this subject, and caused numerous experiments to be made, which have inspired, it appears, much confidence in the efficacy of hail rods. In a late number of the Annals of that Society, the subject is thus noticed. "The Paragrêle, or hail rod, has for several years occasioned much inquiry on the continent, and has engaged the particular attention of the society. In many districts, which were formerly, year after year, devastated by hail, the instrument has been adopted with complete success, while in neighboring districts, not protected by paragrêles, the crops have been damaged as usual; and the Society are receiving from all quarters statements which fully confirm their opinion of the utility of the invention. The Society have made a report to the ministers of the interior, recommending that measures be adopted by the general government, for protecting the country from hail; and it is estimated, from the result of experiments in numerous districts, that if paragrêles were established throughout the whole of France, it would occasion an annual saving to the revenue of fifty millions of francs."‡

These statements are certainly favorable to the hypothesis in question; but since the experiments are in their infancy—since hail storms are often of very limited extent, and, of places very near to each other,

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* Tilloch's Phil. Mag. Vol. XXVI, p. 213. † Am. Jour. Vol. X, p. 196.
‡Am. Jour. Vol. XII, p. 298.

one is desolated, while another escapes uninjured—and since such apparent exceptions in favor of the utility of hail rods would very naturally be exaggerated, I do not feel warranted in assuming the fact of their efficacy as fairly established.* With regard to the merits of the hypothesis in general, I would offer the following remarks.

1. Although we can conceive that a portion of the atmosphere, suddenly and highly rarefied by electricity, might produce the degree of cold requisite to form hail, yet the *possibility* of an event is but slight evidence of its reality; and we have here no independent evidence that such a rarefaction does in fact take place; but, on the contrary, we have certain evidence from the concourse of opposite winds, from the density and consequent blackness of the clouds, that a great condensation of air takes place in the region of the storm.

2. If hail be produced by electricity in the manner supposed, why is it not a *constant* associate of thunder storms, since the same causes operate continually; yet the rare occurrence of hail-storms, as well as their desolating effects, mark them, as out of the common course nature. Why, especially, do not hail storms occur in the torrid zone, where the electricity of the atmosphere is most abundant, and the phenomena of thunder storms the most violent and terrible? Not being able therefore to satisfy ourselves that hail storms are produced by the agency of electricity, let us inquire, in the second place, *what reason we have to believe that they owe their origin to the* COLD OF THE UPPER REGIONS OF THE ATMOSPHERE.

It is a well known fact, that the atmosphere grows continually colder as we recede from the earth, until, at a certain elevation, we reach the temperature of freezing water, called the *term of congelation;* that the height of the term of congelation above the surface of the earth varies with the latitude, being greatest at the equator, but coming very near to the earth at the pole; that its average height at the equator is abont fifteen thousand feet, at the latitude of 30° twelve thousand feet, and at the latitude of 50° six thousand;† that beyond this line of perpetual congelation, the reduction of temperature still proceeds until it shortly

* The establishment of Hail Insurance Companies, so late as the year 1829, indicates a want of confidence in this kind of protection. On account of the efficacy of lightning rods, no such companies are needed to secure the public against damages by lightning.

† Ed. Encyc. 'Phys. Geography.' See figure, page 9.

reaches a degree of cold the most intense that can be imagined. If we now contemplate a current of air, that is, a wind blowing horizontally first at the surface of the earth and afterwards at different elevations, we shall find that it will be subject to the following modifications. We will suppose it to blow first from the polar towards the equatorial regions. When it moves at the surface of the earth, it will rapidly imbibe the heat of the earth as it traverses the warmer latitudes; at the height of one thousand feet it will feel the influence of the earth much less, and grow warm much slower than before; and at the height of ten thousand feet, it will, for the most part, sweep quite clear of the mountains, and be a current of air blowing through the atmosphere alone. And since, as in the case of the gulf stream, a fluid does not readily change its temperature merely by flowing through a body of the same fluid of a different temperature, and especially air by flowing through air, a wind blowing from north to south at an elevation of ten thousand feet above the earth, will pass to a great distance without materially altering its temperature. What we have here supposed respecting the heating of a northerly wind as it blows southerly, will obviously apply to the cooling of a southerly wind as it blows northerly; and since a high wind frequently moves at the rate of sixty miles or about one degree an hour, especially where it passes without obstruction in the upper regions of the atmosphere, it would consequently pass over ten degrees in the short space of ten hours.*

These things being clearly understood, we assign as the cause of hail storms, THE CONGELATION OF THE WATERY VAPOR OF A BODY OF WARM AND HUMID AIR, BY ITS SUDDENLY MIXING WITH AN EXCEEDINGLY COLD WIND, IN THE HIGHER REGIONS OF THE ATMOSPHERE. Let us examine the effects which would result from the meeting of two opposite winds, at the height of ten thousand feet, during the heat of summer, the one blowing from the latitude of 30° or from the confines of the torrid zone, and the other from the latitude of 50° or the northern part of British America. If they had equal velocities, they would meet at the parallel of 40°, that is, at our own latitude, in ten hours from the time of setting out; and according to what has been premised, each current would retain nearly the original temperature. The southerly wind blowing from a point which is still two thousand feet below the line of perpetual congelation, is com-

* Daniel's Meteor. Ess. 113.

paratively warm, while the northerly wind coming from a point which is four thousand feet above the same boundary of the empire of frost, will have a degree of cold probably surpassing any with which we are acquainted. We infer from our preliminary principles, that immediately on meeting, the watery vapor of the warmer current would be frozen with an intensity corresponding to the temperature of the colder current; that the minute hail stones thus formed, and endued with such excessive cold, would begin to descend, and accumulate to a size proportioned to the intensity of the cold of the original nucleus—to the space through which they descended—and to the humidity of the lower strata of the atmosphere; that is, the colder they were when they began to fall, the farther they fell, and the more humid the air, the larger they would become.

We have supposed a strong case, namely, that a wind from the torrid zone is suddenly brought into contact with a wind coming directly from a point far within the limits of perpetual frost, a concurrence of circumstances which appears to be not improbable, and which appears also sufficient to explain the most extraordinary phenomena of hail storms. But since natural causes do not commonly operate in their greatest possible energy, it is probable that hail storms usually result from these causes acting under circumstances less favorable in various degrees. We need not even suppose any thing more than that the cold current instead of meeting with an opposite hot wind, merely mixes with the stationary air of the hotter climates in order to precipitate their moisture in the form of hail. In every minute description of a violent hail storm, however, we shall probably find mention made of this common circumstance, that *opposite and violent winds met*,* hurrying on the clouds from opposite points of the compass. Thus a writer in the American Journal of Science describing a violent storm that occurred in the state of New Jersey, adds, "I observed then, and have many times observed since, that hail is usually accompanied by contrary winds, which seem striving over our heads for the mastery." And Beccaria recognises the same feature of clouds congregated from opposite quarters. "While, says he, these clouds are agitated with the most rapid motions, the rain generally falls in greatest plenty, and if the agitation be exceedingly great, it generally hails."†

* Clark in Am. Jour. II, 134. Beccaria on Elec. in Priestley, 341.
† Priestley, 341, Nich. Jour. XXIV, 111.

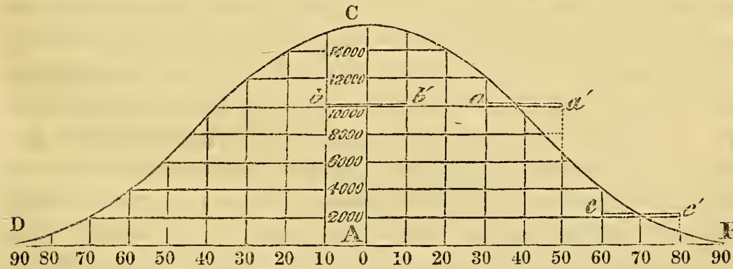
We will now see how far the foregoing explanation corresponds to the facts before enumerated.

Why then are violent hail storms attended by all the other elements of storms,—by clouds of intense blackness, and terrific thunder and lightning? Because the sudden concourse of a wind exceedingly cold with one comparatively hot, ought, in conformity with the known causes of these phenomena, to exhibit them in their most energetic forms. All these atmospheric phenomena are linked together, and the same cause acting with different degrees of energy, produces each of them in its turn. The mixing of portions of air differing but little in temperature is sufficient to form clouds—if the temperature differs somewhat more, the watery vapor may fall in rain—if the one portion is hot and the other cold, more sudden and powerful rains are the consequence, and thunder and lightning result from the rapid condensation of watery vapor—and finally, when a powerful wind from the regions of perpetual frost, mixes with the heated and humid air of a warmer sky, the same watery vapor descends in hail.

Why are such violent hail storms confined to the temperate climates, and why do they occur neither in the torrid nor in the frigid zone? This is a point of great difficulty, and the question has never to my knowledge been satisfactorily answered; but I think we perceive something in the foregoing principles, which may lead us to a correct understanding of it. We have considered the case of two opposite winds from points differing twenty degrees in latitude, one blowing north from the 30th, and the other south from the 50th degree of north latitude, each being at an elevation of 10,000 feet above the earth; and we have found them sufficient to explain the occurrence of violent hail storms within the temperate zones, at least in our own latitude; other opposite points may be assumed for other latitudes. But suppose we transfer this reasoning to the equator, and consider the condition of two opposite winds blowing from ten degrees on either side, and meeting at the equator, each being at the same elevation of 10,000 feet above the earth. Now both of these winds would be warm, and almost equally so, and here of course would be wanting that intensely cold current which we have been able readily to summon to our aid to help in forming our hailstone in the temperate climate. If we take any other point within the torrid zone, the case would be indeed somewhat less unfavorable to the production of hail; the opposite currents might differ in temperature to a degree sufficient to account for the formation of clouds and rain and thunder and lightning; but in this region we know not when to look for that *freezing current*, unless we ascend so high that there, no hot air exists, holding watery vapor to be frozen by it. The case is plain, that if we ascend in the torrid zone for air that is cold enough to answer our purpose, we ascend above the region of the hot air, the watery vapor of which is necessary to afford the materials for hail; whereas, in our own latitude, on ascending to the region of congelation, we find the north and south currents differing in temperature, more than opposite winds in any other part of the globe. There is indeed one situation where we may imagine hail to be formed within the torrid zone, and that is in the vicinity of lofty mountains covered with snow; and there in fact it does sometimes hail.*

Next, if we attentively consider the circumstances of the frigid zone, we shall see that here there is no hot region on the one side to send its heated air to mix with the cold currents from the other; and that no meeting of very cold with warm winds could possibly take place. The rain indeed, on account of the ordinary cold of this region, would frequently descend in the form of hail; but it would necessarily be of that small and ordinary kind, which is formed near the earth, before described as being common in the polar regions.

This will become obvious by inspecting the following figure.



The curve B, C, D, represents the *line of perpetual congelation*, as given in the Edinburgh Encyclopædia, under the article "Physical Geography," and is believed to be a very accurate delineation of it. Let then, *a a′* denote the path described by the opposite winds that are supposed to meet at the latitude of 40°; *b b′*, that of similar winds meeting at the equator, each being at the height of 10,000 feet above the earth; and *c c′*, the path of two currents at the height of 2,000 feet, meeting at the latitude of 70°. These heights are taken arbitrarily, as affording a favorable view of the nature of our reasoning. The same mode of reasoning, however, may be applied to other points of elevation, at which any particular hail storm may be supposed to be generated.

* Edin. Encyc. Vol. XV, Art. Phys. Geogr. at an elevation of 1500 or 2000 feet.

France is so peculiarly exposed to hail storms, on account of its situation between the Alps and the Pyrennees. The country lying between these high mountains being heated by the summer's sun, the cold blasts from the regions of snow and ice, mingling with the hot and humid air over the intervening country, ought, in conformity with our principles, to produce frequent hail storms.

The most violent hail storms occur in the warmer season of the year, and usually in the hottest month, because it is then that the heat of the sun contributes most to set the opposite currents in motion. Hail stones are smaller on the tops of mountains than in the neighboring plains, because not falling so far, they have less opportunity to accumulate by the congelation of successive layers of watery vapor. The white, snowy nucleus which large hail stones frequently exhibit in the centre, indicates that the congelation began in highly rarefied air, such being precisely the appearance of a drop of water frozen under the exhausted receiver of an air pump.* And finally, the sudden and severe cold weather which often immediately follows a hail storm, only indicates that the cold blast which produced the hail, extends something of its influence even to the surface of the earth itself.

What is the cause of the small momentum of hail stones? Although hail stones, when large, do great damage to tender crops, and occasionally kill small animals, yet, it is on the whole, surprising that they fall with no greater force than they do. A pebble of the same size falling from the mouth of a well, upon the head of a man at the bottom, would kill him; and the meteoric stones which fall from the sky, many of which do not exceed the size of some hail stones, bury themselves deep in the ground, and sometimes even penetrate through the entire body of a house, and bury themselves in the cellar.† The small momentum of hail stones is partly to be ascribed to their low specific gravity, which is a little less than that of water; but still they are heavy enough to fall with a hundred times the momentum which they actually exhibit, descending as they do through many thousand feet. Their velocity is in fact very small, whereas we should expect to find it immensely great: the true reason of this I

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* Leslie, Encyc. Ed. Meteorology.

† See an amusing account of the force of falling hail stones by Fairfax, in the first volume of the Phil. Transactions.

apprehend to be the following. We are to regard the largest hail stone as commencing its formation with a small nucleus, and as receiving continual accessions of matter in descending, until it reaches the ground. But the watery vapor of which these accessions are composed, is matter at rest to be put in motion by the falling body, which is therefore taking on a new load at every stage of its progress, and consequently has its speed continually retarded. The velocity which it acquires in falling each successive moment, is lost by communicating motion to so large a quantity of matter at rest, as that which composes its accretions.

Art. II.—*Architecture in the United States.*

Having discussed the position and the planning of cities, we now come to the filling up—the part to which architecture applies in the true and proper sense of the term.

I propose in this article to give a brief history of the art, together with its character as it presents itself in the edifices of different ages, and thus, by putting the reader in possession of facts, to enable him to draw conclusions for himself. We shall then endeavor to see why the Greeks succeeded, why the Romans failed, and why modern Europe has failed still more than the Romans. From the whole we shall attempt to ascertain our own chances of failure, and if possible, the best way to success.

Architecture was at first only an improvement on the necessities of man, but as man became more refined and more wealthy, its character rose also, until, at last, it took rules and forms and proportions and became an art. The earliest exhibitions of it now remaining are in the monuments of Egypt, where it appears massive, heavy, simple, and sometimes with a glimmering of good taste. Persia and India contend with Egypt for the precedency, but the architecture of Persia was light, and that of India highly labored, both evincing a greater advancement in the art: at the same time, the resemblance in all is so great as to shew that whichever was first, it gave to the others their ideas on the subject. From Egypt, the art passed into Greece, where, after accommodating itself to the modes of building in use there, it soon passed into symmetry and grace and beauty, that have never since been equalled, and on which we now look as objects rather to be reverenced than rivalled. The Doric order was at first universally employed, and nearly all the ancient monuments now remaining in that country are of this. The Ionic is a beautiful order, but its introduction seems to have marked the first downward step in Grecian taste, which had perhaps grown careless from success, perhaps was weary of the hard labor necessary for these pure productions; and which at all events, seems to have lost confidence in itself: ornament was called in to act on the senses, and from this time may be dated the retrograde progress of the art. I shall say more of this hereafter. The Ionic, however, provided ornament with a sparing hand; but the course once begun, they could not be expected to stop here, and the Corinthian with its gay and rich adornings was next introduced. There are however few monuments of this order in Greece: before it could fairly establish itself, the country was brought under the Roman power, and Grecian artists began to carry their skill to a more profitable market in Italy.

The Romans, up to this time, had been too much engaged in war to give any great attention to building, and both private dwellings and temples were of the rudest kind. Marcellus made some attempts at improving their taste, but it was not till after the close of the Mythridatic war that architecture received any encouragement. Sylla, in his progress through Greece, was struck with its beautiful temples and porticos; his soldiers and officers shared his admiration; an impulse was given to the art at Rome, and in a short time Italy was covered with structures whose richness and splendor surpassed every thing that had yet been any where seen. Every traveller, however, who has an opportunity of comparing the remains of these edifices with those in Greece, is struck with the great inferiority of the Roman taste. "To a person who has seen the ruins of Rome," writes Dr. Clarke, "the first suggestion made by a sight of the buildings in the Acropolis, is that of the infinite superiority of the Athenian architecture." "Accustomed as we were," says Stuart, in speaking of the Parthenon, "to the ancient and modern magnificence of Rome, and by what we had heard and read, impressed with an advantageous opinion of what we were come to see, we found the image our fancy had preconceived, greatly inferior to the real object." The causes of this deterioration will be considered in their proper place: at present we will content ourselves with following the progress of the art. Rome was then in the height of its power. The most distant nations looked to it for laws, and took from it their character in the arts as well as in politics : its style of architecture spread in all directions, and soon fastened itself on the rest of Europe with a power from which there is perhaps no release. The Corinthian order was almost exclusively employed : examples of the Doric were extremely rare. Their architects formed what is called the Composite order by uniting the Corinthian and Ionic : they reduced the volutes of the Ionic in size, and added new ornaments both to this order and to the Doric : they introduced a mutiplicity of curved lines : they formed their temples in every variety of outline ; they aimed at delicate nicety in the parts, rather than expression in the whole. Each of these the reader will observe is a departure from simplicity. Palmyra and Balbec exhibit the best specimens of the Roman style. It flourished most from the reign of Augustus to that of Hadrian ; after which it declined with a rapidity nearly as great as that with which it had risen. To the Romans, however, we are indebted for the arch. Some traces of it may perhaps be discovered in ancient Egyptian and Grecian monuments, but if known to these nations it was little used : the Romans employed it frequently and with great advantage, as the Pantheon and numerous triumphal arches still attest. Their bad taste however was shewn in giving to it the Greek column for a support, an object intended for straight, not for curved lines, and adapted to no other. The pillars from which these arches sprung were sometimes single, sometimes in pairs. The whole is worthy of little attention in itself, but we discover here and in the line formed by the meeting of these arches, the first hint of the Gothic style. The name applied to this order is apt to lead us into error. The Goths had no more connexion with it than other nations, and the term was first applied to it by Sir Christopher Wren, when he wished to bring it into contempt. Architecture, after the time of Diocletian, had passed rapidly into neglect : the churches of Constantine are in barbarous taste : the best artists in the reign of Justinian could produce only a clumsy effort at the marvellous, and this after repeated failures ; and from this time we altogether lose sight of the art. The last glimpse of it, shews it transferred to ecclesiastical edifices, and used only in these. Thus it rested till the crusades, when all christendom roused itself and a new impulse was given to this, as well as to the other arts. A company was formed, consisting of natives of Greece, Italy, France, Germany, and Flanders, who travelled through Europe, superintending the construction of ecclesiastical edifices: they called themselves free-masons, were bound by strict rules, and from regard to honor as well as profit, confined their knowledge to the members of the society. The arch with the column for a support had been extensively employed in churches: they gave height and lightness to both of these, adopting for this purpose the pointed arch: pilgrims from the East brought accounts of the fantastic yet graceful Saracenic, and the ornaments of this being added, the Gothic style came into existence. Its grand and solemn character was well suited to those times, and the princely revenues of the church were equal to its large pecuniary demands. It rose into universal favor, and after passing through several changes, became a style of the highest excellence and beauty, particularly in England. Until the commencement of the 14th century, it was suffered to be without a rival. In 1016, it is true, Buscheto erected the cathedral of Pisa, in the Roman style, but this went little further until the construction of the Duomo of Florence in the beginning of the 15th cenury. The dome of this building gave eclat to the whole edifice and to this manner of building: St. Peters was commenced in 1506, and since that time the triumph of this style has been complete. The Gothic gave way before it, and then fell into undeserved contempt: it has however, been lately revived, and bids fair once more to succeed, as far at least as the scanty means of our times will admit.

In all these revolutions, Greece, from the time when she gave the art to Western Europe, till the middle of the last century, seems to have been most strangely forgotten. In 1751, Messrs. Stuart and Revett visited Athens, where they spent three years, delineating the plans and profiles of its beautiful remains. This was done with remarkable fidelity, and once more gave to the world the true principles of the art. Since that time, attempts have been making in Europe to revive the Grecian style, but with indifferent success.

Let us pause here and look back for a moment on these facts. They are of a singular character. We have seen architecture pass in a simple yet heavy and rude state from Egypt into Greece. With its incipient stages in Greece we are not acquainted, but we know that it soon gained a majesty and power which have never since been equalled. Pagan Rome, with the revenues and genius of half the world at command, attempted these and failed: Christian Rome has succeeded still worse: all Europe has made the effort, and powerful minds have been brought to aid it, and yet Grecian architecture is still without a rival.* Why is it so? If the Grecian edifices were all the labor of one man or of a few men, we might attribute the success to a lucky hit of the times, and be no more surprised than we are at the fact that the world has produced but one Homer and one Newton. But this was not the case. There were so many structures and in so many distant places, that there must have been many architects, and yet every one of these structures seems to have been of the same grand and noble character as those which have come down to our times. Every column, every block of marble which has reached us from that age, no matter to what use it was applied, seems to have received its form from some master in the art. There must then have been certain principles well known and extensively practised upon to produce this constant and extensive effect. What were they, and how can they be discovered? They did not consist in giving certain shapes to the building, or certain forms to a column, or certain proportions to the parts: these shapes and forms and proportions are universal in their edifices it is true, but the Romans adopted them and failed, and so have the moderns also done. There is a speaking character, a majesty, a power in the expression of a Grecian edifice even in its ruins, which the Roman buildings never had, and to which modern architecture makes no approach. This may seem like poetry, but I describe only what I have often felt and what every one must feel who has an opportunity of comparing the different styles; I believe, at least, that hitherto there has been but a single exception.† Where does this superiority lie; what is the secret of its origin; can other nations succeed as the Greeks have succeeded? Or does the failure during two thousand years shut out all hope of success? If the principle were known, how would it apply to the forms which architecture must take among us?

Others may discuss these questions as matters of abstract knowledge: to us they are of the deepest practical interest. Greece was republican in its government, and was divided into rival states, and so is our country: Palmyra‡ was a republic, and there the Roman style is found in its greatest perfection: Florence was a republic when she became distinguished in architecture: Genoa built her marble palaces while a republic, and Venice was a republic while her fairest edifices

* "—Compared with whose stupendous works [the Grecian] the puny efforts of modern art are but as the labors of children."—*Clarke's Travels, Chap. XII.*

† Wheler.

‡ Vide "Ruins of Palmyra," by Wood and Dawkins.

arose. I leave to others to decide why this form of government seems to be best fitted for the success of architectural effort: it is sufficient for our present purpose that we have every encouragement from the fact. We have also a style to form for ourselves, and we have yet among us little that is calculated to corrupt our taste: we have excellent materials: we have wealth quite sufficient for our wants, but not enough to tempt to extravagance in our buildings: our institutions require many public edifices: we have a population enlightened, and prepared to reward success in architectural skill: the minds of all are beginning to awake to the subject, and it is only requisite that a proper impulse should be given. What more can we wish, unless it would be to revive the Grecian architects themselves, and transfer them to our shores? We cannot do this, *but we can do what will honor us more.* We can create the same skill, the same grandeur and power of conception, and can secure to ourselves the same success that marks every part of the Grecian architecture, and our posterity will be able to do the same. There is no greater difficulty in the art now than there formerly was: it is only necessary for our architects to take the course that was pursued by those of Greece, and they will succeed as well.

What was this course? Men have reasoned about it from abstract principles: let us draw our conclusions from the Grecian buildings themselves. The art is there before us in a visible, tangible form, and in its highest purity and power; we feel this power strongly; we can place full confidence in the subjects from which we reason; and our inferences here will also take a practical character. Such are the inferences we want.

The reader has no reason to be alarmed at the task before him, for the field of our enquiry is less extensive than it would, at first thought, seem to be. Our examination is limited to a single form of building, and to a single order, the Doric.

This order was almost exclusively employed till the Macedonian conquest, a term comprising the best days of the art. Of this were the temple of Jupiter Olympius at Olympia, of Ceres at Eleusis, of Minerva at Sunium, of Jupiter Panhellenius at Egina, of Theseus at Athens, and of this was the Parthenon, together with a great number of other temples of inferior consequence. Indeed, scarcely a building of note, except the temple of Diana at Ephesus, can be named in Greece, or in the countries settled from it, that is not of this grave but beautiful order. And why was it so? There was no necessity for this order, or for any order: nor was there any necessity for this form of building, since the professed object of their erection would have been answered just as well by any other style. There was no necessity in the case. It is indeed difficult to find any purpose of equal consequence, that would leave the artist so entirely to the guidance of his own inclination, as that of the Grecian temple. He must have a spot for the image of his deity, but this spot might be enclosed or open; the enclosure might be made light, or obscure; it might be a single chamber, or many chambers, and of any shape whatever: the artist was left *ad libitum* in every point. This form and this order then, selected when architecture was at its greatest perfection, and used almost exclusively during its perfect state, while at the same time, it was at full liberty to employ any others, present to us the best subject we could desire, from which to discover the true principles of the art. The exceeding beauty of the Grecian Doric, is acknowledged by every one, who has had an opportunity of examining it. "In this fabric," says Hobhouse, speaking of the temple of Theseus, "the most enduring stability and a simplicity of design peculiarly striking, are united with the highest elegance and accuracy of workmanship; the characteristic of the Doric style, whose chaste beauty is not in the opinion of the first artists, to be equalled by the graces of any of the other orders. A gentleman at Athens, of great taste and skill, assured me that after a continued contemplation of this temple, and the remains of the Parthenon, he could never again look with his accustomed satisfaction upon the Ionic and Corinthian remains at Athens, much less upon the more modern specimens of architecture to be seen in Italy." To this order and this form, we shall then direct our attention with the strongest confidence in both.

The Greek temple was so simple in all its parts, that the process of its construction may be easily understood. A level area was first formed considerably larger than the intended limits of the building: this was paved and constituted the *peribolus*. On the peribolus a rectangular platform was constructed, of the same material as the temple, and usually of a length a little greater than twice the breadth.* The platform was ascended all around, by three low steps. The

* The following may be taken as a specimen of their proportions.

	Length.	Breadth.
Parthenon,	218	98½
Temple of Theseus,	110	45
Jupiter Panhellenius,	94	47

parts thus far were common to all: we must now select a particular kind of temple, and will take the one called *peripteral*, having a row of columns all around.

The columns had no base, being placed immediately on the upper step. Within them, at a distance nearly equal to the interval between the columns, was the cell or body of the temple, a solid structure without any opening in its whole circuit, except the door for entrance at one end. At this end the row of columns was usually double, forming the *pronaos:* in the Parthenon, the row of columns was doubled at both ends, but this was an exception to the general rule. The interior was lighted only by the door or by a break in the roof immediately over the central part of the cell. The cell was usually quite plain and of the same material as the rest of the building. The height of the columns was about six times their diameter at the base, a proportion that would have given them a heavy character, had this not been guarded against by twenty shallow flutings to each. Over the columns was the entablature, in this order equal in elevation to about one third of their height. The entablature consisted of three parts, the architrave which was plain, the frieze and the cornice. A low roof crowned the whole, the triangle formed by it at each end being called the *tympanum.* Here only, and in the metopes of the frieze was any ornament admitted; the triglyph and other parts which resemble ornaments, being only an improvement on the original projection of the beams, and thus an essential part of the building. In most of their temples the metopes and tympanum appear to have been entirely plain.

This is the Grecian temple, so highly and so justly admired, and so long retained by the art as the only one suited to the display of its greatest skill. I have gone carefully through the description, that the reader may have the whole distinctly before him, and be able to judge for himself.

The most striking character of this temple is its simplicity. Its shape is the simplest possible, even more simple than a circle, when we consider that the subject is solid walls instead of lines. Its parts also are extremely simple: nothing can be more so than the platform on which it rests, or the walls which form the body of the edifice. The former is plain and uniform all around; the latter has no break in it, except the door: when more light is needed, the opening for it is in the roof and out of sight. The Grecian Doric is also the simplest form in which an order can appear. The pillars have no base: they are fluted, but this is necessary to prevent the appearance of heaviness: they have the exact shape required for strength: their capital swells out just as an object should do when preparing to support a heavy weight. The entablature is also simple. But if this quality is so striking in the best efforts of architecture, its absence is no less so in those edifices which mark the downward progress of the art. We know little of its early history except what we can gather from the ruins themselves, but these are sufficient to shew us that during the period when it flourished most, which was from the time of Solon to that of Pericles, a period of two hundred years, the simplest Doric was almost exclusively employed. Towards the close of this term, the Ionic appears to have come into notice. I do not wish to depreciate this order, for it is a neat and beautiful one, but it must be allowed to be far less simple than the Doric: it admits of more ornament, and one of the first temples in which it was employed in Greece,* was in shape a wide departure from the simple oblong form. It paved the way for the gay Corinthian, an order apparently unknown, at all events not used, before the age of Pericles. The Corinthian is the very opposite of simplicity, and of course this quality is almost entirely unknown in the Roman style: every change they made was a further departure from it, and a still greater failure.

But simplicity is only a quality of good architecture, and though the two are inseparably connected, we must look still further for the principles of the art. This quality is a striking feature in the Egyptian style, but although the antiquities of that country affect us with wonder and often with pleasure, they are wanting entirely in that strong mastery over the soul which is always possessed by the Grecian art. In what then lies this power? Let us turn again to the Grecian Doric temple and, if possible, search it out. The edifice is of no great dimensions, and the effect therefore does not proceed from size: the work is exquisitely finished, but other edifices of exquisite finish have not this effect, and it is therefore not in careful finishing: simplicity is predominant throughout, but we have just seen that it is not in simplicity: the order is noble and striking, and the form is a beautiful one, but others have employed both of these and have failed; it is therefore not in them. Other architects, the reader will say, may have employed part of these; but perhaps none

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* The Erechtheum.

have united them all, exquisite finish, simplicity, the best order and the best form: we can easily imagine however a building with all these united, and which would yet be very far inferior to the edifice which we have before us. I ask the reader to look again, and as he cannot discover the secret of this charm by admiring, perhaps he can do it by trying to find fault. He answers that no one need attempt to find fault—for all is so perfect that it seems as if a taste so well disciplined and matured as to know almost by instinct what were the best and happiest forms, had tried every promising combination of such forms, and that the same maturity had led it to choose the very best. In this answer is contained all the secret that there is in the whole matter—*A taste so well* DISCIPLINED *as to be able to judge with instinctive certainty as regards beauty of form, and this taste exercised with unceasing industry in combining such forms and in trying their combinations.* This, and nothing but this, will make an architect. The Greeks were like other men, and came to perfection in architecture as men have come to perfection in other matters. We err most egregiously if we suppose them artists *by nature*, or that they gained their mighty power by folding their hands and waiting for hints in a happy dream, or even by profuse but idle admiration of the efforts of men from other countries. They took the powers which nature gave them, and by unceasing culture brought them to the very highest perfection: these they applied, and they succeeded: others will succeed when they do all this, and not till then. In this diffusion of a severe and pure taste throughout the Grecian structures lies all their charm. It gives them a mental character, a soul, if I may use the term, which seems to elevate them above a mere union of wood and stone, and makes them almost live and breathe and hold communion with ourselves. This was the point to which the artist directed all his attention. The marble, the brass, the gold were to him inferior objects: they are never protruded on our view: he did not mean to have them seen or felt. He seized on them only as the objects through which the grand and beautiful conceptions of his mind could embody themselves: as the building rose, these conceptions took shape and character and power, and it became a masterpiece of art. We are indeed surprised when we come to examine one of these buildings, to find how much the artist relied on expression for its effect. He seems to have disdained all other effects; to this he directed all his efforts, the efforts of a taste matured perhaps beyond what we now can even imagine; and he could scarcely fail of success. The Gothic style creates and overcomes vast mechanical difficulties, that we may be astonished with the display of skill; but here there is not one mechanical difficulty throughout the whole: the Gothic employs every variety of ornament to dazzle or distract the senses; the Grecian uses ornament sparingly if it uses it at all: the former calls in every adventitious circumstance to heighten the effect—painted glass, music, obscurity; it awes us with its vastness, it overpowers and subdues the senses, and we gaze on it with wonder and with fear. The latter rejects every thing foreign to itself; it never affects us with its size; it exerts itself chiefly on the outside, in the broad light of day; our senses grow clear and critical before it, it insinuates itself into our very soul, and we become filled with lively and almost bewildering admiration.

Such was the Grecian art, and such the power of taste displayed in it. To form their taste to this great effort and this severe scrutiny required a preparation with which subsequent artists seem not to have been familiar, and in the want of which may be traced the chief cause of subsequent failure. Let us now try to discover what this preparation was.

They have left us no history of it, and we can form our judgment only through what we know of the sister arts. Let us take the painter as an example. His art is far different, it is true, but yet his education may furnish us with some useful hints. He is made to begin with the most simple lines, and one who watches him would think that all this was an exercise of the pencil only; but it is not so. If he has the *materiel* of a painter in him, the moment he touched his paper, commenced an exercise not only of his pencil, but in an equal degree of his taste. He is probably not aware of it himself, for it is a delightful exercise and is unheeded, but it is this very exercise of the taste that makes the labor of the pencil even tolerable: destroy the workings of his taste, and the pencil will soon be thrown aside. We may soon know this by observing the progress of another: this latter has begun with the same ardor, and the same honest hopes; he draws a few lines, but grows listless as the other becomes more engaged, and then relinquishes the study:—the clumsiness of his lines shews that taste has had no part in his labor. As the successful student proceeds, and while still confined to simple lines, he finds his taste becoming less easily gratified, and his labor therefore more severe: exercise has rendered this faculty critical: lines which pleased him at first are rejected one after another, until few are left that give him complete satisfaction; but his pleasure from these is of the purest and most exquisite kind. He proceeds now to lines of a less simple kind, and continues the same rigid discipline through these. When his taste has grown so familiar with them as to decide with instinctive quickness and certainty on their merit, he ascends to the higher character of the art, expression in single lines. Should we look at him now, we should find that his labor has become anxious and toilsome. As he bends over it his features become animated and swollen: pleasure and vexation by turns pass rapidly over them: he draws line after line, looks intently at them and then brushes them hastily away to renew the attempt and to please himself no better than before. Why is this? Other men can see nothing to cause his sensations: they behold only a few lines and these so simple that any one could make them: in this simplicity, however, he finds their greatest difficulty and their greatest charm; each one of them has expression, and some strong feeling is acted upon by every one. Yet he is not satisfied: there is some part of that feeling left untouched; his art must reach the whole of it; he tries again, and rests not till these simple lines take the full mastery of his soul. His taste well disciplined on these, he proceeds to combinations of lines and to expression in these, to complete figures, to posture, and then to grouping, and is now prepared to enter the lists with the giants of his art. In all these his taste has the same difficult duty to perform. I do not mean to say that all painters go through this course: probably few could trace one so regular as this in the acquisition of their skill: but I believe that every painter of eminence proceeds through one similar to it. The numerous steps by which he rises are probably little known even to himself; for many of them scarcely proceed further than his own mind: he gives them no shape on paper; they pass unheeded, and he is scarcely aware himself that his taste is constantly exercised, and that it is becoming each moment more critical and more powerful, simply from this exercise. The first known effort of West was in a portrait of his infant brother: a portrait requires little exercise of taste compared with imaginary forms; but how much this faculty had been previously exercised we have no means of judging, and probably he could not have told us himself. How much however must have passed between this and his painting of Christ healing the sick, we can easily imagine. I do not mean to say that a skilful painter may not exist without a critical taste; a man may be an excellent copyist of nature: there are such men, a species of Camera Lucida in the art, but our reasoning is about another order of men—of men who range through all creation and all ages, who pass into the bright and boundless regions of fancy and then place in one view before us, the treasures of all this time and space—of real and imaginary worlds. To these a chastened and severe taste is requisite, and this is gained only by long and unremitted effort.

Is architecture a less intellectual art than painting? Grecian architecture, at least, is not; but how different from that of painters is the course of most of those persons who aim at this difficult style. They read Vitruvius perhaps: more probably they examine some plans and profiles of Grecian and Roman edifices: they learn the proportion of the orders, and then, as if afraid that their skill may evaporate, go directly to work. As well might we expect to become painters by measuring the figures in Salvator Rosa's Cataline, or in his cave of banditti. As reasonably might we prepare for writing an epic poem, by counting the lines of the Iliad, or of Paradise Lost.

Taste in *solid forms*, is capable of as great improvement, as taste in lines. Nature, the perfection of such forms, is all around us. No one can examine an elm, or an oak, or a weeping willow, whether verdant or naked, without finding himself benefitted by the labor. If we wish to make the effort on artificial forms, it is necessary only to represent a few of the simplest kind on paper and compare them. Let any one repeat the effort a few times, and I venture to say that his judgment will be materially improved. Here probably commenced the labors of the Grecian architect. With his taste well matured on these, he rose to the more complicated kinds, still adhering to the severest simplicity, and when so familiar with these as to be almost instinctive in his perception of their merit, he proceeded next to the higher character of design or expression in solid forms. Here was to be the trial of his ultimate success, and on this part he labored perseveringly and long;—and then he went forth confident in his powers,—not to do homage to other minds, but to claim it for his own. If he seemed to follow in the footsteps of others, it was because the qualities of true beauty are always the same, great simplicity and great finish. The Doric temple seems to have been the favorite object, and no person who has seen one of them, will wonder that it was so, for no edifice can be found, so fitted for giving form to pure and grand conceptions; but every thing he touched, whether temple, or altar, or tripod base, or even if it was the covering of a well—all became exquisitely beautiful: it could not be otherwise.

The Romans failed simply from a want of this discipline of taste. If we were ignorant of the Roman style, and were acquainted only with the fact, that they had the Grecian models before them on which to form themselves, we should at first thought, expect them to have pursued this art with the greatest success. Their first artists were Greeks, and these it is true employed, most probably, the Corinthian, the least pure order of the three. But the Romans were fast becoming a refined nation, and it might have been expected that architecture, as their knowledge of it was enlarged, would ascend to the pure source, instead of drawing from a corrupted stream. But it was not so. In their high admiration of the Grecian art, they turned copyists, and to do this requires little effort of the mind. Architecture was among them a fair and well proportioned body, but it wanted life.

"'Tis Greece, but living Greece no more."

Any one who passes from a contemplation of the Grecian to the Roman monuments, will feel all this: the Romans seem to have felt it also, and they resorted to ornament to supply or conceal the deficiency. Sensible that power and majesty of expression were wanting in their edifices, they began to amuse the attention with what was finical and nice, and then ended with being absurd. There is scarcely any species of form into which their temples did not pass,* or any kind of ornament that may not be found on them, until at last, the effort seems to have been solely to produce something new, and something pretty, not something noble or grand. Their wealth is to be considered an evil, as it furnished them with the means of supporting this perverted taste. There are some exceptions to all this, but they are few. The arch had no prototype in the architecture of Greece, and its employment required the exercise of their own faculties. The Pantheon and some of their triumphal arches, shew how well they might have succeeded, had they only employed with diligence the powers with which nature had provided them; but the impulse was too slight to carry them far, and they appear to have soon passed into many puerilities, even in the arch.

I have shewn how the Roman style fastened itself on the rest of Europe, and how it has come down to modern times. Europe by degrees became Christianized, and here was another change in the

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* The reader is referred to Montfaucon for an exhibition of some of them.

art,—a still greater failure than that which had accompained its transfer from Greece to Rome. The purposes of public buildings were nearly the same among the Romans as among the Greeks; they worshipped the same gods and with similar rites: it was easy then to adhere closely to the Grecian models, and though the new building might want beauty of expression, or have no expression at all, still, this close adherence would keep it from being absurd. This saved the Romans for a while, and would have saved them altogether, had they been contented with this. But Christian edifices must be of a different character: their objects were different: their plans, their whole structure must be different: here there could be no security from simple copying. Failure was inevitable, and the Grecian art took its last downward step. Even the boasted St. Peter's is but a "a labored quarry above-ground:"* it affects us with wonder, with astonishment, but at what? At the rich marbles, the gorgeous adornings, the vastness, the splendor: but all these can exist without a particle of true architecture. Money can buy them all, and when we stand before St. Peter's, we think not of its majesty—*but of its cost!* And if this is St. Peter's, what are most other modern edifices? Away with such architecture, or at least, degrade not the art by coupling them with its name.

The Grecian architecture grew up in a manly discipline of the taste: it is founded on this: every part of it shares this character, and no one can ever succeed in it without having passed through the same severe course. All attempts even to blend any part of it with our buildings will end in failure without this. As well might our newspaper poets expect to draw admiration by mingling the lines of Milton or Homer with theirs. We may succeed in the Egyptian, the Indian, the Chinese, the Saracenic; we may succeed also in the Gothic, if wealth can be found equal to its demands;—but, in the Grecian, *sine pulvere nulla palma*, is the language of reason, and is echoed back to us from the experience of more than two thousand years.

We may, however, succeed: the prize as well as the race is placed before us, and we have every thing that can give us hope. Whatever labor it may impose on our architects, to all other persons the means of success are the easiest possible: we need scarcely do more than

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* "A person accustomed to the cumbrous churches of Christendom, those labored quarries above-ground, &c."—Hobhouse' Albania, Letter XXII.

wish for it and it will come. I will point out the way. The artist who loads our edifices with ornament or multiplies the parts more than is necessary, is either ignorant of his art, or means to slight his work and throw dust in our eyes so as to blind us to its defects. Let us begin then with requiring simplicity in our buildings. We shall soon have it, and its immediate effect will be a powerful and favorable action on our taste. I have seen such a result. In one of our cities there was erected during the past year an edifice after the Grecian plan. It is of the Doric order, and is marked with much simplicity in all its parts. It is of the cheapest and coarsest materials, and is yet unfinished, indeed is still very rude in its exterior. This building has already had very great effect on the minds of the population of that city : men are beginning to judge of expression and force in architecture who never thought of such things before. So much for the effect of simplicity on the taste of our people : let us look for a moment at the effect our demand for it will have on the architects themselves. Finding it impossible to dazzle or bewilder the mind, by factitious helps they will from necessity attempt beauty and power of design : their taste will thus begin a course of discipline and will again act on ours. Mind will continue to operate on mind. And then will arise among us men of pure and lofty conceptions, who will scorn all tricks of art, and whose taste will be content only when it makes each object it touches, an image of itself : architecture, no longer disguised by tinsel or borne down by profuse ornament, will rise once more in majesty and power, and will once more take its proper rank among the arts : cherished by the nation, it will in return add honor to our halls of legislation ; it will meet us with its purifying influence in our houses of worship ; it will assist as in rewarding the brave ; it will encourage us in our reverence for virtue ; it will draw a bright halo around the name of our country ; it will make us a better and a happier people.

(*To be concluded in the next Number.*)

Art. III.*—*Sketch of a Classification of the European Rocks; by* Henry T. De la Beche, *Esq. F. R. S. &c.*†

To propose in the present state of geological science any classification of rocks which should pretend to more than temporary utility,

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* From the London Philosophical Magazine for December.

† Communicated by the Author.

would be to assume a more intimate acquaintance with the earth's crust than we possess. Our knowledge of this structure is in reality but small, and principally confined to certain portions of Europe; and even in many of these portions we are continually presented with new views and a detail of newly discovered phænomena by able observers, which so modify our previously received opinions, as in many instances almost to amount to a change of them. Still, however, a large mass of information has been gradually collected, particularly as respects this quarter of the world, tending to certain general and important conclusions; among which the principal are,—that rocks may be divided into two great classes, the stratified and the unstratified;—that of the former some contain organic remains, and others do not;—and that the non-fossiliferous stratified rocks, as a mass, occupy an inferior place to the fossiliferous* strata, also taken as a mass. The next important conclusion is, that among the stratified fossiliferous rocks there is a certain order of superposition, marked by peculiar general accumulations of organic remains, though the mineralogical character varies materially. It has even been supposed that in the divisions termed formations, there are found certain species of shells, &c. characteristic of each. Of this supposition, extended observation can alone prove the truth; and in order properly to investigate the subject, geologists must agree to what mass of rocks they should limit the term Formation: if, as some now do, they apply it to every accumulation of ten or twenty beds, which may happen, in the district they have examined, to contain a few shells not found in the strata above and beneath, the investigation is not likely to lead to any extended conclusions.

To suppose that all the formations into which it has been thought advisable to divide European rocks can be detected by the same organic remains in various distant points of the globe, is to assume that the vegetables and animals distributed over the surface of the world, were always the same at the same time, and that they were all destroyed at the same moment to be replaced by a new creation, differing specifically if not generically from that which immediately preceded. This theory would also infer that the whole surface of the world possessed an uniform temperature at the same given epoch.

It has been considered, but remains to be proved, that the lowest fossiliferous rocks correspond generally in their fossil contents, in pla-

* The term *fossiliferous* is here confined to organic remains.

ces far distant from each other. Let us for the moment suppose this assertion to be correct. To obtain this uniform distribution of animal and vegetable life, it seems necessary, judging from the phænomena we now witness, that there should also have been an uniform temperature over the surface of our planet. To obtain this, solar influence, as it now exists, would be inadequate; we must therefore have recourse to internal heat to produce the effect required. In the present varied temperature of the earth's surface, if we imagine a rock to be formed which should envelop every animal and plant now existing, the fossil contents of one district would differ from the fossil contents of another; if we except man, whose bones would more or less become the characteristic fossils of those portions of the rock which might overlie the present dry land. The rock supposed to be now formed would present a striking contrast with the old fossiliferous, and we should have two very distinct accumulations of organic remains. The question arising on such phænomena would be, Has so great a change of organic character been effected gradually or suddenly? To suppose it sudden, will not agree with the phænomena presented to us, even by the now known European rocks; and if it be considered gradual, we cannot expect that rocks should every where contain the same organic remains, even in those that have commonly been called secondary: consequently the organic remains considered characteristic of any particular formation in one part of the world, may not be found at all in an equivalent formation in another.

Upon the theory that the world cooled in such a manner that solar heat, as now existing, gradually acquired its influence, the warm climate vegetation would gradually be restrained within narrower limits, until it became circumscribed as it now is; consequently all rocks formed within the tropics would probably contain warm climate plants, while these would gradually cease on the N. and S.; so that it would be by no means safe to deduce the kind of Flora that should be found in any given rock in the tropics from the fossil plants discovered in an equivalent rock in Europe. If vegetable life might under such circumstances so vary, there seems no good reason why animal life might not equally differ. To what extent the mass of organic fossils found in any particular European formation or group of formations may exist in equivalent rocks (of Africa or America for instance), remains to be seen. In the present state of our knowledge, it is only safe to state that certain remains have been discovered in a given rock, not that they are absent from it.

The old divisions into primitive, transition, secondary, and tertiary, are now admitted by many persons to be founded on an erroneous view of nature; yet such is the force of habit, that many geologists, aware of the fallacy of these divisions, still continue to use the terms, and we hear nearly as much as ever of transition rocks. Would it not be imagined by the person first directing his attention to the study of geology, that there were three great marked periods, during each of which rocks of a peculiar character, distinct from each other, were formed, and that there was a transition or passage only between the first and second of these. I appeal to those who have examined rocks in the field, and not merely in cabinets and museums, whether or not the student would entertain correct opinions. These divisions may be said to have been made in the infancy of the science, and doubtless contributed much to its present comparatively advanced state; but it should always be recollected that they were formed from limited observations, and were connected with particular theories, which recent and more accurate observations have shown to be any thing but correct. If it shall be proved that there is an occasional passage between the old tertiary and secondary classes, there would appear to be more or less transition throughout the whole series of the stratified rocks, showing that the term transition, at least, is incorrect. A great mass of evidence is, indeed, in favor of a break at the epoch of the Exeter Red Conglomerate (*Rothe Todte Liegende*), resulting from a great derangement in the previously existing rocks, and the grinding and rounding of detached portions of them into gravels, which when comparative tranquillity was restored, were deposited in horizontal beds on the disturbed strata. Yet able observers assert, that there is an occasional passage of these rocks into the coal-measures, upon which they so commonly rest in an unconformable manner. We have now so many instances of great differences in the mineralogical structure of the same formations, either original or consequent on disturbance, that such structure is no longer a character of importance; and it yet remains to be seen how many of the strata supposed to belong to the primitive class are altered rocks.

M. Brongniart's division into "Sediment Rocks," would be both natural and useful were it certain where such rocks commenced, and that all those necessarily included in the class were so formed. This division has been much used in France of late, and would appear infinitely superior to the terms secondary and tertiary.

In offering the annexed sketch of a classification of European rocks to the attention of the reader, it is merely my intention to show that divisions can be made for practical purposes, independent of the theoretical terms primitive, transition, secondary and tertiary; terms which, not being founded on an enlarged view of nature, but grounded on peculiar views, now doubted, there would appear no good reason for preserving. It is not presumed that this classification will be adopted, and I am well aware that many just objections can be made to it; but it pretends to nothing beyond convenience: and if geologists could be induced to use something of this kind, or any other that would better answer the purpose of relieving us from the old theoretical terms, I cannot but imagine that the science would derive benefit from the change.

In the accompanying Table, rocks are first divided into stratified and unstratified, a natural division, or at all events one convenient for practical purposes, independent of the theoretical opinions that may be connected with each of these two great classes of rocks. The same may perhaps also be said of the next great division; viz. that of the stratified rocks into superior or fossiliferous, and inferior or non-fossiliferous. The superior stratified or fossiliferous rocks are divided into groups, nearly the same as those which I published in the *Annales des Sciences Naturelles* for August last. I have myself found them useful in practice, more particularly in the examination of districts distant from each other.

Stratified Rocks.—Group 1. (*Alluvial*) seems at first sight natural and easily determined; but in practice it is often very difficult to say where it commences. When we take into consideration the great depth of many ravines and gorges which appear to originate in the cutting power of existing rivers, the cliffs even of the hardest rocks which more or less bound any extent of coast, and the immense accumulations of comparatively modern land, as for instance, those great flats on the western side of South America, there is a difficulty in referring these phænomena to the duration of a comparatively short period of time. Geologically speaking, the epoch is recent; but, according to our general ideas of time, it appears to be one that reaches back far beyond the dates usually assigned to the present order of things. Man and the monkey tribe seem to be the most marked new creation of this epoch. I would by no means be supposed to deny that they may not have previously existed, but at present the mass of evidence is against their prior appearance. There seems, indeed, no good reason why man and the monkeys should not have lived as well as the bears and hyænas at periods antecedent to this epoch; but until the remains of the two former be found in rocks proved to be formed previous to this period, it cannot be affirmed that they did.* The animals now existing, considered as a mass, appear to differ specifically from those whose remains are found entombed in the various rocks, gravels, clays, &c. formed previously to the existing order of things. There are indeed a few exceptions to this observation, but the body of evidence seems to render a new creation presumable.

Group 2. (*Diluvial*) comprises those gravels so commonly occurring in situations where actual causes could not have placed them, but where, on the contrary, such causes tend to destroy them. The most extraordinary feature of this group is the distribution of those enormous blocks or boulders found so singularly perched on mountains, or scattered over plains far distant from the rocks from whence they appear to have been broken. Many valleys appear to have been scooped out of horizontal or nearly horizontal strata at this epoch; the force which excavated them having acted often upon strata shattered and broken into faults. Of course a general modification of the previously existing forms of mountain and valley must have taken place, if we are to consider the catastrophe general. Much information is yet wanting respecting this group, which it is hoped those observers who have been more especially occupied with it, will soon afford us.

Group 3. (*Lowest Great Mammiferous*) comprises the rocks commonly known as tertiary: they are exceedingly various, and contain an immense accumulation of organic remains, terrestrial, fresh-water, and marine. The recent observations of some able geologists have shown that the upper members of this group approach more closely than was formerly supposed to the existing order of things. We yet require much information respecting even the European rocks composing this class, notwithstanding the labors of those who may almost

* Should such observations as those lately made on the caverns of the department of the Gard by M. de Christol (*Annales des Mines*, 1829) be multiplied, and should it be always shown that human bones and pottery are, as is stated to be the case, in these caverns, really of the same date as the hyæna's bones, dung, &c. with which they are mixed,—we can scarcely refuse to admit that man existed previous to the alluvial epoch; supposing it in all cases proved that these cavern remains are of the same date as those considered of the diluvial period.

be said to have devoted their exclusive attention to them. The group is characterized by the first appearance, in the ascending series, of any abundance of the mammiferous animals, many genera of which are now extinct.

Group 4. (*Cretaceous*) contains the rocks which in England and the North of France are characterized by chalk in the upper part, and sands and sandstones in the lower. The term "cretaceous" is perhaps an indifferent one; for, possibly, the mineralogical character of the upper portion whence the name is derived is local, that is, confined to a particular portion of Europe, and may be represented elsewhere by dark compact limestones or even sandstones. As however the geologists of the present day are perfectly agreed as to what rock is meant when we speak of "the chalk," there seems no objection to retain it for the present. The French geologists have long considered the sands beneath the chalk, known as green-sands, as belonging to the same formation with the chalk. That the freshwater character of the shells contained in the Wealden rocks is more or less local, it seems but rational to infer; for it cannot be imagined that all the waters of the globe became suddenly fresh in order that these rocks might be formed, and as suddenly salt again for the deposition of the green-sands and chalk. Some French geologists moreover consider that in France there is a marine equivalent of the Wealden rocks.

As far as our observations of fossil organic remains have yet extended, it would seem probable that the ammonites and belemnites ceased to exist after the formation of this group; for, as yet, their remains have not been detected in Group 3. Should this, after a greater extent of the world has been examined, be found generally true, it will be a most valuable guide in determining the relative ages of this and the previously noticed group in cases where the mineralogical structure is of no avail.

Group 5. (*Oolitic*) comprises the various members of the oolite or Jura limestone formation, including lias. The term oolitic has been retained upon the same principle as that of cretaceous: in point of fact even in England and the North of France the oolites, properly so called, form but an insignificant part of the mass of rocks known by the name of the oolite formation; this character is also not confined to the rocks in question, but is common to many others. In the Alps and Italy the oolite formation is replaced by dark and compact marble limestones, so that its mineralogical structure is of no value. Saurians would appear to have been abundant in some places. The prevailing fossil characteristic seems the extraordinary quantity of ammonites and belemnites, the remains of which are so numerous in this group. It is remarkable that the nautilus should have been continued down to the present time, and that the other camerated shells which swarmed at this epoch should not have been found. The belemnites do not appear to occur beneath the lias, at least as yet we have no well authenticated instance of such occurrence.

Group 6. (*Red Sandstone*) contains the variegated marls (*Marnes irisées, Keuper*) the Muschelkalk, the New Red Sandstone (*Grès Bigarré Bunter Sandstein*), the Zechstein, and the Exeter Red Conglomerate (*Rothe Todte Liegende*). The whole is considered as a mass of conglomerates, sandstones, and marls, generally of a red color, but most frequently variegated in the upper parts. The limestones may be considered subordinate. Sometimes only one occurs, sometimes the other, and sometimes both are wanting. There seems no good reason for supposing that other limestones may not be developed in this group in other parts of the world. When the muschelkalk is very compact with broken stems of the *lily encrinite*,* one of its characteristic fossils, it might easily be mistaken for some of the varieties of the carboniferous limestone. In some places the new red sandstone contains an abundance of vegetable remains, at others none can be detected in it. The saurians first appear in the ascending series, at least in any abundance, in this group. As I have before observed, the lower part of this group generally rests unconformably on the inferior rocks, and seems to have resulted from a very general upheaving and fracture of the pre-existing strata, accompanied by the intrusion of trap rocks.

Group 7. (*Carboniferous*) Coal-measures and carboniferous limestone. The former would appear in the greater number of instances to be naturally divided from the group above it, but the latter would seem more allied to that beneath: there is however so much connection in this country between the coal-measures and the carboniferous limestone, that it would appear convenient for the present to keep them together. Judging from Europe, the coal-measures present us with the largest mass of fossil vegetables.

Corals were common, but they occur in as great abundance, if not more plentifully now; though the recent species, generally

* Encrinites moniliformis. *Miller.*

speaking, differ from the fossils. But Productæ, the abundance of which characterizes this group, are now unknown; and the Crinoidea which occur in these rocks in multitudes are very rarely found in a living state.

Group 8. (*Grauwacke*) This may be considered as a mass of sandstones, slates and limestones, in which sometimes one predominates, sometimes the other; the old red sandstones of the English geologists being the upper of its sandstones. Trilobites are the most remarkable and abundant fossils of this epoch, and corals and orthoceratites occur in great numbers. It is difficult to fix the inferior limits of this group.

Group 9. (*Lowest Fossiliferous*) It is very difficult in the present state of our knowledge to say whether or not this constitutes a separate group from No. 8; and I have here introduced it more in accordance with the views of other geologists than with my own. A difference in mineralogical structure proves nothing; the changes in this respect are so various, that the different appearance of one slate from another, if not shown to occupy a different geological position, is of no value. It has indeed been supposed that the Snowdonian slates are older than the grauwacke series, but we yet require the proof of this.

Inferior or Non-fossiliferous Stratified Rocks.—It would be useless in a sketch of this nature to enumerate the varieties of slates and other rocks that enter into this division, they will readily present themselves to the mind of the geologist; recent observations show that many rocks to all appearance of this division may belong to the preceding. M. Elie de Beaumont, in one of his late letters to me, states, that mounting the Val Bedretto from Airolo to the foot of the Col, which leads into the Haut Vallais, he found "an alternation many times repeated of small beds of a compact and grey-black limestone, and a nearly black limestone mixed with clay slate thickly studded with crystals of garnets and staurotides. Both the one and the other of these rocks contain a considerable number of belemnites transformed into white calcareous spar, but of which the general forms and alveoli are nevertheless very visible, and can leave no doubt as to the nature of the fossils. As these limestone beds are the prolongation of those in which the gypsum of the Val Canaria is found, and as these are the same with those in which the dolomite of Campo Longo occurs, we can assure ourselves that all the curious mineralogical phænomena of the St. Gothard have been introduced into beds contemporaneous either with the oolite series or the greensand." Now when such important changes as those noticed by my friend M. Elie de Beaumont can be fairly traced, what may we not expect to find in the sequel, when geologists shall cease to be contented with referring a particular mineralogical structure to the old divisions transition and primitive, of which the former seems only to have been created as a geological trap.

Unstratified Rocks.—This great natural division is one of considerable importance in the history of our globe. To the rocks composing it, and the forces which threw them up, may be attributed the dislocations and fractures in the stratified rocks every where so common, and in many instances their elevations into lofty mountain ranges. In many of the great chains the trap rocks are visible along their line of elevation, as was first observed by M. Von Buch in the Alps,—on the southern side of which they are exposed at intervals; and it is on this side that there is so much dolomite in the limestones. To assert that igneous rocks cannot be present along the whole of this line because not every where visible on this surface, is like affirming that there is no table beneath a cloth spread on it except in the cases where there may be a few holes. We are too apt in judging of the mass and thickness of rocks to compare them with our own size, and imagine them enormous, expressing surprise at the immense forces which it must have required to raise such masses into mountains; when if they were compared, as they ought to be, with the mass of the world, the thickness becomes trifling, the highest mountains insignificant, and the forces required to raise them comparatively small.

That granitic, trappean, and serpentinous rocks have exercised a great influence on the present position of the stratified rocks, few geologists will doubt. The igneous origin of the two former is also very generally admitted; but though the third is not so generally referred to that origin, I know not how we can deny that it was produced by a cause somewhat similar to that which produced the others, when we consider its mode of occurrence, more particularly in the Alps and in Italy.

The geological dates of the elevations of mountains is a most important subject, and one on which M. Elie de Beaumont read a very interesting paper, in June last, before the Institute of France.* His

* The first part of this paper has been published in the *Annales des Sciences Naturelles* for September.

recent observations have tended to confirm his previous remarks on four of these epochs. 1st. That the Ezgeberge, the Cote d'Or, &c. have been elevated between the epoch of the Jura limestone and the green-sand and chalk. (Groups 5 and 4 of the annexed Table.) 2nd. That the Pyrenees and Apennines were thrown up between the epoch of the chalk and tertiary rocks (Groups 4 and 3.) 3d. That the Western Alps were raised between the tertiary epoch and the first "terrains de transport" (Groups 3 and 2.) 4th. That still later, there was an elevation of mountains, in which were comprised some in Provençe, the Central Alps, &c.

How far the igneous rocks have been connected with these phænomena remains to be seen; but, as before stated, it is by no means fair to infer that because not seen on the surface they do not exist beneath. Volcanoes, properly so called, both existing and extinct, seem to have exerted a minor influence in the elevation of strata compared with that exerted by the igneous rocks which were shot up previous to the action of these volcanoes. Elevations of land do however take place apparently from the causes that produce volcanoes; and of these the rise of land noticed in Chili by Mrs. Maria Graham, in consequence of the earthquake of 1824, is a striking example.

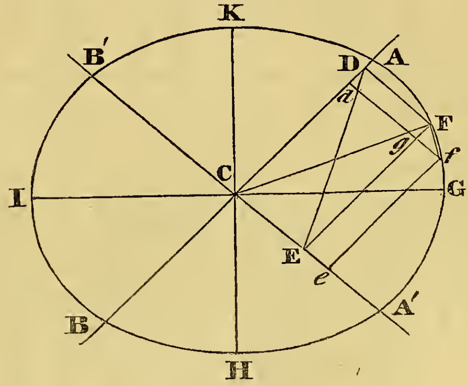
Should the annexed Table succeed in calling the attention of geologists to other divisions than those made in the infancy of the science, and grounded on particular theories, one supposing three great epochs and a transition between the first and second of these, another considering rocks divisible into two great classes, a primary and secondary, the primary containing organic remains in its upper part,—my object will, as I before stated, be fully answered. We are yet acquainted with so small a portion of the real structure of the earth's exposed surface, that all general classifications of rocks are premature; and it seems useless to attempt any others than those which are comparatively local, calculated for temporary purposes, and of such a nature as not to impede by an assumption of more knowledge than we possess, the general advancement of geology.

CLASSIFICATION OF EUROPEAN ROCKS.

Stratified Rocks.	Superior Stratified or Fossiliferous.	1. Alluvial Group	Detritus of various kinds produced by actual causes. Coral Islands. Stalagmitical incrustations. Peat bogs, &c.	Probable appearance of Man and the Monkey Tribe, according to existing information.
		2. Diluvial Group	Transported boulders and blocks; gravels on mountains, hills, and plains, which actual causes tend to destroy.	Valleys cut in previously horizontal, or cracked strata; modification of the anterior forms of mountain and valley.
		3. Lowest Great Mammiferous	The various rocks known as tertiary; characterized by a great abundance of terrestrial, marine, and fresh-water remains, some of which approach, and others resemble, those now existing.	First appearance of any abundance of mammiferous animals in the ascending series.
		4. Cretaceous Group	Chalk, green-sand, and Wealden rocks; the latter perhaps a local variety of marine formation.	Last appearance, in the ascending series, of Ammonites and Belemnites.
		5. Oolitic Group	Rocks usually known as the Jura limestone or oolite formation, including lias.	Great abundance of Ammonites and Belemnites; last appearance of Belemnites in the descending series.
		6. Red Sandstone Group	Variegated marls (*Marnes Irisées Keuper*), Muschelkalk, New Red Sandstone (*Grès Bigarré, Bunter Sandstein*), Zechstein, Exeter Red Conglomerate (*Grès Rouge, Rothe Todte Liegende.*)	First appearance, in any abundance, of Saurians in the ascending series.
		7. Carboniferous Group	Coal-measures. Carboniferous limestone.	Abundance of vegetable remains, Encrinites and Productæ common in the limestone.
		8. Grauwacke Group	Old Red Sandstone, Grauwacke, Grauwacke limestones, Grauwacke clay slates.	Trilobites common.
		9. Lowest Fossiliferous Group	Snowdonian Slates. Tintagel Slates, &c.	Organic remains rare.
	Inferior Stratified, or Non-fossiliferous.	No determinate order of superposition	Talcose Slate. Clay Slate. Flinty Slate. Micaceous Slate. Gneiss, &c. &c.	It would seem that the superior stratified may, from various circumstances, assume the appearance of the inferior stratified rocks.
Unstratified Rocks		1. Volcanic Group	Ancient and Modern lavas, Trachyte, Basalt, &c.	The trappean and granitic rocks so pass into each other, that they can often be considered only as modifications of the same substances.
		2. Trappean Group	Greenstone, Basalt, Porphyry, Amygdaloïd, &c.	
		3. Serpentinous Group	Serpentine, Diallage Rock.	
		4. Granitic Group	Granite, Syenite, Porphyry, &c.	

Art. IV.—*On the Rectification of the Ellipse; by* C. Wilder.

Draw the indefinite right lines, AB and A′B′, intersecting in C, and between the lines AB and A′B′ place the given right line DE, so that the point D may be in AB and the point E in A′B′; through D and E draw DF and EF, parallel to A′B′ and AB, then the locus of F is an ellipse, AA′BB′.



Put x=CE=DF, y=CD=EF, DE equal to unity, and φ for the obtuse angle ACB′, then by trigonometry $y^2-2\cos.\varphi xy+x^2=1$; from this equation it is seen that x and y are positive in the direction CA′ and CA, and that φ is estimated from the line CB′.

Draw df indefinitely near to DF, and through f draw fe, parallel to FE, then without more words it is evident that we have

$$gF^2-2\cos.\varphi gfgF+gf^2=Ff^2;$$

and at its limit $dy^2-2dxdy\cos.\varphi+dx^2=dz^2$, z being the arc, AF. Passing to the factors of the first member of

$$y^2-2xy\cos.\varphi+x^2=1, \text{ and we have necessarily}$$

$$y-x(\cos.\varphi-\sin.\varphi\sqrt{-1})=e^{\pm z'} \text{ and}$$

$$y-x(\cos.\varphi+\sin.\varphi\sqrt{-1})=e^{\mp z'};$$

e being the base of the Naperian system, and z' a function of x and y to be determined.

Differentiating and $dy-dx(\cos.\varphi-\sin.\varphi\sqrt{-1})=\pm dz'e^{\pm z'}$,

$$dy-dx(\cos.\varphi+\sin.\varphi\sqrt{-1})=\mp dz'e^{\mp z'};$$

multiplying and $dy^2-2dxdy\cos.\varphi+dx^2=-dz'^2$;

integrating we have $\int\sqrt{dy^2-2dxdy\cos.\varphi+dx^2}=z'\sqrt{-1}=z$.

Consequently, $y-x(\cos.\varphi-\sin.\varphi\sqrt{-1})=e^{z\sqrt{-1}}$, (1)

and $y-x(\cos.\varphi+\sin.\varphi\sqrt{-1})=e^{-z\sqrt{-1}}$; (2)

also, accenting, $y'-x'(\cos.\varphi-\sin.\varphi\sqrt{-1})=e^{z'\sqrt{-1}}$, (3)

and $y'-x'(\cos.\varphi+\sin.\varphi\sqrt{-1})=e^{-z'\sqrt{-1}}$; (4)

then (1), (3), $yy'+xx'(\cos.^2\varphi-2\cos.\varphi\sin.\varphi\sqrt{-1}-\sin.^2\varphi)$
$-(y'x+yx')(\cos.\varphi-\sin.\varphi\sqrt{-1})=e^{(z+z')\sqrt{-1}}$,
and (1), (4), $yy'+xx'-(y'x+yx')\cos.\varphi-(y'x-yx')\sin.\varphi\sqrt{-1}$
$=e^{(z-z')\sqrt{-1}}$. Put α and β for the co-ordinates of the arc $(z+z')$ and α' and β' for those of $(z-z')$,

and then $\beta-\alpha(\cos.\varphi-\sin.\varphi\sqrt{-1})=e^{(z+z')\sqrt{-1}}$

and $\beta'-\alpha'(\cos.\varphi-\sin.\varphi\sqrt{-1})=e^{(z-z')\sqrt{-1}}$. Consequently $yy'+xx'(\cos.^2\varphi-2\cos.\varphi\sin.\varphi\sqrt{-1}-\sin.^2\varphi)-(y'x+yx')(\cos.\varphi-\sin.\varphi\sqrt{-1})=\beta-\alpha(\cos.\varphi-\sin.\varphi\sqrt{-1})$ and $yy'+xx'-(y'x+yx')\cos.\varphi-(yx'-y'x)\sin.\varphi\sqrt{-1}=\beta'-\alpha'(\cos.\varphi-\sin.\varphi\sqrt{-1})$.
Comparing the homologous parts of these equations we have

$$\alpha=y'x+yx'-2xx'\cos.\varphi,$$
$$\beta=yy'-xx';$$
$$\alpha'=y'x-yx',$$
$$\beta'=yy'+xx'-2yx'\cos.\varphi.$$

When φ is a right angle, $\cos.\varphi=0$, and the ellipse becomes a circle, and the co-ordinates take the name of sine and cosine : we then have

$$\sin.(z+z')=\cos.z'\sin.z+\cos.z\sin.z';$$
$$\cos.(z+z')=\cos.z\cos.z'-\sin.z\sin.z';$$
$$\sin.(z-z')=\cos.z'\sin.z-\cos.z\sin.z';$$
$$\cos.(z-z')=\cos.z\cos.z'+\sin.z\sin.z'.$$

Writing nz for z, in (1) and (2) we have

$y-x(\cos.\varphi-\sin.\varphi\sqrt{-1})=e^{nz\sqrt{-1}}$ and (5)

$y-x(\cos.\varphi+\sin.\varphi\sqrt{-1})=e^{-nz\sqrt{-1}}$; (6)

x and y being the co-ordinates of any multiple, nz of the arc z,

from which (6)−(5) $x=\dfrac{e^{nz\sqrt{-1}}-e^{-nz\sqrt{-1}}}{2\sin.\varphi\sqrt{-1}}$ (7)

and (6)+(5)+$x\cos.\varphi$

$$y=\frac{e^{nz\sqrt{-1}}+e^{-nz\sqrt{-1}}+\text{cotan.}\varphi\sqrt{-1}\,(e^{nz\sqrt{-1}}-e^{-nz\sqrt{-1}})}{2}. \quad (8)$$

When φ is a right angle, (5) and (6) become

$$\cos. nz + \sin. nz\sqrt{-1} = e^{nz\sqrt{-1}} \tag{9}$$

$$\cos. nz - \sin. nz\sqrt{-1} = e^{-nz\sqrt{-1}} \tag{10}$$

and (9) and (10) are $\sin. nz = \dfrac{e^{nz\sqrt{-1}} - e^{-nz\sqrt{-1}}}{2\sqrt{-1}}$ (11)

$$\cos. nz = \frac{e^{nz\sqrt{-1}} + e^{-nz\sqrt{-1}}}{2}; \tag{12}$$

writing 1 for n and φ for z, then (9) and (10) become

$$\cos. \varphi + \sin. \varphi\sqrt{-1} = e^{\varphi\sqrt{-1}}$$

and $\cos. \varphi - \sin. \varphi = e^{-\varphi\sqrt{-1}}$; we may write therefore

(5) and (6) thus: $y - xe^{-\varphi\sqrt{-1}} = e^{nz\sqrt{-1}}$ (13)

and $y - xe^{\varphi\sqrt{-1}} = e^{-nz\sqrt{-1}}$; (14)

hence, $nz\sqrt{-1} = \log.(y - xe^{-\varphi\sqrt{-1}})$ (15)

$$-nz\sqrt{-1} = \log. (y - xe^{\varphi\sqrt{-1}}) \tag{16}$$

when $x=0$ we have $y=\pm 1$, and $nz = \log.(\pm 1^{\sqrt{-1}})$; the upper sign indicating any complete number of circumferences, and the lower sign any odd number of semi-circumferences, as is easily seen by counting from A positively.

When $y=0$ we have $x=\pm 1$, and $nz = \log. (\mp e^{\mp\varphi\sqrt{-1}})^{\sqrt{-1}}$;

$\log. (-e^{-\varphi\sqrt{-1}})^{\sqrt{-1}}$ commences at A, and terminates at A′, comprising any number of circuits together with AA′,

$\log. (+e^{-\varphi\sqrt{-1}})^{\sqrt{-1}}$ comprises any number of circuits, commencing at A and terminating at B′, counting positively,

$\log. (+e^{\varphi\sqrt{-1}})^{\sqrt{-1}}$ commences at A and terminates at B′ and

$\log. (-e^{\varphi\sqrt{-1}})^{\sqrt{-1}}$ begins at A, and ends at A′, counting negatively.

When φ is a right angle $nz = \log. (\mp\sqrt{-1})^{\sqrt{-1}}$

When $\pm x = y$ it indicates the vertex of the greater and lesser axis, as is seen by making the first member of $y^2 + 2xy \cos. \varphi + x^2 = CF^2$ maximum; writing therefore $\pm x$ for y, in (15) and (16) and we

have $nz = \log. x(1 - e^{-\varphi\sqrt{-1}})^{\sqrt{-1}} = AG$; (17)

$$-nz = \log. x(1 - e^{\varphi\sqrt{-1}})^{\sqrt{-1}} = -AG; \tag{18}$$

$$nz = \log. -x(1-e^{-\varphi\sqrt{-1}})^{\sqrt{-1}} = -AK \qquad (19)$$

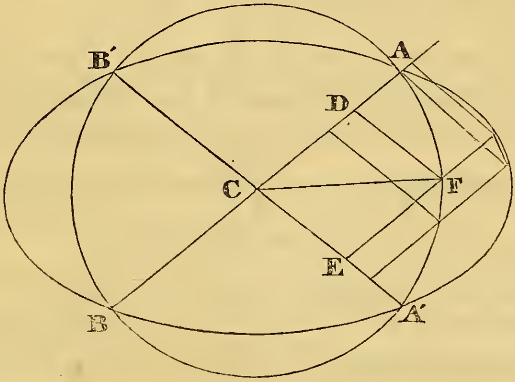
$$-nz = \log. -x(1-e^{\varphi\sqrt{-1}})^{\sqrt{-1}} = AK \qquad (20)$$

then (17) – (18) $nz = \log.\left(\frac{1-e^{-\varphi\sqrt{-1}}}{1-e^{\varphi\sqrt{-1}}}\right)^{\frac{\sqrt{-1}}{2}} = AG$ (21)

and (19) – (20) $-nz = \log.\left(\frac{1-e^{-\varphi\sqrt{-1}}}{1-e^{\varphi\sqrt{-1}}}\right)^{\frac{\sqrt{-1}}{2}} = -AK$ (22)

consequently, (21) – (22) $nz = \log. (\pm 1^{\sqrt{-1}}) = AG + AK = GK$ equal to the elliptic quadrant.

Drawing the figure below, and following the description at the commencement, it is evident that we have $CD^2 + 2CE\ CD \cos. ACB' + CE^2 = CF^2$ or $y^2 + 2xy \cos. \varphi + x^2 = 1$.



Parting the first member of this equation into its simple factors, we have $y + x(\cos. \varphi - \sin. \varphi\sqrt{-1}) = e^{\frac{+z}{-}}$ and

$$y + x(\cos. \varphi + \sin. \varphi\sqrt{-1}) = e^{\frac{-z}{+}};$$

differentiating both of these equations, observing from

$dy = -dx \cos. \varphi \mp \frac{xdx \sin.^2 \varphi}{\sqrt{1-x^2 \sin.^2 \varphi}}$ that dx and dy have different signs,

we have $dy - dx(\cos. \varphi - \sin. \varphi\sqrt{-1}) = \pm dze^{\frac{+z}{-}}$ and

$$dy - dx(\cos. \varphi + \sin. \varphi\sqrt{-1}) = \mp dze^{\frac{-z}{+}}$$

multiplying, $dy^2 - 2dxdy \cos. \varphi + dx^2 = -dz^2$ the differential relation of the circular arc AF, and its co-ordinates, as is seen by the figure, hence, what has been said of the ellipse, AB′BA′ is equally applicable to the circle AB′BA′.

Developing (15) and (16,) y being treated as the greater, we have

$$nz\sqrt{-1}=\log.(y)-\frac{x}{y}e^{-\varphi\sqrt{-1}}-\frac{x^2}{2y^2}e^{-2\varphi\sqrt{-1}}-\frac{x^3}{3y^3}e^{-3\varphi\sqrt{-1}}-\frac{x^4}{4y^4}e^{-4\varphi\sqrt{-1}}-\text{etc. and}$$

$$-nz\sqrt{-1}=\log.(y)-\frac{x}{y}e^{\varphi\sqrt{-1}}-\frac{x^2}{2y^2}e^{2\varphi\sqrt{-1}}-\frac{x^3}{3y^3}e^{3\varphi\sqrt{-1}}-\frac{x^4}{4y^4}e^{4\varphi\sqrt{-1}}-$$

etc. then taking the difference of these two equations and observing the equations (11) and (12), we get

$$nz=\frac{x}{y}\sin.\varphi+\frac{x^2}{2y^2}\sin.2\varphi+\frac{x^3}{3y^3}\sin.3\varphi+\frac{x^4}{4y^4}\sin.4\varphi+\text{etc.}$$

the sum of these two equations gives

$$\log.(y)=\frac{x}{y}\cos.\varphi+\frac{x^2}{2y^2}\cos.2\varphi+\frac{x^3}{3y^3}\cos.3\varphi+\frac{x^4}{4y^4}\cos.4\varphi+\text{etc.}$$

When φ is a right angle, the sines of the even multiples of φ are equal to zero, and of the odd, alternately plus and minus; the reverse happens to the cosines; the ratio $\frac{x}{y}$ takes a name, and then

$$nz=\tan.nz-\frac{\tan.^3 nz}{3}+\frac{\tan.^5 nz}{5}-\frac{\tan^7 nz}{7}+\text{etc.}$$

$$\text{and }\log.(\cos.nz)=-\frac{\tan.^2 nz}{2}+\frac{\tan.^4 nz}{4}-\frac{\tan.^6 nz}{6}+\text{etc.}$$

when x is greater, we have

$$nz\sqrt{-1}=\log.(-xe^{-\varphi\sqrt{-1}})-\frac{y}{x}e^{\varphi\sqrt{-1}}-\frac{y^2}{2x^2}e^{2\varphi\sqrt{-1}}-\frac{y^3}{3x^3}e^{3\varphi\sqrt{-1}}-\frac{y^4}{4x^4}e^{4\varphi\sqrt{-1}}-\text{etc. and}$$

$$-nz\sqrt{-1}=\log.(-xe^{\varphi\sqrt{-1}})-\frac{y}{x}e^{-\varphi\sqrt{-1}}-\frac{y^2}{2x^2}e^{-2\varphi\sqrt{-1}}-\frac{y^3}{3x^3}e^{-3\varphi\sqrt{-1}}-\frac{y^4}{4x^4}e^{-4\varphi\sqrt{-1}}-\text{etc.}$$

the difference of these two equations gives

$$nz=\log.(\pm e^{-\varphi\sqrt{-1}})\sqrt{-1}-\left(\frac{y}{x}\sin.\varphi+\frac{y^2}{2x^2}\sin.2\varphi+\frac{y^3}{3x^3}\sin.3\varphi+\frac{y^4}{4x^4}\sin.4\varphi+\text{etc.}\right.$$

adding and log. $(x)=\frac{y}{x}$ cos. $\varphi+\frac{y^2}{2x^2}$ cos. $2\varphi+\frac{y^3}{3x^3}$ cos. $3\varphi+$
$+\frac{y^4}{4x^4}$ cos. $4\varphi+$etc.

when φ is a right angle, we have

$$nz=\text{log.}\ (\sqrt{1})^{\sqrt{-1}}-(\text{cotan.}\ nz-\frac{\text{cotan.}^3\ nz}{3}+\frac{\text{cotan.}^5\ nz}{5}-\frac{\text{cotan.}^7\ nz}{7}+\text{etc.}$$

$$\text{log.}\ (\text{sin.}\ nz)=-\frac{\text{cotan.}^2\ \varphi}{2}+\frac{\text{cotan.}^4\ \varphi}{4}-\frac{\text{cotan.}^6\ \varphi}{6}+\text{etc.}$$

when $\pm x=y$ we have

$$nz=\text{sin.}\ \varphi+\frac{\text{sin.}\ 2\varphi}{2}+\frac{\text{sin.}\ 3\varphi}{3}+\frac{\text{sin.}\ 4\varphi}{4}+\text{etc.}=AG.$$

and $nz=-\text{sin.}\ \varphi+\frac{\text{sin.}\ 2\varphi}{2}-\frac{\text{sin.}\ 3\varphi}{3}+\frac{\text{sin.}\ 4\varphi}{4}-\text{etc.}=-AK,$

hence $nz=2\ (\text{sin.}\ \varphi+\frac{\text{sin.}\ 3\varphi}{3}+\frac{\text{sin.}\ 5\varphi}{5}+\text{etc.}=AK$ equal to the elliptic quadrant; and their sum is

$$nz=2(\frac{\text{sin.}\ 2\varphi}{2}+\frac{\text{sin.}\ 4\varphi}{4}+\frac{\text{sin.}\ 6\varphi}{6}+\text{etc.}\ =AG-AK.$$

When φ is a right angle, we have

$nz=2(1-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}-$etc. equal to the circular quadrant and $AG-AK=0$.

With regard to the circle, $AB'BA'$, it is sufficient to observe that its equations $nz\sqrt{-1}=\text{log.}\ (y+xe^{-\varphi\sqrt{-1}})$ and $nz\sqrt{-1}=\text{log.}(y+xe^{\varphi\sqrt{-1}})$ give the co-efficients of the even powers of $\frac{x}{y}$ or $\frac{y}{x}$ negative in the developement of nz.

The equations $y\pm xe^{-\varphi\sqrt{-1}}=e^{z\sqrt{-1}}$ (23)
and $y\pm xe^{\varphi\sqrt{-1}}=e^{-z\sqrt{-1}}$ (24)
include both the circle and ellipse, and we have by eliminating y

$$z=\text{log.}\left(\pm x\frac{(e^{\varphi\sqrt{-1}}-e^{-\varphi\sqrt{-1}})\pm\sqrt{4+x^2(e^{\varphi\sqrt{-1}}-e^{\varphi\sqrt{-1}})^2}}{2}\right)^{\sqrt{-1}}$$

or $z=\text{log.}((\pm x\ (\text{sin.}\ \varphi\sqrt{-1})\ \pm\sqrt{1-x^2\ \text{sin.}^2\varphi}))^{\sqrt{-1}}$

and $dz = dx \sin.\varphi\, (1 - x^2 \sin.^2\varphi)^{-\frac{1}{2}}$. Developing and

$$z = \log.(\pm 1)^{\sqrt{-1}} + x \sin.\varphi + \frac{x^3 \sin.^3\varphi}{1.\,2.\,3} + \frac{3.\,3.\,x^5 \sin.^5\varphi}{1.\,2.\,3.\,4.\,5} + \text{etc.}$$

or $z = \log.(\pm 1)^{\sqrt{-1}} +$ circular arc AF

from which it would appear that

$\int dx \sin.\varphi\,(1 - x^2 \sin.^2\varphi)^{-\frac{1}{2}}$ is either an elliptic or circular arc.

We come to the same conclusion, by calculating dz directly from the equations

$$y^2 \pm 2 \cos.\varphi xy + x^2 = 1$$
$$dy^2 \pm 2 \cos.\varphi dxdy + dx^2 = dz^2.$$

From (23) and (24) we have

$$x = \frac{e^{z\sqrt{-1}} - e^{-z\sqrt{-1}}}{\pm(e^{-\varphi\sqrt{-1}} - e^{\varphi\sqrt{-1}})};\ \text{and}\ y = \frac{e^{(2\varphi+z)\sqrt{-1}} - e^{-z\sqrt{-1}}}{e^{2\varphi\sqrt{-1}} - 1}.$$

From these two equations come

$$\sin.\varphi \int ydx = \frac{(e^{(2\varphi+2z)\sqrt{-1}} - e^{-2z\sqrt{-1}})\sqrt{-1} + 2ze^{2\varphi\sqrt{-1}} - 2z + C}{\pm 4(e^{2\varphi\sqrt{-1}} - 1)},$$

and

$$\sin.\varphi \int xdy = \frac{(e^{(2\varphi+2z)\sqrt{-1}} - e^{-2z\sqrt{-1}})\sqrt{-1} - 2ze^{2\varphi\sqrt{-1}} + 2z + C'}{\pm 4(e^{2\varphi\sqrt{-1}} - 1)},$$

and then $\frac{\sin.\varphi}{2}\int(xdy - ydx)$ and $\frac{\sin.\varphi}{2}\int(ydx - xdy)$ the elliptic sections, bounded by an axis, the radius vector and curve.

We arrive at the equations (1) and (2) by simply changing the direction of the axes of the co-ordinates of $a^2y^2 + b^2x^2 = a^2b^2$ where x and y are supposed to be at right angles. It is evident from what has been said that $x = \cos.\varphi\,(x' + y')$ and $y = \sin.\varphi\,(x' - y')$ but dx and dy have different signs, as is seen from $a^2y^2 + b^2x^2 = a^2b^2$; consequently, $dx = -\cos.\varphi\,(dx' + dy')$ and $dy = \sin.\ (dx' - dy')$ dropping the accent, and we have, after substitution

$$y^2 - 2xy\left(\frac{a^2 \sin.^2\varphi - b^2 \cos.^2\varphi}{a^2 \sin.^2\varphi + b^2 \cos.^2\varphi}\right) + x^2 = \frac{a^2b^2}{a^2 \sin.^2\varphi + b^2 \cos.^2\varphi}$$

and $dy^2 + dx^2 = dz^2 = y^2 + 2dxdy\,(\cos.^2\varphi - \sin.^2\varphi) + dx^2$

φ being arbitrary, we have the right to make

$$\cos.^2\varphi - \sin.^2\varphi = \frac{a^2 \sin.^2\varphi - b^2 \cos.^2\varphi}{a^2 \sin.^2\varphi + b^2 \cos.^2\varphi}$$

whence, $\cos.^2\varphi=\frac{a}{a\mp b}$ and $\sin.^2\varphi=\mp\frac{b}{a\mp b}$: it is plain that we must use the lower sign, and consequently φ is in general less than the half of a right angle, and therefore $\cos.^2\varphi-\sin.^2\varphi=\cos.2\varphi=\frac{a\pm b}{a\mp b}$. is to be taken negatively, since $\cos.\varphi$ is negative.

We have then, $dy^2-2dxdy\cos.2\varphi+dx^2=dz^2$ and $y^2-2xy\cos.2\varphi+x^2=1$; parting $y^2-2xy\cos.2\varphi+x^2$ into its simple factors, and we have

$$y-x(\cos.2\varphi-\sin.2\varphi\sqrt{-1})=e^{\stackrel{+z'}{-}}$$

$$y-x(\cos.2\varphi+\sin.2\varphi\sqrt{-1})=e^{\stackrel{-z'}{+}}$$

differentiating and $dy-dx(\cos.2\varphi-\sin.2\varphi\sqrt{-1})=\pm dz'e^{\stackrel{+z'}{-}}$

$$dy-dx(\cos.2\varphi+\sin.2\varphi\sqrt{-1})=\mp dz'e^{\stackrel{-z'}{+}}$$

multiplying and $dy^2-2dxdy\cos.2\varphi+dx^2=-dz'^2$

consequently $\int\sqrt{dy^2-2dxdy\cos.2\varphi+dx^2}=z'\sqrt{-1}=z$

and $z'=z\sqrt{-1}$ and we have

$$y-x(\cos.2\varphi-\sin.2\varphi\sqrt{-1})=e^{z\sqrt{-1}}$$

$$y-x(\cos.2\varphi+\sin.2\varphi\sqrt{-1})=e^{-z\sqrt{-1}}$$

When b^2 is negative, we have $b^2x^2-a^2y^2=a^2b^2$,

and then $\cos.^2\varphi=\frac{a}{a\mp b\sqrt{-1}}$ and $\sin.^2\varphi=\frac{\mp b\sqrt{-1}}{a\mp b\sqrt{-1}}$

and $\cos.^2\varphi-\sin.^2\varphi=\cos.2\varphi=\frac{a\pm b\sqrt{-1}}{a\mp b\sqrt{-1}}$,

and we have then $dy^2-2dxdy\cos.2\varphi+dx^2=dz^2$

and $y^2-2xy\cos.2\varphi+x^2=1$, by making $ab=\sqrt{-1}$,

and by the same steps, we have for the hyperbola

$$y-x(\cos.2\varphi-\sin.2\varphi\sqrt{-1})=e^{z\sqrt{-1}},$$

$$y-x(\cos.2\varphi+\sin.2\varphi\sqrt{-1})=e^{-z\sqrt{-1}};$$

by putting $x=\cos.\varphi(x'+y')$

and $y=\sin.\varphi(x'-y')\sqrt{-1}$, it will be seen that z comprises also $\int\sqrt{dx^2-dy^2}$, both for the ellipse and hyperbola.

The equation $Ay^2+Bxy+Cx^2+Dy+Ex+F=0$, may take the form $y^2+nx+mx^2=0$, without losing its generality.

Put $x=a+\cos.\varphi(x'+y')$,

$y=\sin.\varphi(x'-y')$;

then $dx=\cos.\varphi(dx'+dy')$,

$dy = \sin.\varphi(dx' - dy')$; we have, after writing for x, y, dx and dy, their values, $y'^2 - 2x'y'\left(\frac{\sin.^2\varphi - m^2\cos.^2\varphi}{\sin.^2\varphi + m^2\cos.^2\varphi}\right) + x'^2 + \frac{(2am^2\cos.\varphi + n\cos.\varphi)}{\sin.^2\varphi + m^2\cos.^2\varphi}y' + \frac{(2am^2\cos.\varphi + n\cos.\varphi)}{\sin.^2\varphi + m^2\cos.^2\varphi}x' + \frac{m^2a^2 + na}{\sin.^2\varphi + m^2\cos.^2\varphi} = 0.$

And $dx^2 + dy^2 = dz^2 = dy'^2 + 2dx'dy'(\cos.^2\varphi - \sin.^2\varphi) + dx'^2$, the arbitraries a and φ authorise us to make

$$\frac{\sin.^2\varphi - m^2\cos.^2\varphi}{\sin.^2\varphi + m^2\cos.^2\varphi} = \cos.^2\varphi - \sin.^2\varphi$$

and $\qquad 2am^2 + n = 0.$

From the first we have $\cos.^2\varphi = \frac{1}{1 \mp m}$ and $\sin.^2\varphi = \frac{\mp m}{1 \mp m}$,

and then $\cos.^2\varphi - \sin.^2\varphi = \frac{1 \pm m}{1 \mp m} = \cos.2\varphi$;

and from the second $a = \frac{-n}{m^2}$.

We see from $\cos.2\varphi = \frac{1 \pm m}{1 \mp m}$, by using the lower sign, that in general 2φ is less than a right angle, and therefore its cosine has the same sign as that of φ. When dx and dy have different signs, $\cos.\varphi$ is negative, and we have $y'^2 - 2x'y'\cos.2\varphi + x'^2 = 1$, (by making $\frac{m^2a^2 + na}{\sin.^2\varphi + m^2\cos.^2\varphi} = 1$ or $n = \left(\frac{m^3}{m^2 - 1}\right)^{\frac{1}{2}}$), and $dy'^2 - 2dx'dy'\cos.2\varphi + dx'^2 = dz^2$.

From these equations we have, as before,

$$y' - x'(\cos.2\varphi - \sin.2\varphi\sqrt{-1}) = e^{z\sqrt{-1}},$$

$$y' - x'(\cos.2\varphi + \sin.2\varphi\sqrt{-1}) = e^{-z\sqrt{-1}}.$$

When $m = 0$ we have $y^2 + nx = 0$, the equation of the parabola, then $a = \frac{-n}{0}$, $\cos.2\varphi = 1$, $\sin.\varphi = 0$, and consequently the equations above fail in this case.

The determination of the primitive function $\int\sqrt{dy^2 + dx^2}$, y being a function of x, given by $Ay^2 + Bxy + Cx^2 + Dy + Ex + F = 0$, leads to the determination of $\int\sqrt{dy^2 + dx^2}$, y being a function of x, given by $F(xy) = 0$; for parting $F(xy)$ into its simple factors and we have

$$(y + ax + b)(y + cx + d)(y + ex + f) \text{ etc.} = F(xy), \text{ (A)};$$

American Cicada or Locust

N.º 1. back view of a female cicada flying.
N.º 2. back view of a female at rest.
N.º 3. front view of a female.
N.º 4. back view of a male cicada flying.
N.º 5. front view of a male cicada.

Engrav'd by A. Doolittle.

parting $y^2+Axy+Bx^2+Cy+Dx+E=0$ into its simple factors and we have

$$(y+a'x+b')(y+c'x+d')=y^2+Axy+Bx^2+Cy+Dx+E, \text{ (B)}.$$

Comparing the factors of (B) and any two of (A), for example the first and second, and we have $a'=a$, $b'=b$, $c'=c$ and $d'=d$, and (B) becomes a factor of (A), independently of x and y, for there are but four independent co-efficients in (B); the co-efficients in (B) being known in functions of those in $F(xy)$, we have then $\int\sqrt{dy^2+dx^2}$.

Art. V.—*Notices and Observations on the American Cicada, or Locust; by* Dr. S. P. Hildreth.

Cicada, Septemdecem of Lin. Tettigonia, Septemdecem of Fabr. Head black, eyes brick red, thorax and back black or very dark brown, the latter edged with orange; wings transparent, immaculate, lower margins of a rich orange; abdomen dark brown, the rings of a dark yellow or of dun color; opercula, oval; legs and breast, same color as that of the rings.

No part of natural history more abounds in wonderful and extraordinary productions, than that portion of it embraced in the study of Entomology. Whether we consider the number and variety of insects, or the curious changes they undergo in the progress of their existence, we are led to admire not only their elegant forms and beautiful colors, but also the harmony and order which attends all the operations of nature. Amongst this numerous class, none excites the wonder and admiration of man, more than the cicada septemdecem. The regularity with which they return at the expiration of seventeen years, their simultaneous appearance over a vast extent of country, and the countless myriads of their numbers, equally arrest our attention. They have made their appearance at Marietta, Ohio, at three different periods, since its first settlement, viz.: in the year 1795; again in 1812; and now in 1829. With us they have commenced their ascent from the earth the last of May and first days of June; and disappear the beginning of July, two or three days earlier or later according to the temperature of the season.

The month of May this season was very warm, and the cicadæ made their appearance rather earlier than heretofore. By the 15th of this month, they had risen so near to the surface of the earth, that the depth of a common furrow in ploughing, turned them out in their chrysaloid state. By the 24th, they had begun to arise from the earth, burst their transparent covering and expand their wings. From this time to the 10th of June, their numbers daily increased, until woodlands and orchards were filled with countless multitudes. A continual singing or scream was kept up by the males, from sunrise till evening, and so loud that in a calm morning the sound was heard a full mile. For this purpose the male is furnished with an air bladder under the axillæ, of a pale blue color, as represented in the figure; the females make no noise. They appeared only in situations which were covered with trees, as was the fact when they were here in 1812; thereby proving that they had not wandered far in their journey of seventeen years. The earth was perforated like a riddle, with holes about a third of an inch in diameter. In an orchard in this town, I counted twenty-five holes on a foot square, and an intelligent acquaintance told me that in his neighborhood, he had seen more than double that number in the same space. Where trees were not near each other, the ground underneath them was covered with their skins or cast off robes, to the depth of two or three inches. These shells retain the exact figure of the insect when it leaves the earth, with a rent on the back, through which the cicada creeps as from a coat of mail—and are firmly fastened by the feet to the bark and twigs of trees and bushes, until they are thrown down by the winds or rain. Instinct leading them to seek the nearest tree, bush or post, as soon as they leave the earth; here they remain until they have left their shells for some hours, or until their wings are dry and sufficiently strong for flying. There appeared to be two varieties of the cicada, one much smaller than the other: there was also a striking difference in their notes. The smaller variety were more common in the bottom lands, and the larger in the hills. A continual scream was kept up by the males during the day, but they were silent through the night. Their flight was short, seldom exceeding eight or ten rods, and their whole lives appeared to be spent near the place of their nativity. I could not discover that they made use of any food; they certainly eat no leaves of trees or plants, as they are not furnished with jaws or teeth. They have a hard and sharp proboscis, about two lines in length, which is generally compressed closely to the thorax: this I have seen inserted in the smooth bark of young trees, and when driven from the spot, a drop of juice issued from the puncture: they would also, when disturbed, throw out a small jet of thin watery liquid, as if in self defence. From their being unprovided with organs for eating, it would seem that their whole business during their short visit to the surface of the earth, was to propagate their species and to die. While here they served for food for all the carnivorous and insect-eating animals. Hogs eat them in preference to any other food; squirrels, birds, domestic fowls, &c. fattened on them. So much were they attracted by the cicadæ, that very few birds were seen around our gardens during their continuance, and our cherries, &c. remained unmolested. By the fourth or fifth day after their leaving the earth, the female began to deposit her eggs in the tender branches of most kinds of orchard and forest trees. She generally selected the wood of last years' growth, and commenced her task on the under side of the twig, by slitting the bark with her puncturing instrument, which embraced the properties both of a saw and a punch, the point being lancet-shaped and serrated, and then making a hole in an oblique direction to the pith of the branch, she withdrew the instrument a little way, and deposited an egg through a tube in the punch. This was repeated until from ten to twenty eggs were deposited on each side of the center of the pith, the center wood having been previously comminuted and cut up so as to make a soft bed for the eggs, and to afford food for the embryo until it hatched. There was daily an evident increase in the size of the eggs, until they were hatched, and an evident diminution of the comminuted woody-fibres and enlargement of the cells containing the eggs, so that they must have derived some sustenance from the juices of the twig. Another proof that they did so, was, that the eggs invariably perished in those branches which withered and dried up soon after the punctures were made. This work continued from day to day, until the female had expended her stock of eggs, which, so far as I could ascertain, amounted to about one thousand. When this operation was completed, the object of her existence seemed to be fulfilled, and in a few days she dwindled away and died. The whole period of the life of a single individual, from her leaving the earth to her death, averaged from twenty to twenty-five days. The life of the male continued for nearly the same time. When the cicadæ first leave the earth, they are plump and full of oily juices, so much so that they were made use of in the manufacture of soap; but before their death they were dried up to mere shells; and I have seen them still able to fly a few feet, after one half of the body was wasted away, and nothing remained but the head, wings and thorax. From the time the eggs were deposited to the period of hatching, was, as nearly as could be ascertained, sixty days, and almost daily attention was given to the subject. When first placed in the twigs, the eggs are about the sixteenth of an inch in length, and the thickness of a coarse hair, appearing through a small magnifying glass of the shape and size of a grain of rye: at the period of hatching, they had increased about one-third in size. They are white and transparent, with a black spot on the larger end, just before hatching. They are placed very closely by the side of each other, in an oblique direction to the line of the twig; several portions of the branch of an apple tree, full of the eggs ready to hatch, were placed on a bowl of earth, with a glass tumbler inverted over them, in the afternoon; by morning nearly a hundred young cicada were found in the earth, and a few on the surface, who had just left their woody cells. They were about a twelfth of an inch in length, with the exact shape, color and appearance of the parent when she first comes to the air, and before bursting the transparent shell which covered her while in her terrene abode. From the fact, that the young ones immediately seek a retreat in the earth, I am led to believe that these insects are tenants of the ground for seventeen years, and until He who created them again calls them forth to propagate their kind, to fulfil their destiny, and die. As to their extent, so far as I can ascertain, they covered the woody regions from beyond the shores of the Mississippi, to the heads of the Ohio river; embracing the States of Missouri, Illinois, Indiana, Ohio, and the western parts of Pennsylvania. Whether they appeared in Kentucky and Tennessee, I have not yet learned.

Marietta, (Ohio,) 20th Dec. 1829.

Art. VI.—*The Gold of the Carolinas in Talcose Slate; by* Prof. Eaton.

TO THE EDITOR.

It may appear arrogant for one, who was never in the Carolinas, to give an opinion on the subject of the geological associations of the gold of that district, after reading the elaborate statements of Professors Olmsted and Mitchell, and of the practical miner, Mr. Rothe. But, since these gentlemen, though learned, and indefatigable in their inquiries, do not agree in opinion, the subject is still open for discussion. I claim nothing, but the right to state facts.

It seems, that Prof. Olmsted supposed the gold embraced in argillite,* Mr. Rothe assigned it to granite, and Prof. Mitchell expresses less certainty on this point. It is not a subject of surprise to a geologist, to learn, that there is such a difference of opinion among the most careful and judicious observers. Were all the detritus swept from the earth, leaving the rock formations naked and clean, mere inspection would settle this, and numerous other important geological questions. As it is, we are left to infer much from a few well ascertained facts.

This day, Nov. 7, 1829, Dr. Isaac Branch of Abbeville, S. C. gave me a fine suite of specimens from Charlotte, (Cabarras Co.) of the gold, gangue, and rock walls of that remarkable formation. Though I had seen numerous specimens of the gold and its quartzose gangue, I had never seen perfect specimens of the rock before, with the gold and gangue attached to it. The rock is *most surely* the talcose slate of Prof. Strouve. Its gangue is the quartz which is found, *exclusively*, in the talcose slate. In these specimens, specular iron ore is associated with the gold ; and the gangue is that intermediate variety between the opake milky quartz of the argillite, and the translucent variety of the granite. All the quartz contained in the talcose slate of Taughconnuk and of other places in New England and New York, is precisely the same. One of the specimens has its gangue connected with coarse novaculite. The same fact was noticed by Prof. Olmsted. I have never seen novaculite in connexion with any American rock, but talcose slate. The localities of novaculite in Memphremagog, Belchertown, &c. are merely talcose slate, where the talc diminishes in proportional quantity, and becomes more closely, (perhaps chemically,) combined with silex and alumine. These specimens precisely resemble the talcose slate of Hawley, Mass. which embraces the specular and micaceous iron ore.

From the geographical situation of these gold mines, they all appear to be embraced in the range of talcose slate, which forms Killington Peak in Vermont, and runs down along the heads of Deerfield River, Mass. through Hawley, and appears more or less con-

* In the second part of his Report, written in 1825, Prof. Olmsted remarks, that he had originally supposed the "slate formation," (consisting not merely of *argillite*, but of novaculite, *talc* slate and several others,) to be the peculiar repository of the gold, but that subsequent observations had taught him that it extended likewise over a region based on granite and gneiss.—(See Geological Reports made to the Board of Agriculture of N. Carolina, 1826.)

tinuous in a south westerly direction along the east side of the Highland range, crossing New York, New Jersey, Pennsylvania, Virginia, and the Carolinas. It passes into novaculite in many places. The Rev. John C. Keeney sent me specimens of novaculite from Sparta in Georgia, which is directly in the gold range. I wish not to press any unsupported hypothesis upon the scientific republic; but shall I be deemed extravagant in the following opinion? If Gen. Field's specimen of gold, found in Newfane, Vermont, was a native specimen; we may anticipate the discovery of gold in the talcose slate from Georgia to Canada, along the east side of the Green Mountain range.

I am aware of the danger of deciding geological questions from hand specimens. But these are so well characterized, that I do not hesitate to commit myself fully on this statement—*I have before me gold from North Carolina, connected with a gangue of quartz, semitranslucent, which is embraced in talcose slate.**

Rensselaer School, Troy, Nov. 7, 1829.

Art. VII.—*On the Office of the Nitrogen of the air, in the process of Respiration; by* Lewis C. Beck, M. D. Professor of Chemistry, &c. in the Vermont Academy of Medicine.

The part, which the large proportion of nitrogen in our atmosphere performs during respiration, has often excited the attention of chemists and physiologists. But until recently the investigations upon this point have not been attended with much success, and even at

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* *Remarks.*—The above paper was mislaid, which prevented its appearance in the January number of this Journal. In a communication from Prof. Eaton, dated Feb. 18, 1830, it is mentioned that a little gold has been lately found in talcose slate in Maryland.

He mentions also that two of his pupils have recently crossed the Carolina gold region, and from their report and other concurrent testimony, he concludes "that the gold is in the talcose slate." He adds—

" At p. 353, of Vol. 17, under Minerological Journey, &c. I observe that the "soapstone quarry" is not referred to the *talcose slate* stratum. It seems, that the doubt thrown upon this subject in the treatise on the geology of Connecticut River, still remains. It is too important a point in the geology of North America to remain in doubt; especially as it is so easily determined. I have traced the talcose slate from Savoy and Florida, Mass. to the great soapstone quarries of Windham, Vt. and found the soapstone there to be a continuous variety of the very same individual talcose rock of Massachusetts."

the present time the opinion is generally maintained that the nitrogen is entirely passive, or at least that its only use is to neutralize the energetic properties of the oxygen. This view which has retarded, nay almost stopped the progress of enquiry, has however, been shaken by the recent and well conducted experiments of Dr. Edwards. In examining these experiments, it occurred to me that nitrogen performed other offices which have not to my knowledge been assigned to it. These views I now present for publication, in the hope that even if they are ultimately found to be incorrect, they may open a new subject for chemical and physiological enquiry.

That acute physiologist Dr. Edwards, has shown that the quantity of nitrogen given out by the same animal during respiration is very variable, being at one time increased, at another diminished, and at a third remaining wholly unchanged.* These phenomena he has traced to the influence of the seasons and to other causes. It has also been shown by Mess. Allen and Pepys, that when animals are confined in vessels of oxygen gas, or in an atmosphere composed of twenty one measures of oxygen and seventy nine of hydrogen, the residual air contains a large quantity of nitrogen, and in the latter case a portion of hydrogen was consumed. Mess. Dulong and Despretz inferred from their experiments that the proportion of nitrogen is in all cases greater in expired air than in that which is inspired.

It does not appear then to admit of a doubt, that nitrogen is constantly exhaled or given out by the lungs. The accurate experiments of Priestley and of Davy show that nitrogen is also absorbed or consumed during respiration.

Having premised these observations, the position which I shall advance is,—That nitrogen as well as oxygen is absorbed by the blood, that during its passage through that fluid, it combines with carbon, and forms *cyanogen*, and that this last uniting with iron exists in the blood in the form of a *cyanide of Iron.*

In favor of this view I offer the following facts and reasonings.

1. It has been satisfactorily shewn that many, if not all, the gases may be taken into the circulation. It is also known that a large proportion of carbon exists in the blood. If then nitrogen is absorbed during respiration, there is no greater difficulty in supposing that it combines with a portion of carbon, than that oxygen should do so, which appears to be quite generally admitted.

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* De l'Influence des Agens Physiques sur la Vie.

2. As to the nature of cyanogen, which it is important to understand in this enquiry, it may be stated that Gay-Lussac has ascertained by detonating that gas with a due proportion of oxygen that one hundred measures of cyanogen require two hundred of oxygen for complete combustion, that no water is formed, and that the products are two hundred measures of carbonic acid and one hundred of nitrogen. From which it follows that cyanogen contains its own bulk of nitrogen and twice its volume of the vapor of carbon, and consequently consists of 1 proportional of Nitrogen, and 2 proportionals of Carbon.

3. Cyanogen is obtained from blood as well as other animal matters by various processes, though the opinion heretofore maintained by chemists is, that it is generated during the processes employed, and that it does not exist *ready-formed* in the blood. But upon studying the processes with attention, it will be found that they all have in view the formation of the hydro, or ferrocyanates; and no attempt has to my knowledge been made to obtain the cyanogen in a separate state. Granting, however, that cyanide of iron or even of mercury existed in the blood, would the process for obtaining Prussian blue differ from that now adopted? I answer no. The same steps would be necessary;—the decomposition of the cyanide by means of an alkaline metal would require the application of heat, and after that, the addition of the sulphate of iron would furnish the ferrocyanate.

4. The view which I have proposed will happily reconcile the discordant results of chemists concerning the existence of iron in the blood. This point has exercised the ingenuity of some of our ablest chemists. Although iron had been detected in the ashes of blood by several, it is only lately that we have been made acquainted with a method of proving its existence by the liquid tests. This method was discovered in 1825, by Dr. Engelshart a German Chemist. It consists in transmitting a current of chlorine gas through a solution of the red globules, upon which the color disappears, white flocks are thrown down, and a transparent colorless solution remains in which the peroxide of iron can be detected by the usual reagents. These results have since been confirmed by Professor Rose and other chemists.

Now it is believed that the presence of cyanide of iron cannot be detected by any of the liquid tests with which we are acquainted, or in other words, that the iron in this compound cannot be made apparent. But it has been ascertained by M. Serullas that when moistened cyanide of mercury is exposed to the action of chlorine gas, cyanide of chlorine is formed and bichloride of mercury is thrown down. Reasoning analogically, similar phenomena would be presented by passing chlorine gas through a solution of cyanide of iron; the compound of chlorine and cyanogen would be formed, and the iron would be rendered evident to the liquid tests in the form of the peroxide.

These are the principal arguments which I have at present to offer in favor of the opinion which has been advanced. If it be asked why it has not been submitted to the test of experiment, my answer is that there is greater difficulty in doing so than may at first sight appear. Supposing it previously proved that cyanide of iron or the hydrocyanate of iron exists in the blood, what process would be adopted for separating the cyanogen from its combination? If in the state of a hydrocyanate, we might by passing through it a stream of carbonic acid, separate the hydrocyanic acid, but even this would require the application of heat; and moreover, hydrocyanic acid is very liable to spontaneous decomposition and is resolved into its elements. Or supposing the actual existence of cyanide of iron, we should probably be able to decompose it by a stream of sulphuretted hydrogen, which would afford hydrocyanic acid and sulphuret of iron; but in this case also the expulsion of the acid would require heat. In either of these methods, therefore, though as might be inferred from what is already known, we should be successful, the formation of hydrocyanic acid, might be ascribed to the heat employed in the processes.

There is one method, however, which appears to me destitute of objection on this score. And it is to submit a portion of blood to the action of chlorine gas, for the purpose of ascertaining whether cyanide of chlorine can be formed in this manner. If successful, it would, taken in conjunction, with the known effect of chlorine upon blood, (viz. that of rendering the iron manifest by the ordinary tests) amount to a complete demonstration of the presence of cyanide of ron. But this process is tedious and difficult, and I must leave it to those who are better acquainted with the nature of this singular compound, and who possess better advantages for pursuing researches of this kind.

I cannot refrain from applying the above view of the constitution of the blood, to the explanation of the production of Animal Heat.

Notwithstanding the experiments of Mr. Brodie, it appears to be allowed that at least a portion of animal heat is derived from the formation of carbonic acid during respiration, in the manner suggested by Dr. Crawford. But according to the most accurate experiments only a part of the heat is accounted for in this manner. The remainder has been ascribed to various causes, as the processes of nutrition and secretion, and even to the friction of the different parts of the body upon each other. But it occurs to me that if the views here advanced are correct, we need not look elsewhere to account for the additional quantity of heat. If cyanogen is formed in the course of the circulation and united with iron, a portion of heat must in this way also be generated;—and thus the whole might be placed to the account of respiration alone.

These are the facts and reasonings which have induced me with some confidence to advance the opinion *that during respiration the nitrogen of the air is absorbed by the blood;—that it combines with the carbon in the blood;—that the cyanogen thus formed unites with iron; and that cyanide of iron is therefore, one of the constituents of that fluid.* If this is admitted, the formation of hydrocyanate of iron could be easily shown, and perhaps the study of this would lead to more correct notions concerning the difference between venous and arterial blood, especially as it regards color. But fearing that I may already have trespassed the precepts of the Baconian philosophy, I forbear pursuing the subject at present.

Albany, N. Y. July, 1830.

Art. VIII.—*Notice of Animalcules in Snow; in a letter to the Editor, from Dr. Joseph E. Muse.*

Dear Sir—I believe it is universally admitted, that in the wide, or rather unlimited, range of the natural sciences, nothing has attracted the attention and inquiry of man, more anxiously, than the mysteries of "animal life." The circumstances under which it is occasionally observed to be supported, in repugnance to our common experience and limited knowledge, are worthy to be recorded; and though apparently trivial in themselves, yet when accumulated, arranged, and appropriately digested, they may, by their concurrent influence, throw new light upon this interesting branch of physiology, which is now enveloped in much darkness.

I am conscious of the unrequited hazard of a statement of any facts, inconsistent with ordinary observation; yet I am equally conscious of the propriety of courage to bear witness to truths, however extraordinary may be their aspect.

With this, perhaps necessary preface, I will state to you a phenomenon which, a few winters ago, came within my observation, as well as that of most of my friends, who are in the habit of social intercourse with me.

When the winter had made a considerable progress, without much frost, there happened a heavy fall of snow; apprehending that I might not have an opportunity of filling my ice house with ice, I threw in snow, perhaps enough to half fill it; there was afterwards severely cold weather, and I filled the remainder with ice; about August the waste and consumption of the ice, brought us down to the snow; when it was discovered that a glass of water which was cooled with it, contained hundreds of animalcules; I then examined another glass of water, out of the same pitcher, and with the aid of a microscope, before the snow was put into it, found it perfectly clear and pure; the snow was then thrown into it, and on solution the water again exhibited the same phenomenon; hundreds of animalcules, visible to the naked eye with acute attention, and when viewed through the microscope resembling most diminutive shrimps, and wholly unlike the eels discovered in the acetous acid, were seen in the full enjoyment of animated nature.

I caused holes to be dug in several parts of the mass of snow in the ice house, and to the centre of it; and in the most unequivocal and repeated experiments had similar results; so that my family did not again venture to introduce the snow ice into the water they drank, which had been a favorite method, but used it as an external refrigerant for the pitcher.

I ask, whence these animalcules could possibly have been derived? how, and where generated? how so intimately mixed with the mass of snow?

That they should have been capable of enduring the temperature in which they were immersed was, certainly, not anomalous in the animal economy; instances innumerable have established, that the living animal is possessed of a peculiar power to generate heat and support its own temperature under astonishing circumstances; and as a well known physiologist has remarked, "whether environed by mountains of snow at the poles, or exposed to a vertical sun in the sultry regions of the torrid zone."

These little animals may class with the *amphibia*, which have cold blood, and are generally capable in a low temperature of a torpid state of existence; hence, their icy immersion did no violence to their constitution; and the possibility of their revival, by heat, is well sustained by analogy: but their *generation*, their *parentage*, and their *extraordinary transmigration* are to me subjects of profound astonishment.

The dangerous and repulsive notion of "living monades" pervading the universe, and constituting integral parts of "all creation," will, perhaps, be more forcibly resisted, by referring to a reasonable cause, those occasional phenomena, than by the ablest arguments, in the abstract, which can be framed to demonstrate the fallacy of the doctrine.

Cambridge, E. S. Maryland, Jan. 27, 1830.

ART. IX.—*The Iodide of Potassium, (Hydriodate of Potassa of the shops,) as a test for Arsenic, with remarks upon the nature and properties of the compound formed; by* J. P. EMMET, Professor of Chemistry in the University of Virginia.

ALTHOUGH the detection of arsenic, even in minute quantities, is, at present, a problem of sufficient accuracy, the most perfect of the operations recommended for this purpose often require too much manipulation for inexperienced persons. On this account, as well as with the view of extending our means of research, it must always be desirable to increase the list of reagents even of a secondary character. It is not pretended to assign to the process, about to be described, a more elevated position, in as much as it fails to exhibit the mineral poison in such minute quantities as can be effected by means of sulphuretted hydrogen, ammonio-nitrate of silver, &c. It has, however, peculiar advantages arising from the great facility of its application, and may always be employed with benefit in connexion with those agents that indicate more minute quantities.

The solution to be tested may contain either arsenious acid alone or combined with an alkali, as is recommended for other tests. Even *uncombined iodine* may be substituted for the hydriodate, in cases where the arsenic has been previously made to combine with an alkali, but it will not answer for the simple solution of the arsenious acid. When these substances are added to each other, a very characteristic white precipitate appears, the properties of which will be noticed presently.

Immediate precipitation takes place when

Iodide of potassium is added to a solution containing	2.8 per cent. arsenious acid, 1.8 per cent. arsenite of potassa.
Iodine alone is added to a solution containing	2.8 per cent. arsenite of potassa.

As in all these cases of immediate precipitation, a drop of the solution upon a plate of glass will furnish enough of the precipitate to judge of its nature, we may consider that the quantity of arsenious acid exhibited does not exceed $\frac{1}{300}$th of a grain; but much weaker solutions answer the purpose equally well, when the fluid is gradually evaporated. Indeed, they have one important advantage arising from the great tenacity with which the white precipitate, when gradually formed, adheres to the glass plate—it may be repeatedly washed and entirely separated from all excess of the precipitant.

When thus purified, it possesses the following characteristic properties:—

1. Concentrated nitric acid immediately changes the white color to a dark brown, purple, or even black, according to the quantity, and starch added at the same time, assumes the deep blue tint, so distinctive of free iodine.

2. Strong sulphuric acid, with the assistance of heat, produces the same effects, but at the ordinary temperature, it merely changes the color into a bright yellow.

3. Strong muriatic acid also immediately imparts a bright yellow color.

These simple experiments, with ordinary care, are quite sufficient for the purpose of testing, and will enable us to recognize the mineral acid even in very small quantities; other properties will, however, be noticed subsequently in a more general manner.

It will be seen that the foregoing characteristics are actually those of iodine and its compounds; yet this very circumstance is considered to enhance the value of the test; since the powder admits, by repeated washing, of being completely separated from all the hydriodate not *chemically* combined. Metallic salts are indeed the only compounds which could well occasion confusion, when hydriodate of potassa is the precipitant, and even were such substances originally in the suspected solution, they would be separated by the carbonated alkali employed to dissolve the arsenious acid. Neither does it appear, from the experiments made, that coffee, tea, milk, and the other liquid articles of food have much effect in retarding the operation. But we cannot, in all cases, trust to simple precipitation when iodine alone is employed. This substance, for example, will produce the effect when added to a solution of coffee quite free from arsenic. It is not desired, however, to recommend even the iodide, for the detection of arsenic in complicated cases, and on this account, I shall refrain from offering any further remarks, but pass on to consider the white compound in a manner purely chemical.

Properties.—In several respects it resembles arsenious acid, particularly in its solubility and precipitation; boiling water, for instance, dissolves about 5.3 per cent. and deposits nearly one half upon cooling. So also, when it is separated from weak solutions, it adheres with great tenacity to the vessels, resembling a white enamel in appearance. But arsenic begins to sublime at a temperature a little above 300°, whereas this powder requires a heat equal to 550° F. When exposed to a heat of about 600°, it undergoes decomposition, arsenical fumes being given off abundantly, and towards the end of the process, particularly when the temperature is more elevated, iodine is liberated very freely. The degree of its decomposition by heat alone is very variable, the minimum and maximum losses being 30 and 70 per cent. In close tubes there is no reduction; the products being arsenious acid, iodine and a yellow matter which was considered as the iodide of arsenic; but as the substance bears a high temperature without decomposition, metallic arsenic may be collected even in small quantities, by rubbing up with it charcoal powder. Black flux is entirely unnecessary.

Composition.—As this precipitate appeared at first to be a double salt, composed of iodide of potassium and arsenite of the alkali employed, several attempts were made to determine its composition by using definite amounts of either of these salts, and adding the other as long as there was any precipitation. Analysis was also subsequently performed upon the white matter precipitated; but in all such cases the results were unsatisfactory, owing, as it subsequently appeared, to the variable amount of the arsenic in the different arsenites employed. Notwithstanding the want of uniformity, it appears advisable to indicate the method pursued.

The process which was found best calculated to furnish the composition, consists in decomposing the powder by a solution of the ammonio-nitrate of silver, cautiously added, until it ceases to occasion any precipitation. There are thus formed an iodide and arsenite of silver nearly insoluble in water, while the solution contains, (in union with nitric acid,) all the alkali originally present in the precipitate. The soluble and insoluble portions were separated by decantation.

From the *former*, all excess of nitrate of silver was precipitated by a few drops of muriatic acid, and the solution then evaporated to dryness—lastly, the nitrate was converted into a sulphate, and all excess of matter driven off by a red heat—from the sulphate, the alkali was determined both directly and by means of nitrate of baryta.

From the *latter*, the arsenite of silver was removed by dilute nitric acid, and, after separation, converted into a chloride, by the addition of common salt. By such experiments, the iodide varied from 23 to 28 per cent., but the arsenious acid proved very indefinite, and always very far exceeded the amount necessary for combination with the alkali obtained, even to the exclusion of the iodine. The following experiments were made in order to determine how far the arsenious acid contributes to this irregularity. An arsenite of potassa was prepared, according to the usual directions, by boiling carbonate of potassa with excess of arsenious acid. The solution was allowed to cool, and then filtered. Still, upon concentration, arsenious acid was regularly deposited, thus indicating that the arsenite was not neutral, owing to the power which its solution had of dissolving the acid. Cold water was next added to dissolve the salt, the arsenious acid being almost insoluble at this temperature, and the solution was again concentrated. Upon the addition of a drop of acetic acid, a white cloud, owing to the separation of the arsenic, appeared, but upon agitating the mixture, again immediately disappeared. This precipitation and re-solution was repeatedly performed by successive drops of acetic acid, and ceased only when the latter had completely decomposed the arsenite; then the arsenious acid separated copiously and permanently, adhering, with great firmness, to the glass vessel, and marking the course of the rod with white streaks. In these experiments we perceive clearly the facility with which this acid, notwithstanding its insolubility, may be retained in solution, and to this circumstance may be attributed the variable quantity furnished by the precipitate with iodide of potassium. It is difficult moreover to evaporate the solution of arsenite of potassa to perfect dryness without converting some of it into arseniate, a change which is indicated by an odor of garlic and the dark color of the salt.

The most uniform results were obtained by adding to a cold but concentrated solution of the arsenious acid alone, as much iodide as was necessary to effect complete precipitation. For this purpose, arsenious acid was boiled with water until the solution upon cooling, was found, by experiment, to contain 2.85 per cent. 100 grammes of this solution were decomposed by the cautious addition of iodide of potassium, well dried at about 600° Fahr. When 4.13 grammes of this substance had been added, precipitation entirely ceased, and the powder, upon being well dried, was found to weigh 7. grammes, making a difference of 2 centigrammes more than the sum of the bodies mixed. Alcohol, marking 34.5 on Cartier's scale, was added in order to remove the excess of iodide, by which operation the powder was reduced to 4.5 grammes. Of this amount, it is known, from the first operation, that there must be 2.85, owing to the presence of arsenious acid. Hence the composition is,

Arsenious acid,	2.85,	or per cent.	63.3
Iodide of potassium,	1.65,		36.7

The accuracy of this synthetical process was next tested analytically, by determining the amount of the alkali, as follows:—1 gramme of the powder, resulting from the last experiment, was exposed to a heat regulated by a mercurial thermometer. It withstood a temperature of 500° without suffering any further change than a loss of ½ per cent. in weight. By elevating the temperature, arsenic was driven off with free iodine, both making a loss of 31 per cent. To the remainder sulphuric acid was added, which changed the color to deep brown, and liberated a great deal of iodine and iodide of arsenic. When all excess of sulphuric acid was removed by a red heat, the sulphate was decomposed by nitrate of baryta, and the amount of potassa determined from the insoluble sulphate, after repeated washing in dilute muriatic acid and exposure to a red heat. The sulphate of baryta weighed 0.267 millegrammes, equivalent to 34.7 per cent. iodide of potassium or to 36.6 per cent. of the hydriodate of potassa, supposing that this salt or the elements of water are present.

Notwithstanding the novelty of such a compound, in which it is impossible to tell whether the white arsenic acts the part of an acid or of a base, (although it is present nearly to the extent of five atoms,) and where, moreover, we do not perceive even any analogy to the composition of a double salt, it appears obvious, by the following additional facts, that its existence must be inferred. Iodide of potassium, even when added in great excess, does not precipitate the whole of the arsenite of potassa, nor is it capable of diminishing its alkaline reaction. On the contrary, when the arsenite of potassa is so far neutralized by free acetic or arsenious acid as to be incapable of giving a red stain to turmeric paper, this property is immediately restored upon the addition of the iodide of potassium; apparently in consequence of an union between the latter substance and the *excess* of arsenious acid, which, while dissolved, had the power of counteracting the alkaline effect. Iodine, alone, also occasions a precipitate from the arsenical salt, when there is an excess of acid present; and here, although we may suppose the conversion of iodine into hydriodic acid, the presence of some free alkali seems necessary to the formation of a double salt. Other considerations lead us to the same result.

It is well known that the arsenites of soda and potassa have the power of discharging the blue color from a mixture of starch and iodine. This, indeed, is a part of the process proposed by Brugnatelli for the purpose of distinguishing between corrosive sublimate and arsenic. The effect, however, may be shown by experiment, to depend more upon the affinity which exists between arsenious acid and iodide of potassium than upon the facility with which iodine is acidified by exposure to alkaline solutions. Thus, for instance, carbonate of potassa may be mixed with this blue compound of iodine and starch for a long time, at the ordinary temperature, before there appears to be any diminution of color, and arsenious acid alone even heightens the tint, but upon adding the acid subsequently and some time after the potassa, the color at once flies. In this case, the presence of arsenious acid leads to the rapid formation of hydriodate of potassa, at the expense of the iodine, upon which the color depended.

If subsequent experiments should establish the existence of such a compound, it will be a solitary but striking example of what may be considered as a chemical hybrid.

ART. X.—*On the Dew Point; by* A. A. HAYES.

To assist those who are not intimately acquainted with hygrometry, the following illustrations of the facts, on which the experiments with the hygrometer are based,—with the tables, which for convenience are attached to the scale of the instrument I use,—are offered with the hope that they may induce many to make observations with that instrument.

When a smooth surface of any substance which possesses no attraction for water, is exposed to an atmosphere in contact with water, if the temperature of the surface is considerably below that of the atmosphere, it soon becomes covered with moisture, which increases and assumes the form of dew. By observing the temperature of this surface, we learn at what temperature the invisible vapor previously existing in the atmosphere, becomes tangible in the form of water; the temperature may be considered as the "point of deposition," and it bears no permanent relation to the temperature of the vapor. Aqueous vapor, while forming, is of the same temperature as the surface of the fluid from which it is produced; and if, after this experiment we allow the surface of the substance gradually to approach the temperature of the atmosphere, the moisture begins to disappear and the thermometer remains stationary, while any considerable portion of moisture is on the surface. The temperature now indicated by the thermometer, is that of the vapor, and for convenience is called the "dew point." It is evident that the point of deposition bears the same relation to the dew point, as the "freezing point" of water does to the "fusing point" of ice; it may be below, but can never be above it. By confounding these terms, some writers have caused considerable ambiguity, and we are inclined to place little confidence in the results of these experiments, when we are informed that "the comparison of the temperature of the air, at the commencement of the experiment, with the mean of the indications of the thermometer, at the appearance and evanescence of the dew, will give with relative accuracy the measure of the force of vapor in the atmosphere." The dew point, ascertained by the aid of suitable instruments, enables us to solve several important problems, which could not be done, when hydroscopes of animal and vegetable substances were employed; as these, besides being subject to many imperfections, indicate a state of "dryness" when the atmosphere is nearly saturated with moisture.

I. Having ascertained the dew point, on referring to a table of the elasticity of steam, we learn the *tension* of the atmospheric vapor, expressed in inches and parts of the mercurial column.

II. By dividing the numbers denoting the elasticity, by that of the mean barometric height, we ascertain the *volume* of vapor in one hundred cubic inches of the air surrounding the instrument.

III. Multiplying this number, by the weight of one hundred cubic inches of steam, the *weight* of vapor in one hundred cubic inches is found.

IV. Dividing the mean barometric height, by the numbers denoting the elasticity, the proportion of pressure due to the vapor is determined.

V. The numbers denoting the elasticity, multiplied by the specific gravity of mercury; the numbers obtained on the inches, and parts in depth of water, which would result from a total condensation of the whole vapor. Other interesting results are readily obtained from these numbers.

The following table exhibits the results, without the delay of arithmetical processes; the numbers expressing the elasticity of steam, are from the table by Mr. Dalton; his numbers being a mean between those of Mr. Daniell and Dr. Ure.

Dew Point.	Elasticity.	Volume.	Weight.	Water.	Dew Point.	Elasticity.	Volume.	Weight.	Water.
+ 1	.066	.22	.42	.894	49	.363	1.21	2.30	4.91
5	.076	.25	.47	1.03	50	.375	1.25	2.38	5.08
10	.090	.30	.57	1.21	51	.388	1.29	2.45	5.25
15	.108	.36	.68	1.46	52	.401	1.33	2.53	5.43
20	.129	.43	.81	1.74	53	.415	1.38	2.61	5.61
25	.156	.52	.99	2.11	54	.429	1.43	2.72	5.79
30	.186	.62	1.18	2.42	55	.443	1.47	2.80	6.00
35	.221	.74	1.41	2.99	56	.458	1.52	2.89	6.20
36	.229	.76	1.44	3.10	57	.474	1.58	3.00	6.41
37	.237	.79	1.51	3.21	58	.490	1.63	3.10	6.63
38	.245	.82	1·56	3.32	59	.507	1.69	3.21	6.85
39	.254	.85	1.61	3.44	60	.524	1.75	3.33	7.10
40	.263	.88	1.67	3.56	61	.542	1.80	3.44	7.34
41	.273	.91	1.73	3.69	62	.560	1.87	3.56	7.58
42	.283	.94	1.79	3.83	63	.578	1.92	3.67	7.83
43	.294	.98	1.86	3.98	64	.597	1.99	3.79	8.08
44	.305	1.02	1.94	4.13	65	.616	2.05	3.90	8.35
45	.316	1.05	2.01	4.28	66	.635	2.11	4.02	8.60
46	.328	1.09	2.07	4.44	67	.655	2.18	4.15	8.88
47	.339	1.13	2.15	4.59	68	.676	2.25	4.28	9.16
48	.351	1.17	2.23	4.75	69	.698	2.32	4.42	9.47
					70	.721	2.40	4.57	9.77

Art. XI.—*On the cause of the peculiar aspect of the air, in the Indian Summer.*

TO PROFESSOR SILLIMAN.

You requested in one of the numbers of your Journal, a long time ago, a communication on the Indian summer. You of course are acquainted with the explanation of the phenomenon, which refers it to the smoke, arising from the combustion of the dead vegetable substances, that are strewed over the surface of the earth in autumn. This account of the matter seems to have arisen from the fact, that there are frequently, from accident or design, during the the Indian Summer, great conflagrations in the prairies and mountains; but these appear rather to follow the season, as the effect, than to precede it as the cause. The warm dry weather fits every thing, in the decay of vegetable life, for inflaming at the slightest touch of fire; and of this, numerous conflagrations are a natural consequence. Besides, smoke does cause a similar appearance in the atmosphere, but of a deeper shade; and although its peculiar sensation is not felt at the beginning of the Indian Summer, yet soon after the extensive fires have commenced, the darkness of the atmosphere is increased; and the smoke becomes painful to the organs of vision. It is not strange therefore that the bluish atmospheric appearance should have been attributed to what usually accompanies it. Some imagine that the phenomenon, of which we are speaking, is connected with the decay of vegetation in itself considered; but how this is so, they have not been able to explain.

If we inquire for the cause of the bluish appearance in the air, we have no difficulty in perceiving, that it must be ascribed to the reflection of the darker part of the solar rays. The reflecting power in the atmosphere therefore must be greatly increased during the Indian Summer: since only the less reflexible portion of the rays of light is transmitted. The whole inquiry then is resolved into this: Whence arises the increased reflecting, or (which is the same thing) the increased refracting power in the atmosphere?

It is evident at once that this must be owing to foreign substances intermingled with the atmosphere, rather than to the latter itself. We have therefore further to examine what substances the change of seasons, from heat to cold, and the reverse, would be likely to produce; and which might be intermingled with the atmosphere.

The application of heat causes evaporation; and the abstraction of heat is followed by the deposition of vapor. Now during autumn, the earth is becoming cooler in consequence of the loss of more caloric than it receives. This change in the earth will produce a similar change in the atmosphere. The earth therefore by its contact with a warmer stratum of air, will reduce its temperature, and the consequence will be the deposition of vapor. This first stratum of air will have the same effect upon a second; and this again upon a third; and so on ascending. It is obvious then that there must be a continual deposition of vapor while the earth is cooling; and this will be greater in proportion as the process, which causes it, goes on more rapidly.

In the spring season the changes just described will take place in a reversed order. The earth is becoming warmer; and the vapor which arises from it, held in perfect solution by caloric, comes in contact with the air, which is now colder than the earth; and thus has a portion of its heat abstracted, and consequently is deposited. The refracting power of vapor however is nearly equal to that of water; and consequently very much greater than that of air. Perhaps the high refracting power, in the atmosphere, during the autumn and spring season may be explained in this manner.

I send you these suggestions respecting the Indian Summer, your request in relation to which has been recalled to my mind by the existence of the peculiarity in the season here at present. They may slightly interest you, if you have not yet received a satisfactory communication on the subject. Z.

Baltimore, Dec. 15, 1830.

Art. XII.—*Solution of a Problem in Fluxions; by* Prof. Theodore Strong.

TO PROFESSOR SILLIMAN.

New Brunswick, Feb. 12, 1830.

Dear Sir—I send you the following method of extending (B) (given at page 333 of the last Journal,) to the motion of a system of bodies. Yours respectfully, T. Strong.

I have heretofore (virtually) supposed the mass of the moving particle to be unity; I will now suppose it to be m, or that it contains the unit of particles m times; the magnitude of m being supposed so small that all its parts may be considered as having the same motion. Hence (B) becomes $m\left(\frac{d^2x\delta x+d^2y\delta y+d^2z\delta z}{dt^2}+F\delta r+F'\delta r'+\&c.\right)$ $=0$, (B′), for the motion of *m;* for (B) is evidently to be taken as often as the unit of particles is contained in *m*. Now supposing that the moving particles are *m*, ,*m*, ,,*m*, &c.; I shall have for ,*m*, ,,*m*, &c. equations of the same form as (B′). Thus, supposing that ,x ,y ,z are the rectangular co-ordinates of ,*m*, which are respectively parallel to x y z and have the same origin; and that the quantities corresponding to $F\delta r$, $F\delta r'$, &c. are denoted by $,F\delta,r$, $,F'\delta,r'$, &c.; I shall have for ,*m* the equation $,m\left(\frac{d^2,x\delta,x+d^2,y\delta,y+d^2,z\delta,z}{dt^2}+,F\delta,r,\right.$ $\left.+,F'\delta,r'+\&c.\right)=0$, (B″). In like manner the formula for ,,*m* may be denoted by writing two marks below the letters, and so on for ,,,*m*, &c. Now since *m*, ,*m*, ,,*m*, &c. move as a system, or in connexion; it is evident that the equations (B′), (B″), &c. must be added; hence supposing (for brevity) that S written before (B′) denotes the sum thus formed, I have $Sm\left(\frac{d^2x\delta x+d^2y\delta y+d^2z\delta z}{dt^2}+F\delta r+F'\delta r'+\&c.\right)=0$, (D); which is the general formula of dynamics. (See the Mec. Anal. of La Grange, Vol. I, page 251.) (D) can be changed to $Sm\left(\frac{d^2x\delta x+d^2y\delta y+d^2z\delta z}{dt^2}+X\delta x+Y\delta y+Z\delta z\right)=0$, (E); the large capitals X, Y, Z, denoting the same things as in (C), (given at page 333 of the last Journal,) ,X, ,Y, ,Z, being the corresponding quantities for ,*m*, and so on for ,,*m*, ,,,*m*, &c. (E) agrees with (P), (given by La Place in Vol. I, p. 51 of the Mec. Cel.) By means of the equations of connexion between *m*, ,*m*, ,,*m*, &c. and of the lines, or surfaces, on which they are supposed to move; we are to eliminate from (E) so many of the variations δx, δy, δz, δ,x, δ,y, δ,z, $\delta,,x$, &c. as there are equations; then since the remaining variations are independent of each other, their co-efficients must each be put $=0$; and there will arise equations which together with the equations of condition will make as many equations as there are co-ordinates, x, y, z, ,x, ,y, &c.; by which each of the co-ordinates can be found at any given time, and hence the place of each of the particles *m*, ,*m*, &c. becomes known at the same time. But the same thing can generally be more expeditiously effected by adding to (E) the variations of the equations of condition, each multiplied by a separate indeterminate; then δx, δy, δz, &c. being considered as independent, their co-efficients must each be put $=0$; which will give as many equations as there are co-ordinates; but the indeterminates are to be eliminated, which being done, the number of equations will be less than before by as many as there are indeterminates; but the equations of condition being the same in number as the indeterminates, there will be as many equations as there are co-ordinates, whence the place of each particle can be found as stated above. This process is virtually the same as to suppose that the effects of the connexions, &c. of m, $_{,}m$, &c. in altering their motions are included in (B′), (B″), &c. among the terms $F\delta r$, $F'\delta r'$, &c. and then to eliminate the indeterminate forces. Another method consists in expressing x, y, z, $_{,}$x, &c. in terms of other variables, which either wholly or in part comprehend the equations of condition; then by putting the co-efficients of the independent variations thus obtained, each $=0$, there will result equations sufficient, with the equations of condition, to find the place of each particle m, $_{,}m$, &c. at any given time as before. In the case of the motion of a solid, m, $_{,}m$, $_{,,}m$, &c. are to be considered as elements of the body; hence by supposing their sum, or the quantity of matter in the body to be M, m may be expressed by dM; then by expressing x, y, &c. in terms of other variables, which are the same for all the elements of the solid, integrate relatively to the mass of the body, considering the common variables as constant in the integration; (the well known properties of the centre of gravity, and the principal axes of a solid, will serve much to facilitate this integration;) after the integration put the co-efficients of the variations which remain after having eliminated so many as there are equations of condition, each $=0$, and there will result equations sufficient, with the equations of condition, to find the place of any given particle of the solid at any given time.

It may be observed that if the forces mF, mF′, &c. $_{,}m_{,}$F, $_{,}m_{,}$F′, &c. which act on m, $_{,}m$, &c. destroy each other's effects, so that there is no motion in the system; then $\frac{d^2\text{x}}{dt^2}$, $\frac{d^2\text{y}}{dt^2}$, &c. are each $=0$; hence by putting (for brevity) $m\text{F}=f$, $m\text{F}'=f'$, &c. $_{,}m\text{F}={}_{,}f$, $_{,}m_{,}\text{F}'={}_{,}f'$, &c. and so on for $_{,,}m$, $_{,,,}m$, &c. (D) becomes $\text{S}(f\delta r + f'\delta r' + \&c.)=0$, (F); which is the well known formula of statics. (See Mec. Anal. Vol. I, p. 29, art. 2.) But the formula of statics can be otherwise demonstrated by the aid of the principle of the composition and decomposition of forces. For imagine a particle of matter, considered as unity, to be referred to three rectangular axes, x, y, z, whose origin is at any point of the line r, in which the force F that acts on the particle is exerted; then F decomposed in the directions of x, y, z, gives $\frac{Fx}{r}, \frac{Fy}{r}, \frac{Fz}{r}$, for the force of F in those directions; put $\frac{Fx}{r}=-X$, $\frac{Fy}{r}=-Y$, $\frac{Fz}{r}=-Z$; hence $Xx+Yy+Zz+Fr=0$, (c); X, Y, Z, being fictitious forces, which are equal respectively to $\frac{Fx}{r}, \frac{Fy}{r}, \frac{Fz}{r}$, and acting directly opposite to them, so that the particle is kept at rest by these opposing forces; (c) is similar to (c) given at page 332 of the last Journal; by changing $\frac{d^2x}{dt^2}, \frac{d^2y}{dt^2}, \frac{d^2z}{dt^2}$, into X, Y, Z, respectively, that formula becomes (c) given as above. In like manner for another force F' acting on the particle, I have a similar formula, $X'x'+Y'y'+Z'z'+F'r'=0$, (c'); and so on for the forces F'', F''', &c. to any number of forces whatever; by accenting the letters once for F', twice for F'', and so on; the co-ordinates x, y, z, x', y', z', &c. being respectively parallel to each other. Now by adding (c), (c'), &c. and taking the variation, &c. as at pages 332, 333 of the last Journal, I have $(X+X'+ \&c.)\delta x+(Y+Y'+ \&c.)\delta y+(Z+Z'+ \&c.)\delta z+F\delta r+F'\delta r'+ \&c. =0$, (G); this is the equation of connexion between the actual and fictitious forces in the case of the equilibrium of the particle. Hence supposing that the particle is kept at rest by the actual forces alone, the fictitious forces must destroy each other; hence (G) becomes, by the omission of the fictitious forces, $F\delta r+F'\delta r'+ \&c. =0$, (H); which is the formula of statics in the case of the equilibrium of one particle of matter. (H) can be extended to the equilibrium of a system of particles in the same manner that (B) has been extended to the motion of a system of particles m, $_{,}m$, etc.

Art. XIII.—*On capillary attraction; by* Prof. Theodore Strong.

TO PROFESSOR SILLIMAN.

New Brunswick, Jan. 27, 1830.

Dear Sir—Should you think the following method of considering the phenomena of capillary tubes of any importance to the cause of science, you will oblige me by giving it a place in the Journal.

Yours respectfully, T. S.

I suppose the internal surfaces of the tubes to be either cylinders, or right prisms, made of the same kind of glass, and immersed in a given fluid of indefinite extent. I also suppose the internal surfaces of such tubes to be composed of an indefinite number of laminae, of uniform and equal width, which are parallel to the axes of the tubes. My object is to find the effect of one of these laminae, and to show, that it is always the same whatever the diameter of the tube may be. It has been proved abundantly by experiment, that the attraction between the fluid and tubes extends to imperceptible distances. I hence infer, that the diameter of any capillary tube may be regarded without sensible error as infinite in comparison with these distances; and that the internal curvature in cylindrical tubes, and the angles in those of a prismatic form do not sensibly affect the attraction between the fluid and tubes, nor the attraction of the particles of the fluid to each other. From these principles it is evident that the effect of one of the laminae is the same as if it was detached from the tube, and inserted by itself in the fluid, which effect is manifestly constant. Let $a=$ the quantity of fluid raised in any vertical capillary tube; $w=$ the weight of a portion of the fluid whose mass is denoted by unity; then $aw=$ the weight of a; put $m=$ the width of one of the laminae, and $n=$ the number of them; $p=$ the internal perimeter of the tube, then $nm=p$ or $n=\frac{p}{m}$. Now $aw=$ the effect of all the laminae $\therefore \frac{aw}{n}=$ the effect of one of them (since they evidently produce equal effects;) hence by what has been shown $\frac{aw}{n}=\frac{awm}{p}=$ const. or (since $m=$const.) $\frac{aw}{p}=$const.$=c$. (1). Supposing now that the axis of the tube is inclined to the horizon, at the angle, θ; and that $a'=$ the quantity of fluid raised; w, when resolved in the direction of the axis of the tube (by the theory of the inclined plane,) becomes $\sin\theta w \therefore$ as before $\frac{\sin\theta a'w}{p}=c$ (2).

Let the internal surface of the tube be cylindrical, D= the diameter, H= the mean height of the fluid; 3.14159 etc.=P; (the tube being supposed to be vertical) then $a=\frac{D^2HP}{4}$, $p=DP \therefore$ by (1) $\frac{aw}{p}=\frac{DHw}{4}=c$, or $DH=\frac{4c}{w}=$const. (since c and w are constant) or H is as $\frac{1}{D}$. It is evident by (1) and (2) that the vertical height of the fluid in the same tube is constantly the same, whatever θ, may be: this result, together with (1) and (2) have been obtained by La Place in his theory of capillary attraction.

Art. XIV.—*Particulars respecting an irised Aurora Borealis, communicated by* James Bowdoin, Esq.

TO PROFESSOR SILLIMAN.

Boston, Nov. 16, 1829.

Dear Sir—On Saturday evening, Sept. 8, 1827, being at Augusta in Maine, I called the attention of Doct. E. S. Tappan, about half past 9 o'clock, to a bright and well defined arch, extending towards the East and West, whose crown was about 45° above the northern horizon. It almost instantly disappeared. How near the horizon, or how long the arch was visible, I had not an opportunity of knowing. It was even brighter, than that I had witnessed at Boston a fortnight before.

My friend and fellow traveller, G. Ralston, Esq. of Philadelphia, with Dr. Tappan and myself then saw pencils, or rather columns *perfectly irised*; very strongly resembling regular segments of a fine rainbow, in the disposition and arrangement of colors and in shape; although, in some other particulars, having the appearance of clouds, so illuminated. Each of these pencils, or columns, the sides of which were parallel, and their ends regularly and smoothly truncated perpendicularly to these sides, was somewhere about half a degree in width; and in length about eight degrees, though varying in both particulars. They were not *radii* from the north, but parallel to each other, running from a little East of North: their lower extremities being about 20° from the horizon. You will of course note here, that the *bearing* of these columns differed much from that of the arch before mentioned. From parallels, these soon became "merry dancers," as they are elsewhere called, and bent rapidly, and continued nimbly playing into curves of small circles; some times looking as if gracefully folded and twisted, like the most delicate gauze.

Of the disposition of the colors, whether in precisely the same order with those of the solar bow (if indeed any other could be formed,) my notes do not inform me; and taking for granted that though new to me, others had often seen the same thing, my memory does not furnish me with the side or edge, (whether towards the West or East,) on which was the red tint; nor whether it was upon the same side of each of the columns. These appear to me important facts, and I greatly regret that they were not noted when fresh in my recollection.

The iricolored appearance continued only a few minutes. The sky soon became quite pure, every thing resembling a cloud disappearing, and the long, bright streamers now shot up from the north, toward the zenith. Some of these continued near a half a minute, and were occasionally tinged with red, or with yellow :—two colors, I believe, not unfrequently seen : I saw them both a few days after, in another part of Maine.

After these streamers had disappeared, we saw the light, quite feeble springing up from the North almost to the zenith, throughout the northern hemisphere; and if the comparison may be permitted resembling extremely intermittent puffs of light colored or illuminated smoke sent forth from some huge bellows; so very rare and attenuated as not to have been observed without close attention. It was softer and very much less bright than the light of the galaxy.

Next followed what I shall call the *common lights* in the north; and in about fifteen or twenty minutes from our first observation, the whole *spectacle* ended, leaving a bright pure sky. You will not *now* doubt that this was to me an exceedingly interesting exhibition, although I had seen *the lights* an hundred times before.

The moon, nearly full, having risen about 8 o'clock, shone during the whole time : But neither the position of the columns, nor any rain or remarkable humidity of the air ; nor the appearance of the light and colors, allow me to attribute the phenomena to her bow : and besides, there were three or four of these columns equally bright.

The air, towards evening, had become pretty rapidly cool; and during the day the atmosphere had been a little smoky, from the burning wood.—I mention these facts, also, without ascribing to them any effect as regards the colors.

As you may recollect, I am very short-sighted.* Now you know short-sighted people *see with different eyes from others.*—As regards the colors of clouds of different heights particularly, they do not always agree with their " eagle eyed" friends, in the intenseness of color, nor sometimes in the color itself; a cloud being occasionally colorless to the eye of the one, whilst it is tinged to the eye of another :—Such at least is the result of my own experiments, made several years ago;

* But my vision is distinct. I have read the newspaper by moonlight—have detected without any previous intimation of the fact, the initials under the bust of Geo. upon the sovereign, and read the Lord's Prayer, &c. in the medallion specimens of Jacob Perkins.

though as I have never happened to meet with a notice of the fact by others, farther examination may be required. I should indeed have felt some doubts of my own accuracy in the above account of the Aurora Borealis, had I not at the time compared notes with the two gentlemen before mentioned.

I have avoided inferences and deductions from the irised Aurora, and the theories connected with polar ice, &c. If the fact does not exhibit a new "decus cœli," it is probably rare in this region, and this notice of it may lead to a more vigilant observation, should there be a recurrence.

In an examination of this sort, we have many known principles to guide us :—The laws of the spectrum, the general laws of reflection and refraction (which may give us the position of the reflection and refraction of the original illuminator) are known and within the observation of every one, on the great scale, during the summer, and at our great falls during most of the year ; while on the small scale, every house supplies the means of experiment. Should these notes (sent at your suggestion) lead only from a negative towards a positive, from shewing what is *not* the source of the Aurora Borealis, *towards* what is that source, they may not prove entirely without utility.

Remarks.

The colors usually mentioned as being exhibited by the northern lights are white and yellow, and as they grow more active they usually become red, increasing sometimes in intensity to blood red. Occasionally, other colors are mentioned, as green, blue and purple.* In an aurora which occurred Dec. 18th, 1736, at Oswer Zornea, Maupertius observed that an extensive region of the heavens towards the south appeared tinged of so lively a red that the whole constellation Orion seemed as if dyed in blood. This light was for sometime fixed, but soon became moveable: and after having successively assumed all the tints of violet and blue, it formed a dome, of which the summit nearly approached the zenith in the south west. Its splendor was so great, as to be in no degree affected by the strong light of the moon. Maupertius adds that he observed only two of these red northern lights in Lapland, which are of very rare occurrence in that country, although the aurora there assumes a great variety of tints." For

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* Musch. Institutes, quoted by Edin. Encyc.

half a century, the existence of southern polar lights, has been fully established. Besides earlier notices in the Philos. Trans. Mr. Forster who, as a naturalist, accompanied Captain Cook in his second voyage of discoveries, states, that on the night of the 16th of Feb. 1773, in S. lat. 58°, a beautiful phenomenon was observed and was exhibited during several successive nights. "It consisted of long columns of a clear white light, shooting up from the horizon to the eastward, almost to the zenith and gradually spreading over the whole southern part of the sky. These columns were sometimes bent sideways at their upper extremities; and though in some respects similar to the northern lights of our hemisphere, yet differed from them in being always of a whitish color; whereas ours assume various tints, especially those of a fiery and purple hue."

As in the Aurora described by Mr. Bowdoin, and seen also by his observing friends, the columns were perfectly irised and very strongly resembled the regular segments of a fine rainbow, both in form and in the disposition and arrangement of colors, it would seem that the appearance if it should not, on fuller examination, prove to be novel, is probably uncommon; and we are therefore much obliged by his communication. If similar facts gathered either from reading or observation are within the knowledge of any person it is respectfully requested that an account of them may be communicated for this Journal.

New-Haven, March 2, 1830.

Art. XV.—*Notice and description of a Marine Ventilator; by* Samuel Whiting.

The *marine ventilator* consists of a box, or chest, of dimensions to adapt it to the vessel in which it is used, say from six to twelve feet long; from two to four feet in depth, and from three to six feet wide. This box, or chest, is divided into four compartments, to wit, upper and lower, by a horizontal vibrating midriff, suspended upon an axis resting in the middle of the perpendicular sides of the box, and dividing the space into two equal portions. The ends of the box form segments of the circle which would be described by a revolution of the midriff upon its axis, so that in the vibrations of the midriff, as little air as possible may escape from one compartment to the other. These upper and lower spaces, are subdivided by a middle perpendicular partition, above and below the axis, and so fitted to the same, as to permit it to turn without suffering the air to escape from one to the other division; preserving as little communication of air between the compartments as possible. This midriff is to be operated by pistons, or pitmans, attached to it in each of the upper compartments, and passing through the top of the box, they are connected with a break, or lever, resting in a fulcrum in the centre of the top of the box, and for the convenience of working it, extending at each end beyond the end of the box.

Through the perpendicular sides of the box, and as near the axis of the midriff as may be, without interfering with its motion, are four apertures on each side, to admit and discharge the air. These apertures are governed by valves; one on each side of each of the upper and lower compartments, opening inward; and one in each, opening outward; and that transversely. Over each two of the valves, in the upper and lower compartments, respectively, is placed an air-tight cell, calculated to receive a general conductor of air, to or from the valves it covers. Thus on the vibration of the midriff, at the descending end, the fresh air is drawn into the upper compartment through the inside valve, while the foul air is driven out of the lower compartment at the same end, through the outside valve; and *vice versa.*

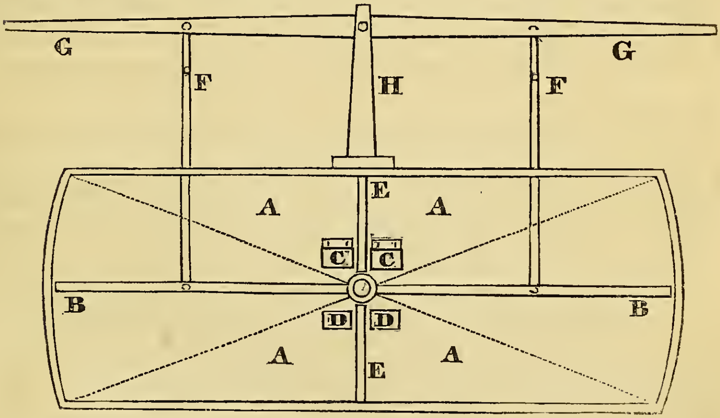
From the cells which cover the valves, conductors extend respectively to the hold of the vessel, at different and remote parts of it, one to inhale at one part, the foul air, and another, at another part, to exhale the fresh air; while others extend abroad in different directions, one to inhale at one place the fresh air, and another at a remote part of the vessel, to exhale the foul air. Thus a continual current of fresh and foul air, respectively, is passing through the ventilator: the fresh air through the upper compartments, and the foul, in an opposite direction, through the lower; so that a fourfold operation is performed by every stroke or movement of the lever which governs the midriff; to wit, inhaling fresh air at one valve, exhaling fresh air at another; inhaling foul air at one, and exhaling foul at another; and this alternately.

This machine is to be suspended under the deck of the vessel, through which the pistons, or pitmans, by which it is worked, pass; and in the most convenient part: Or it may be in a detached and moveable form, and worked altogether above decks, or in the vessel's hold. The pipes, or conduits, to convey the air, may be either stout leathern hose, or wooden, or metallic tubes, passing to the different arts of the hold, under the deck.

By the use of this machine, vessels may be ventilated at sea, at any time, in any situation, and in any weather, and a current of pure air be made to pervade the interior of the vessel, while her hatches are kept closed; whereas in the ordinary method, it is only in situations when the hatches can be open, and the vessel at anchor, or in smooth water that any thing of the kind is attempted, and even then with comparatively, but partial effect.

Considering the very great importance to commerce and navigation, attached to the preservation of vessels and cargoes, which, especially in long voyages, and warm seasons and climates, depends in so great a measure upon the purity of the vessel's hold; and also the very imperfect manner in which that object has heretofore been ordinarily attained; it is presumed that essential benefit may be derived from this improvement to the community, in those branches of its interest.

Redding, Conn. Dec. 29th, 1829.



A, A, A, A, The four compartments.
B, B, The midriff.
C, C, Two apertures in upper compartments; valves inside.
D, D, Two apertures in lower compartments; valves outside.
E, E, Perpendicular partition.
F, F, Pistons, or pitmans.
G, G, Break, or lever.
H, Fulcrum.
Dotted lines exhibit the sweep of the midriff.

Remarks.—The object of the above invention is important; and as far as we can judge without having seen a working model; and with a limited acquaintance with nautical affairs, the machine is at once ingenious, cheap and simple, and likely to prove effectual.

It is said that a machine for ventilating confined places was invented in England by Dr. Hales; its principles were stated to be similar, but its structure more complex, and not well adapted to marine use; and it does not appear to have been so applied. We understand that Mr. Whiting intends that his machine should be used in prisons, hospitals and other situations, which it may not be convenient always to ventilate in the usual modes, and in every case of this kind, it is obviously susceptible of useful application. Even where chlorine and its preparations have been used to destroy noxious effluvia, it may be, and generally would be necessary that the premises should be afterwards ventilated, and their situation might render it very desirable to use such a machine as the marine ventilator.

It might be used, with much advantage, in removing the carbonic acid gas (the damp of the common people,) from wells, as bad air would be replaced by good, and if there were no source from which the noxious gas might flow in again, the cure might be permanent.

Art. XVI.—*Notice of some Localities of Minerals, in the counties of Baltimore and Harford, Md.; by* Philip T. Tyson. *With an Appendix, by* C. U. Shepard.

1. Fine grained dolomite, (mag. carb. of lime,) embracing lamellar talc and crystallized and granular pyrites; fourteen miles from Baltimore, and one fourth of a mile west of York turnpike. Also the compact variety of mag. carb. of lime; one mile west of the 13 mile stone on York turnpike road.

2. *Chalcedony*, of a sky blue color, translucid and beautiful; half a mile east of where the Western Run crosses the York turnpike. *Agate and carnelian*, in thin coatings upon chalcedony; near the Falls turnpike, four miles from Baltimore. Agate is found also thirteen and a half miles from the city on the York turnpike.

3. *Tourmaline*, (*cylindroide* of Haüy,) of a brownish green color; occurs in quartz on the York turnpike, fourteen and a half miles from the city. Also (*trédécimale* of Haüy) in granular limestone, three fourths of a mile E. S. E. of where the York turnpike crosses the Western Run.

4. *Precious garnets.*—In granite, whose felspar is white and granular, two miles and one fourth from the city, N. E. of Jones' falls, there are cuneiform masses of mica, from three to seven inches broad, and some three inches thick at one edge, inclosing great quantities of beautiful garnets; most of them seem to have been compressed between the plates of mica, into a tabular* form; some are not thicker than good writing paper; in color they vary from cherry red to brick red, with a vitreous lustre; their breadth seldom exceeds two tenths of an inch. Such of them as are not so much compressed, as entirely to conceal the crystalline form, appear to be the *trapezoidal* of Haüy.

5. *Common garnets,* (*primitif* of Haüy,) are found in great abundance, the largest two inches in diameter and very perfect for large crystals, in a decomposed mica schist, three miles east of Jessop's mill, on the Gunpowder river. *Common garnets,* (*primitif alongé* of Haüy,) in mica slate, nineteen miles from this city, on the York turnpike.

6. *White augite,* formerly noticed, in this vicinity.†

7. *Talc,* similar to that beautiful green variety of Smithfield, R. I. occurs in serpentine, accompanied by chromiferous oxide of iron, steatite, &c. four miles east of the 24 mile stone on the York turnpike. *Talc,* white, green, brownish red and reddish purple, occurs in small scales, at locality 3; its lustre is pearly.

8. *Magnesian hydrate of silica.*—This substance I met with near Cooptown, Harford county, Md. where it occurs in abundance, in serpentine; and although it is said to exist in other places, yet, as I have never seen a description of it, I shall submit the following. The color, by reflected light, varies from dark chesnut brown to rather dark honey yellow, but a shade of red is given to it by transmitted light; the powder feels rather gritty and is yellowish white; this is also the color of the streak. It is translucid or semi-transparent, in very thin pieces; the surface has a smooth compact appearance, and

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* I have constructed two electric needles, and capped their centres with these garnets, instead of rock crystal, as recommended by Haüy, and find they answer well. Their natural polish is so perfect and their forms so beautiful, that they would derive little embellishment from the jeweller.

† I lately found a crystal, one mile west of the 13 mile stone on York turnpike road, five inches long and two and a half broad, (*perihexaèdre* of Haüy.) I have also found a crystal of the dark variety of augite, formerly noticed by Dr. Hayden as being within the range of the white variety. It is a hexahedral prism.

the lustre is resinous. It may be scraped by the knife, although it scratches glass. It is very brittle, with an imperfectly conchoidal fracture, and exists in botryoidal concretions and amorphous masses, traversed by irregular fissures. Specific gravity from 2.19 to 2.21. Before the blowpipe it loses color, and the point of a slender fragment is fused with difficulty into a white enamel. With salt of phosphorus or borax, a large proportion of the mineral fuses easily into a colorless transparent glass. Mr. Allen of this city analyzed it, and after having carefully verified his results, found it to consist of

Silica, - - - - -	43.
Magnesia, - - - -	30.5
Alumina, - - - - -	2.
Water, - - - - -	24.
Loss, - - - - -	.5
	100.

The magnesia does not seem to exist in a quantity equal to a definite proportion, but there appears just water enough to form with the silica a "hydrate" consisting of an atom of each.

9. *Precious serpentine*, of a lively green color is found at the same locality as the last.

10. *Compact asbestus*, of a dull green color and translucid, with fibres, as usual, rigid and sharp; same locality.

11. *Flexible asbestus*, pure white, in very soft delicate fibres, irregularly disposed, (the var. *cotonneux* of Haüy,) occurs in granular limestone, on the York turnpike, sixteen miles from Baltimore.

12. *Graphite, lamellar*, occurs in gneiss, three miles east of the 17 mile stone on the York turnpike, and also in limestone, fifteen miles from Baltimore, on the same road.

13. *Pyritous copper*, (a mineral which on account of its value to the arts is always worthy of being noticed,) occurs in small quantity seven miles from this city, on the Baltimore and Ohio rail road, in a rock composed of quartz, imbedded in compact felspar, (porphyry?); the rock also embraces small grains of magnetic oxide of iron. Pyritous copper also exists in granite, in several places on the above rail road, from nine to fifteen miles from town, but no vein has yet been discovered.

14. *Iron pyrites*, in large crystals, (*dodecaèdre* of Haüy,) is found in limestone, twelve miles from the city, on the York turnpike.

15. *Magnetic oxide of iron*, massive and in crystals, (*primitif* of Haüy,) occurs in abundance near locality 7, in talc chlorite.*

Baltimore, Feb. 1830.

On the Mineralogical and Chemical characters of the Deweylite, and the probable indentity of the "Magnesian hydrate of Silica" with this species; by CHARLES U. SHEPARD.

The preceding notice of the "Magnesian hydrate of Silica," by Mr. Tyson, agrees so well with what is known of a substance found in Middlefield, Mass., that for the purpose of rendering obvious the identity which I believe to exist between the two minerals, I take the liberty of annexing to his Memoir a more full account of its properties than has been hitherto published.

This mineral was discovered many years ago by Dr. E. Emmons; and is described in his Manual of Mineralogy and Geology, (Albany 1826,) p. 133, under the name of "Deweylite," in honor of Prof. Dewey of Pittsfield, Mass. His description is as follows.

"Color white, yellowish white and sometimes greenish; translucent. Becomes slightly opaline on being immersed in water, and breaks into numerous rounded fragments or coarse grains: brittle: easily scraped and cut with a knife, the detached fragments being projected with considerable force. It is more or less traversed in every direction, by cracks or seams, exhibiting a tendency to break into short columns: decrepitates strongly before the blowpipe: becomes snow white, and fuses with difficulty into an enamel, without effervescence: structure generally compact, but sometimes slightly slaty: often exhibits, in the interior, mammillary and short stalactical concretions, which appear to be covered with the points of exceedingly minute crystals. It is composed principally of silex and magnesia, with about thirty per cent. of water. It is found in irregular seams or cavities in the brown serpentine of Middlefield, Mass. It has every appearance of having been formed by infiltration."

* Duplicate specimens of many of the foregoing minerals, as well as others heretofore noticed in the American Journal, are in the possession of myself and some of my scientific friends in this city, which would be exchanged for those of other places. I am happy to say, that a mineral supposed by some to be the chabasie, and by Dr. H. Hayden believed to be new, and which was mentioned in this Journal, has lately been found in abundance, in large and perfect crystals, and not decomposed like those formerly found. It is accompanied by beautiful pearly zeolite; and some farther notice of it may be expected soon.

About two years ago, and before having seen the description of Dr. Emmons, I made a mineralogical and chemical examination of the mineral under consideration; the account of which has lain by me unpublished until this moment, and which I here give entire, as it was then drawn up.

In the spring of 1825 I visited the locality of this substance in company with Dr. Emmons. It was embraced in Serpentine, and occurred in veins from one quarter, to one and a half inches in thickness. These veins were disposed, for the most part, horizontally; and were situated directly in the bed of a small stream, which at the time we visited the spot, was sufficiently low to admit of our obtaining a tolerable supply of specimens; although considerable masses of serpentine were often to be removed by the hammer and chisel, in following the veins.

Description.

Massive. Fracture even: imperfectly conchoidal.

Lustre vitreous inclining to resinous: in degree, varying from shining to dull: color white, tinged in veins with yellow, green and red: translucent. Streak white. The most translucent fragments, after immersion in water, afford by transmitted light, a bluish color.

Brittle. Easily frangible, especially if thrown into water, when a large mass may be broken into fragments by the mere strength of the hands. Hardness intermediate between that of Calcareous spar and Fluor, and may be expressed by the scale of Mohs, as =3.3. Sp. gr. =2.246.

Before the blowpipe it decrepitates violently: but when heated slowly, it loses its lustre, becomes opaque, and fuses with great difficulty upon the edges, into a white enamel. In the state of powder, with borax, it forms a colorless transparent glass.

Analysis.

50 grains, in the state of an impalpable powder, heated for one hour in a platina crucible, lost 10 grains in weight, and presented no perceptible change in color. Mingled with three times its weight of potash, it was exposed to a dull red heat in a silver crucible during thirty minutes. The resulting mass presented the appearance of having undergone a perfect fusion, and when cold was free from metallic stains. It was separated from the crucible by the affusion of warm water, and treated with an excess of muriatic acid. The colorless

solution thus produced, was evaporated to dryness, redissolved in water, and the solution after having been rendered slightly acid by the farther addition of muriatic acid, was thrown upon the filter to separate the silica, which, after repeated washings and calcination, amounted to 20.4 grs.

In order to learn whether alumine was present, the muriatic solution, after a partial evaporation to reduce its bulk, was decomposed by carbonate of potash at a boiling heat. The precipitate was thoroughly digested in a solution of potash, the alkaline liquor separated from the residue by the filter, and after a slight super-saturation with muriatic acid, again treated with carbonate of potash. No precipitate occurred.

Having assured myself in this manner of the absence of alumine, I dissolved the residue, upon which the potash had been digested, in dilute sulphuric acid. It was entirely soluble.

Carbonate of potash added to the sulphuric solution, at a boiling heat, threw down a copious precipitate, which after separation and drying, was found to be a pure carbonate of magnesia.

Having satisfied myself that the Deweylite consisted of silica, magnesia and water, I proceeded as follows.

25 grains were calcined during one hour, in which time they lost 5 grains in weight. The calcined powder, fused with three times its weight of potash, and treated with muriatic acid as before, afforded 10 grains of silica.

The muriatic solution was decomposed by carbonate of potash, and the precipitate after being dried and calcined for nearly an hour, weighed 10 grains. Thus presenting us with the following result.

Silica,	10.	*or per hundred*	40.
Magnesia,	10.	" " "	40.
Water,	5.	" " "	20.
	25.		100.

It is therefore a compound of

5 atoms silica, - - - -	10.
4 atoms magnesia, - - - -	10.
4 atoms of water, - - - -	4.5
	24.5

Whether the Deweylite be a true chemical compound, or a mechanical mixture of the hydrate of magnesia with silica, I will not pretend to decide. The only difference between it and the precious serpentine in chemical constitution, is, that it contains one proportional more of water, and is free from the accidental ingredients of lime, alumine and manganese, so common in serpentine.

On a comparison of the mineral described by Mr. Tyson, with the Deweylite, the only want of coincidence is seen to lie in the property of hardness and in the composition. His mineral is possessed of an hardness slightly superior to ours, and contains rather more silica and water. The difference however in our results, is not greater than what is found in the analysis of specimens of Serpentine from different localities.

Art. XVII.—*On the Crystalline Form of Iodine ; by* Lieut. W. W. Mather, Assistant Professor of Chemistry and Mineralogy at the U. S. Military Academy.

Iodine has been observed crystallized in rhomboids, rhomboidal tables, and elongated octahedrons, by Sir Humphry Davy, Gay-Lussac, M. A. Plisson, and others ; but we have never seen any account of the angles at which the faces of the crystals incline to each other.* Before seeing M. A. Plisson's notice that iodine could be obtained crystallized, by " exposing ioduretted hydriodic acid," Lieut. Hopkins and myself had observed it in the chemical laboratory at West Point, in a bottle of hydriodic acid, that had been for one or two years exposed to a limited access of air, by the stopper not fitting very closely. Some of the crystals were $\frac{3}{10}$ of an inch in length, having the lustre of the specular oxide of iron from Elba. The form was generally that of an octahedron with a rhombic base, having the acute lateral solid angles replaced by tangent planes. The

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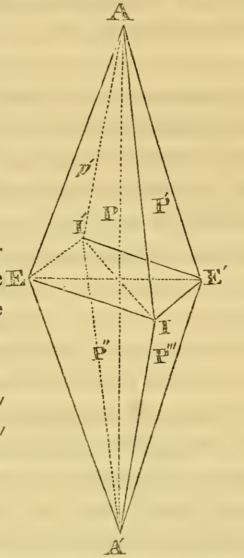
* Dr. Wollaston, in the Annals of Philosophy, Vol. V, p. 237, describes iodine as forming octahedral crystals, whose axes are to each other in the proportion of the numbers 2, 3, and 4: also in rhombic plates, bevelled at their edges by two narrow planes, inclined to each other under an angle of 120° 30′, from the frequent occurrence of which he remarks, that some crystallographers may be disposed to regard this rhombic plate (of which the acute angle is about 53°) as a modification of a rhombic prism, whose diagonals are 2 and 4, and its height 3:—the modification of the octahedron being derivable from either with equal facility.—*Ed.*

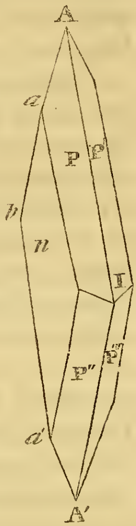
inclination of one of these secondary, with one of the adjacent planes, was determined by the reflective goniometer; but no more of the angles could be measured by this instrument, on account of the vapor from the crystal affecting the eyes.

P on *n*	120°	reflective goniometer.	
P on P′	120°	common	"
P″ on *n*	120°	"	"
Plane angle at *a*	44°	"	"
" " " *b*	136°	"	"

From these, the plane angles, and the inclination of the planes to each other, were calculated.

P on P″	142° 08′ 20″
P on *p*′	73° 10′ 50″
Plane angles at A	38° 56′
" " " E	62° 29′
" " " I	78° 35′





The axis is to the greater diagonal of the base, : : 3 : 2, and to the shorter diagonal, : : 3 : 1; or more accurately, AA′ : EE′ : II′ : : 1 : .497 : .355. These measurements must not be considered as perfectly accurate; but rather as approximations.

Art. XVIII.—*On the Transition Rocks of the Cataraqui; by* Capt. R. H. Bonnycastle, R. E. Canada.

(Communicated for this Journal.)

TO THE EDITOR.

Sir—Conceiving that any circumstances tending to throw light on the ages of rocks, must prove interesting in the present state of geological science, and also apprehending that there are few which present more singular appearances than those I am about to undertake a feeble examination of, I have ventured to address you.

It is well known that transition granites are found superincumbent upon beds of talcose limestone, and that masses or nodules of limestone, as well as of other rocks, have been observed imbedded in such substances, but I do not remember ever to have heard that granite covered by, or in connection with, transition limestone, intermingled and interlaced itself and its constituent particles, with that formation.*

Along the north eastern edge of the great basin of North America, the ridge of granites which marks the division between the primary, or the transition, and the secondary countries, is denuded to a considerable extent, until it approaches the St. Lawrence and crosses that river by the vast chain of amphibolic rocks which divide the beautiful, the extraordinary, and the innumerable channels in which that great stream is forced to wind its way, amidst the lovely scenery of the Thousand Islands.

Kingston, or Cataraqui, at the outlet of Lake Ontario, is the point where, to the eye of a casual observer, this granitic ridge seems to terminate its course; for at this point, the western extremity of the Thousand Isles, the ridge is almost lost, and the character of the rock itself appears wholly changed, as it intermingled with syenites and serpentinite at Cedar Island, or becomes wholly syenitic, as at the northern extremity of Hamilton cove, or resolves itself altogether into a singularly hard compound, intimately mixed in minute grains of felspar, quartz and carbonate of lime, with hornblende and micaceous iron at Point Henry.

Numerous varieties of syenite exist, in a very limited space, on Cedar Island, and appear to pass into each other, by rapid alternations, in a small compass, whilst the specimens of serpentinite aggregate with them, and but for the little carbonate of lime they contain, would appear, in many instances, more like real greenstone than euphotide.†

The granitic associations are again lost and vast tables of transition limestone, with few or scarcely any organic remains, entirely cover them, for the space of above four miles to the north east of Point Henry, when the granite, a kind of very hard, dark whinstone, again

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* In the Pyrenees, vertical beds of granular primitive limestone, intermix with granite and trap.

† Besides this serpentinite, there are also specimens in which fibrous lamellar tremolite, epidote and felspar, assume the exact appearance of verde antico.

breaks forth, assuming the character of a mural precipice and affording a narrow passage for the waters of the Cataraqui; but it retains this character only for a short distance, when it once more changes into the rounded, and wave like pale flesh colored syenite of Hamilton cove, remarkable for a coating of schorlaceous threads, and for the metallic crust investing the interior surfaces of those portions which by the action of the weather, have fallen from the mass, in cubic blocks. Adularia, of a light cloudy blue, is also observed in this syenite, which is extremely hard to work, takes scarcely any polish, and has a slightly unctuous feel. It contains but little hornblende, and less talc, and is composed almost wholly of felspar, in small grains, with white and bluish quartz, the felspar greatly predominating.

One singular vestige of the ancient flood still marks this rock, and indeed all those of the Cataraqui. Channels, deeply worn and perfectly smooth, pervade its surface, in lines running north east and south west, which, indeed is the general tendency of the ridges themselves.*

This syenite sinks immediately beyond Kingston Mills and is covered by the alluvions of the Cataraqui. Where it again rises I do not know, as the adjacent country to the northward is interminable forest, but from the statements of several scientific officers, who have recently explored the interior in much higher latitudes, there is every reason to believe, that it connects itself with the height of land by which the waters of the Ottawa or Grand River are divided from those which, flowing from the Rocky Mountains, pervade the territory of Hudson's Bay.

Primitive granite, or the true granite of the oldest rocks, does not, perhaps, exist in the neighborhood of Lake Ontario;† whilst we know, from the statements of the travellers above mentioned, that it is equally deficient as far north as Lake Temiscaming, or nearly to the height of land, and Franklin's journey shews that it is by no means common, even until we almost reach the shores of the Arctic Ocean.

It will, therefore, by many persons, be deemed very improper to style the aggregate we are about to treat of, by the designation gran-

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* I observe that a writer in the last number of the Journal states, that similar appearances, on the opposite shores of Lake Ontario, are numerous.

† "Dans le voisinage d'un district connu sous le nom des Milles Isles, on trouve une chaine des granites. Tous ces isles semblent être composeés d'un granit congeatre, bien crystallizé dont le feldspath est l'ingredient le plus considerable."—*Guillemard.*

ite, as the micaceous ingredient is almost, or perhaps entirely, wanting in the transition rocks of the Cataraqui. But although there is every reason to be adduced in favor of other terms, inasmuch, particularly, as most other mineral compounds have received distinct names, yet the relative ages of the granitic rocks are still so little understood, that we shall, in obedience to the all powerful sway of custom, continue thus to style them.

In the neighborhood of Kingston, certainly, the micaceous ingredient of a true granite disappears in the various aggregates of which the more ancient rocks consist, but still the positions assumed by modern geologists concerning primary and subsequent formations of granites, is strikingly exemplified in the very singular distribution which nature has here made of her mineral resources.

It is asserted that the presence of tin, magnetic iron, hornblende, garnet, talc and chlorite, replacing mica, as well as a tendency to pass to pegmatite, characterise the newer formations of that substance, which had heretofore been considered as the oldest of all known mineral matter, and that primitive euphotide,* posterior to clay slate, is placed at the limit of primitive and transition formations, a compact grayish limestone passing to fine grained, connecting the euphotide of Scandinavia, according to Humboldt the last member of the primitive family, with very ancient intermediary rocks. The same indefatigable geognost candidly observes, however, that it is as difficult to fix the ages of euphotides as it is those of granites, and that those which he saw at Guanaxuato, Cuba, and Mexico, and at the entrance of the Llanos de Venezuela, connected with syenite or black limestone, appeared to him to be as decidedly transition as those of the Bochetta of Genoa, stratified and imbedded in the transition clay slate which alternates with black limestone.† Anthracite is also said to bear the same relation to the transition as graphite does to the primitive and coal to the secondary formations, whilst the frequent presence of hornblende and the comparative absence of quartz, are also distinguishing marks between the first and the intermediary classes. According to Jameson, schorl is rarely associated with hornblende, and from the testimony of Cleaveland we learn that

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* A mixture of diallage, jade and lamellar felspar, of which serpentinite is a variety, with small grains of an homogeneous aspect.

† De Buch and Brochant considered the euphotides of Spezzia, Prato and the whole of the Siennese, as primitive, whilst Brongniart asserts that they are secondary, or of a very recent transition class.

schorl has hitherto been found only in primitive rocks, particularly in granite* and in gneiss, or in veins which traverse those rocks, whilst it may, occasionally, be observed in mica slate or argillite. These different opinions of eminent men would, if always correct, afford excellent data to reason upon in affixing eras to families of mineral masses, but unfortunately, although they may generally be true on an extended scale in particular localities, they are frequently found to be at variance with existing facts in others.

If such able geologists are at a loss on the absorbing question of the ages of rocks, it may seem presumptuous for us to offer any assertions on a subject so intensely interesting, at a time when geology is still so far from having received more than a glimmering of the true light. Whatever, therefore, may be our preconceived ideas, or however we may have been led to form opinions, either from appearances or from reflection, we must hesitate to announce them, and confine ourselves to simple statements of facts; trusting that when other laborers in the cause shall have outstripped the endeavors of the great modern geologists, and when similar statements from various countries shall have been combined, a Newton may arise, who shall render geology what mathematics is at the present age, a science of reason and of truth.

Werner and his school, define *transition rocks* to be those which have a great analogy to the primitive class, but which alternate with the brecciated or arenaceous kinds, whilst they contain, in their upper genera, some few remains of organized bodies, the animal fossils being chiefly confined to the tribes of madrepores, pentacrinites, orthoceratites, trilobites, &c. and the vegetable relics to impressions of reeds, palms and gigantic ferns, which are all exhibited, chiefly, in those species of rocks not containing felspar and which are not of a very crystalline aspect. As a broad foundation to work upon in the present state of the science, these data are doubtless very well adapted to the exigencies of the case, although we fear that they will be found at some future period, to be in the same predicament with all other positive assertions regarding the ages of rocks, as we shall presently shew, that testaceous organic relics may be expected to exhibit themselves in transition formations, where felspar holds the most

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* It exists however in considerable quantities in the transition rocks of the St. Lawrence and the Cataraqui.

conspicuous place, and we already know that terebratulæ have been discovered in greenstones, associated with carbonate of lime,* which, however, according to Conybeare, is not very important, as he asserts that shells have been found in recent and decided lavas, at the points where they have flowed into the ocean.†

Trunks, branches and twigs, silicified, or penetrated with wood stone, it is well known, occur in a rock called secondary porphyry, but to which some geologists assign an older date, and there is some reason to believe, that even in transition granitic masses, the organic remains of a former world are yet to be seen.‡

But as the object of the prolegomena of the present essay is to analyze remarkable facts concerning these granitic aggregates and other rocks of the transition class, we shall go on to develop the received opinions of the most eminent writers, regarding associations, which the philosophers of the present day consider as decidedly newer than those first created.

It may, however, be necessary, before we proceed further on so interesting a research, to explain our own views on the nature of the term *transition;* a term, we are well aware, highly objected to by many very learned men. But unless either that word, or some other nearly equivalent is employed, how is it possible to detail ideas concerning those extensive formations which so evidently occurred when the planet we inhabit was undergoing, as it were, a new birth, and its oceans were beginning to teem with animate beings. The term itself may be objectionable in a philological, as well as in a geogonic point of view, but it is preferable, in our opinion to any other, hitherto offered; and although it does not fully imply the notions which it is intended to convey, of the vast changes gradually occurring, during an indefinite period on the surface of the globe, yet it is sufficiently explanatory, at least, of the difference which certainly exists between the newest of the ancient, and the oldest of the more recent families of rocks, and as such, we adopt it.

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* By M. Weaver, in Ireland, in a trappose rock.

† It will be recollected that the Huttonians always ascribe the origin of these rocks to submarine volcanos, acting when the ocean still covered the surface of the districts in which they are found.

‡ Jameson says that petrified shells have been found in secondary trap rocks, as secondary greenstones and also in the slaty rock, (slaty compact felspar,) frequently associated with it.

In following the rules laid down by the geologists we have alluded to, as well as in tracing carefully the natural appearances, we must admit cautiously, however, that there are several distinct known species of transition formations, and amongst these the most conspicuous and easily recognizable are the schistose; the felspathose, porphyries, sienites and greenstones; the granular and compact limestones, with gypsum and rock salt; euphotides and the aggregated rocks (graywackes and calcareous breccias.) These are variously arranged and described by different authors, and amongst them granite and gneiss, mica slate and quartz rock are frequently enumerated. The latter are, however, types as comparatively rare as the greywacke schist and transition clay slate are characteristic ones. These rocks associate according to some particular laws which have not been yet made manifest, although there has been proof enough afforded to state, that "transition clay slate* and black limestone, clay slate and porphyry, clay slate and greywacke, porphyry and sienite, granular limestone and anthracitous mica slate, form geognostic associations in all parts of the world."† But notwithstanding the geologist is fully aware of these circumstances, they are so exceedingly complicated in their alternations, that he can with the utmost difficulty satisfy himself concerning the relative ages of even a few of these rocky masses, as some of those which appear by their associations to be decidedly transition, in their peculiar characteristics are not separable from the primitive family, whilst others are as difficult to discriminate from those masses of igneous origin with which they appear so suitably allied.

Many learned men, and amongst others Humboldt, have endeavored to classify the genera of transition rocks, and to divide them into groups, but there appears, at present, so much difficulty in the undertaking, and so many contradictory results occur, that it becomes impossible to follow them through their chains, or rather, labyrinths of reasoning, although the exposition of the six great groups given by the abovementioned geognost, in his essay on the superposition of rocks, is eminently worthy of its author, and abounds in facts, which will, hereafter, greatly assist towards reducing the matter to the laws of truth.

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* Greywacke schist.

† Humboldt on the superposition of rocks.

He asserts, and with a great shew of reason on his side, that the talcose and granular limestones give a peculiar aspect to a great formation composed of steatitic, granular limestones, transition mica slate and greywacke, with primitive fragments; that porphyries abounding in hornblende, but without metals and almost destitute of quartz, characterize another which is anterior to calcareous matter with orthoceratites; that greywacke eminently distinguishes a third group in which we find clay slate, limestone, porphyry and greenstone, and that metalliferous porphyries, and sienites with zircon granites, are the types of a fourth assemblage, which is posterior to transition clay slate, and sometimes to limestone with orthoceratites, whilst there is a fifth composed of transition euphotide with jasper and serpentine.

Some of these groups, such as the porphyries and sienites, he also says, appear to have an intimate relation to the trachytes, the most ancient of volcanic rocks; and others, the greywackes and porphyries, as well as by the great accumulations of carbon, are also so strongly connected with the secondary porphyries and deposites of coal, that it is often exceedingly difficult to separate porphyries, amygdaloids and pyroxenic rocks from the red sandstone, with interposed beds of greenstone and porphyry. Jameson, on the other hand, places a red sandstone in the catalogue of the transition families of rocks.

It is a very favorite mode of getting over all these difficulties to seek at once for the assistance of volcanic agency, and to make every doubtful case, an igneous one. We shall, however, presently see, that by mere accident, the strongest and the most difficult evidence to overturn, has been produced on the shores of Lake Ontario, which may shake opinions so hastily formed. In a position where the positive nature of the igneous origin, or at least, the conversion of rocky masses by volcanic agency or subterrene heat appeared evident, even to the most inattentive observer, a momentary inspection dissipated the illusion, and proved that, however plausible a theory may appear, and however well it may be supported, it is still possible for very simple and unexpected matter of fact entirely to disperse it.*

* After a careful examination of the transition rocks of the Cataraqui, at least of the granitic varieties, many intelligent travellers and geologists have pronounced them to be as clearly trap rocks (in the volcanic sense) as those of Montreal, two hundred miles to the eastward. If the facts, we shall state do not overset these assertions, we shall still have another cause for repeating, how imperfect are all the data on which the modern systems of the structure of the earth are founded.

It is the general appearance of some of the porphyroid and syenitic groups which most tends to mislead an enquirer who has a natural bias towards the vulcanian theory and doubtless there are many cases, in which even the most impartial geognost would not only be in extreme doubt, but would at last, probably give up the examination in despair, especially in some of the syenites which bear strong marks of fusible conversion.

At Kingston, the syenite range, we have mentioned, is of very little, or scarcely any comparative elevation, above the surrounding strata of calcareous matter, and excepting where sharp vallies have been worn or disrupted for the passage of waters, has every where, a low wave like outline and surface. Its denudation moreover, is extremely limited and it is usually bounded by a vast accumulation of superjacent and decidedly transition limestone, the strata of which, from the level of the lake to about the altitude of one hundred and twenty feet, vary, in a generally decreasing ratio, from six feet in thickness, to about eight or ten inches, their upper beds, in many instances, being covered, by a fissile shale, very calcareous, but which is converted into a muddy clay by the action of the weather, whilst several of the superior and some of the inferior layers have very thin seams of clay interposed, and a great proportion of all the beds are separated by an extremely fine, black, bituminous looking substance, which is also of the shale kind, and the whole are marked by minute veins of calcareous spar, which often traverse their longitudinal direction, and cause them to assume the aspect of a laminar rock.

It has been argued, as we have already noticed, that the transition granitic rocks of the Cataraqui (which are almost every where covered by this limestone, but whose basis has never yet been seen) from their wave like and rounded surface, from the singular interminglement and conjunction which takes place between them and large portions of the limestone strata, and from the particular circumstance of a part of these calcareous beds, dipping from its sides at high angles, was formed by igneous agency under the enormous pressure of the great ocean which, doubtless, once rested over this division of the new world. A very attentive and zealous observer who has recently made these rocks a favorite study, in conjunction with the writer of this essay, is so much impressed with this idea, that it would be very difficult to convince him that it may not be the case, notwithstanding the circumstance that the calcareous mass for miles around, and indeed almost in every case where it can be observed, excepting in some few instances where it immediately joins the granites, is nearly horizontally stratified, the dip being very small and following the usual directions of similar rocks in the great North American basin.* It appears to me very clear, that if the granites of the Cataraqui were trachytic a vast extent of the immense limestone plateaux would have been disturbed by their upheaving, as these granites show themselves very frequently on the eastern shore of the river, in distinct hillocks amongst the calcareous beds. Is it not, therefore, probable, that some of those partial cataclysms and earthquakes which have evidently shaken Canada in other localities, may have caused the displacement of those limited portions of the transition limestones of Kingston which seem not to follow the general laws: indeed, this appeared most likely, when, in opening several extensive quarries, the beds were sometimes found so contorted that it was impossible to observe their original connection with the main body, and this although there was no appearance of any extraordinary upheaving of the subjacent rocks.

So far, indeed, am I from yet believing that these assertions concerning the porphyries and syenites of the Cataraqui are correct, that I feel assured, proofs will be adduced to show that they are contemporary formations with the black transition limestone, approaching to lucullite, with few visible organic remains, but containing much carbon and some oxydulous iron; nay, I am even inclined to think, that almost all the granitic aggregates of the country, adjacent to the St. Lawrence, are very highly impregnated with lime, so characteristic with magnesia and titaneous iron, of the transition class.

Beudant has made the important observation, that the syenite and porphyry of Schemnitz, Plauen and Guanaxuato effervesce with acids, whilst the really trachytic porphyries of Hungary do not present the same phenomenon.†

It is also now, a well known fact that the presence of felspar in compact limestone is indicative of the rocks of the intermediary formation, and this type is no where more easy of access than in the neighborhood of the Cataraqui, whilst in the same locality, horn-

* I am not at all well satisfied that the granites themselves are not stratified, the small uncovered portions recently quarried appear to me to be decidedly so, and it is the opinion of the workmen, that they are.

† Saussure and Brochant found mica slate of transition effervesce, and even also a compact quartz, in the Tarentaise.

blende, another strong evidence of the age of rocks, appears to have asserted a complete mastery over the micaceous proportion of the more ancient classes, and here may be studied, with considerable precision, the singular struggle that takes place between felspar and amphibole in the change of proportions in the elements of the crystalline substances of transition greenstones and sienites.

One of the greenstones of the Cataraqui, that hard and unmanageable rock in which the wells of Point Henry have been, with infinite labor sunk, and which will be hereafter more particularly described, is, in fact, a rock wherein hornblende, felspar and lime appear to have had a chemical conflict, nor is it yet very clear which of these compounds has at length obtained the victory, as notwithstanding the dark color and amazing hardness of the mass, the slightest blow leaves a very white surface and the whole effervesces almost as highly as a compact limestone.

The euphotide of Cedar Island, another evidence of the struggle between amphibole and felspar, also yields to the action of an acid.* It yields, however, only slightly, as do all the other varieties of granitic aggregates on the same Island.

A writer of the Encyclopoedia Metropolitana asserts that the Swedish traveller Kalm, found a granite on the banks of the St. Lawrence in which lime occupied a most conspicuous position. Could he have seen the rock of Point Henry, he would indeed have thought so, but it was not then uncovered.

The vast deposit of regularly stratified calcareous matter which we have called the limestone of the Cataraqui in connection with granitic aggregates, into which that substance has intruded itself, will offer a field of speculation that may tend to throw new lights on the geological sciences, and when we find that animal remains exist in very close connection with the felspathose portions we have again still further cause to say, that the relative ages of rocks are very far from being yet well understood.

It may be necessary in order to satisfy doubts, before we proceed farther in this interesting subject, which we most sincerely wish may soon be treated by some abler hand, to afford positive data, for the assertion we have made, " that the limestone of the Cataraqui is de-

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* This serpentinite does not appear to affect the character of serpentine, by the presence of calcareous veins or threads pervading it, no such signs having yet been discovered.

cidedly a transition formation," the more particularly as our chief aim and object is not to found new and presumptuous theories, but to develope facts in accordance with the received notions of the geologists of the present day.

The inference we have drawn, that this limestone is decidedly a transition rock, of the elder class, is formed on the following circumstances, which have been collected not hastily, but as the results of long and mature reflection and observations made under favorable opportunities.

In addition to what we have already stated concerning this limestone, it is subcrystalline, the nature of this property being rendered discernible chiefly by the glimmering lustre of the points and facets of calcareous spar reflecting light, and it is traversed by small contemporaneous veins of that mineral. Its grain is exceedingly fine, and the structure compact, the fracture being at the same time splintery and conchoidal. It is translucent at its fine edges and previous to exposure to the atmospheric action its color is generally blackish blue, passing, when highly polished, into a deep and beautiful black.

Lime, silex, and alumine are its chief component parts, the latter being in such quantity that its upper beds, whenever they are laid bare, turn of a whitish hue, and rapidly change into a tenacious marle.

The specific gravity is very low, (2.5) and it is, as already stated, saturated with carbon, and deeply impregnated by oxidulous iron.

These types, with its magnetic pyritous iron, in which the arsenical variety is mingled, and the presence of sulphuret of zinc, particularly of yellow blende,* associated with magnesian calc spar, and magnificent specimens of sulphate of strontian and barytes,† together with the comparative absence of all organic relics, those which are found, being of the oldest genera, and its extraordinary relations to the newer granitic aggregates, and the smallness of its dip, assuredly complete its claim to the character of a limestone, of the elder transition family.

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* Which has been recently discovered in it by Mr. Baddely, and which is indicative of the oldest formation of zinc.

† By a singular mistake, these beautiful specimens, which are very numerous, have always been called tremolite here, owing to the hasty dictum of a traveller, who should have known better. Their weight caused me to doubt, when I was first shewn them, and analysis soon rectified the error. Tremolite is very rare here.

So rare are the vestiges of animated nature, in this vast deposit of calcareous matter, that during a series of three years of constant labor in opening large quarries, but one solitary, although very perfect trilobite was discovered, and that in the uppermost bed; whilst all other fossils were nearly as uncommon, terebratulæ being the only other relics of former ages that were found, and those are generally very scarce, and very minute. Orthoceratites have, indeed, been occasionally observed, but not in the quarries, and it is, as yet, questionable, whether those we have already mentioned in the commencement of this essay, were really in situ, or belonging to transported masses.*

One caste of a large shell, so much altered, as not to be recognizable, as of any known genus, has lately been obtained, the original matrix, having been filled with lydian stone, or basanite, which is also frequently met with in the shape of little round protuberances.

Nearly forty beds of this stone have been laid bare, either in the course of quarrying, or in sinking wells; and it is probable, from observations of denuded bassets, on the slope towards the Lake, that there are upwards of sixty seven more, in a total altitude of one hundred and twenty feet above Lake Ontario, some of these layers reaching to the enormous thickness of six feet.

It is remarkable that those beds which approach the level of the Lake, or in other words, are the lowest, have the same tendency to a whiter color, and a more argillo-silicious aspect, as those which are near the surface, and which indeed are nearly true shales, so very schistose as to be almost lamellar, and breaking up for pavement slabs into fragments of large size, usually of a subpentagonal, or rhomboidal form.

This transition limestone we have minutely examined, as far as it is visible, in a space contained between the two rivers or streams,

* Whilst mentioning trilobites, it may be proper to say, that I have just seen some specimens from Coburgh, a small town between York and Kingston, which were lately found there in quarrying, in a transition limestone, darker, and of a more marble hue than that of Cataraqui. These singular fossils are said to exist there in great abundance, and from those I saw in the hands of an ignorant quarryman, who had injured them very much by careless transport, they will certainly throw new light on that family. Some were extended or flattened, as if crawling, and were furnished with head and eyes, their appearance strongly resembling that of a toad, others were gibbous; others were actually doubled up, so that the extremities met; and, in short, every variety of position which a soft flexible insect or animal could assume, was exhibited. The eyes were remarkably protuberant. I would have drawn them, mutilated as they were, but the man would not part with them.

called the greater and the lesser *Cataraqui*, an area of above four miles in breadth, by the same depth; and it may be said to be perfectly stratified, with a trifling dip, its layers directing themselves generally, from N. E. to S. W., at a very low angle, perhaps about 25°, and passing directly below the waters of the great Lake, which when it first narrows by the two channels of Long Island, to form the river St. Lawrence, appears as though it had forced its devious course towards the ocean by a general dissolution or disruption of this vast calcareous deposit; the left bank from Kingston, in descending a few miles, being composed chiefly of denuded granitic aggregates, to which broken strata of the limestone are here and there attached; whilst the right bank is composed of the calcareous vestiges themselves, which, as they are on a higher level than those of the other shore, contain more numerous organic remains, particularly large terebratulæ of a more recent family than those we have mentioned; also orthoceratites, favosites, and the cornua ammonis, sometimes very large. In fact, the transition limestones of the Cataraqui, in its upper beds, passes, by slow degrees into a more recent rock.*

On the left bank, in the situation already named, and in the immediate vicinity of the Town, before the granite first rises to view, the set of the lake has formed some large openings, or bays, and in two of these, the streams called Cataraqui empty themselves. On the shores of the lesser river, a considerable alluvion and diluvium are seated, whilst the lake, from the prevalence of strong south-western gales, constantly brings in large deposits of sand, in which very little, or perhaps no mica is present. At certain seasons of the year, when heavy storms visit the shore, the sand appears finer than usual, and there is an absence of the small rolled pebbles of felspar and quartz, which otherwise generally appear, whilst vast numbers of small spiral and discoidal shells, with those of the large fresh water muscle, are thrown up, together with occasional washings, in particular localities only, of magnetic iron sand, of a deep black color.†

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* "A Kingston, ou Cataraqui, a l'extrémité sud-est du Lac Ontario, on retrouve encore la pierre à chaux de l'espece argilleuse, a grain fin, et d'un gris foncé."—*M. Guillemard.*

† Coal is also said to have been occasionally picked up to the eastward of the town, and I have some specimens of an anthracitous kind, which were given to me by a medical gentleman of the Royal Navy, who found them on the lake shore. I have also seen one from the Thousand Islands, which resembles jet, and probably belongs to a very pure cannel coal.

The shore of Lake Ontario, near Kingston, on which we have remarked that the more ancient rocks have hitherto been supposed to exist, is covered with boulders of different sizes and shapes, some being large masses of tolerably pure quartz, of various shades: others of different granitic aggregates; others of hard silicious schists, and others jasper, of a coarse quality, with black, basaltic looking masses, and many sandstones. Mica is comparatively rare in all those along the borders of the lake, but as we ascend the plateaux of limestone above, we find that common mineral in all its various associations with quartz and felspar; on the whole, however, felspathic and hornblendic boulders predominate, and there are but few amygdaloids, porphyries, or conglomerates. We have not observed the organic remains mentioned in the subjoined note, although frequently sought for.*

These boulders generally appear on the surfaces of the calcareous strata, or on the incumbent soil, but wherever the marly deposit has occurred to any extent, they are disposed in it, at various depths.

We have imagined that these transported masses have some general tendency to particular lines of direction, and that they form wavy lines spreading towards the same points, commonly, as the directive ones of the calcareous strata, but the country is yet so much covered with wood that this cannot be positively stated. With respect to that extremely far fetched and somewhat affected notion that they exhibit what is termed "diluvian dressings," we have only to remark, that no evidence is afforded by the vast multitude of boulders near Kingston, to show either that they have been rolled to the sites they now occupy, or, that having been once stationed, they have had to undergo the action of water, for long periods, on any one of their sides.

It will be remembered, that we have spoken of Humboldt's division of transition rocks, and we shall now proceed to exemplify such parts of it as meet our views in endeavoring to trace the Cataraqui formations, stating whatever occurs, to point out most clearly their relations to the country under examination.

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* "A Kingston, ainsi que sur la plûpart des cotés du Lac Ontario, les cailloux, sont des differentes éspéces des schistes durs, des chouches de quartz, et granite. On voit prês du rivage des grosses pierres noires roulées, ressemblant à des basaltes, et beaucoup des pierres sablonneuses, contenant des impressions d'animaux de mer : en descendant le fleuve St. Laurent, le pays est schisteux."—*Guillemard.*

No rocks analagous to the granular talcose limestone, mica slate, and graywacke with the anthracite group, are observable nearer than Gananoqui, or about seventeen miles below Kingston, which we have as yet had no opportunity of personally examining,* but from various descriptions and the possession of large and numerous specimens, we entertain no doubt that there are vast associations of serpentine, steatite of many varieties, talcose minerals, and a highly crystalline and very brilliant white saccharoid marble, which, with the rough and singular scenery, so opposed to the tranquil plain plateaux of the adjacent country to the westward, prove, that this class of transition rocks exists there, or else that they are merged into the primary order, wherein an extensive deposit of magnetic iron appears, which has hitherto been very imperfectly explored.†

In an essay like the present, a few passages only can be spared for the details of those systems of the transition formations which do not bear an immediate or close connection with the rocks of the Cataraqui, nor should we mention them at all, but that it is useful to collect as many data as possible on so very interesting a subject.

Of the porphyries and sienites immediately covering primitive rocks with black limestone and greenstone, it would at a first glance appear, that we have at Kingston ample materials on which to expatiate; but this division of transition rocks, abounding in hornblende almost destitute of quartz; non-metalliferous; reposing immediately on the primitive genera, and sustaining nearly the same relations, seems exceedingly difficult to separate from the class posterior to clay slate and which is metalliferous. The latter is said, but without sufficient proof, to be a later formation than clay slate, whilst the former is anterior to that rock, a position which all the learning and elaborate research of Humboldt and of the German school fail to substantiate, nor from the total absence of clay slate in the Cataraqui locality, could any data to prove it, be in the present case, adduced.

We shall therefore blend these two classes together, and go on exemplifying it by detailing at large the facts as they occur, adding remarks afterwards on the transition euphotides with serpentine, and

* "On voit a Gananoqui quelques especes de steatite donc on assure qu'il y a des larges veines dans le voisinage."—*Guillemard.*

† I am not, however, aware, whether or no anthracite has been found near Gananoqui, although it appears probable that this substance will be obtained in some of the formations between Kingston and that place. It bears, according to Humboldt, the same relation to the transition rocks, as graphite does to the primitive.

leaving out altogether any notice of those porphyries and sienites (which are posterior to clay slate and limestone with orthoceratites,) characterized by zircon granites; as this class does not appear in any alternations of the transition rocks which have passed under our observation in the vicinity of Kingston.

Previously to entering on a research thus undertaken, it is proper to state that neither Humboldt's theories, nor those of any other writer, are looked upon by us to exhibit such absolute proofs of verisimilitude, that the student of nature should be at all bound to yield obedience to them. We have premised, that geological science is yet in its infancy, and it is not from books that it can be nurtured into adolescence. A vast host of names may be adduced by an essayist, to shew his reading or to support his relation, many perhaps equally deserving of respect with that of the German traveller, but there are few who have had equal opportunities of observing facts so generally as Humboldt, and fewer who have had the patience to develop them. His theories, doubtless, partake of the same difficulties and obscurities with those of the French, the English and the Edinburgh schools, whilst they have also the disadvantage of being cloaked in such an exceedingly heavy investiture of learning, that their internal splendor is much obscured and greatly depreciated.

But Humboldt, in his general outline of the divisions of the rocky masses which compose the surface of the globe, appears to our humble conception to exhibit a simplicity of arrangement under the cloud of argument and reasoning, which we have no where else observed, and which, joined to his laborious display of facts, renders his system a very just and very perfect exposition of the present state of geological knowledge.

The transition rocks of the Cataraqui consist, for the most part, of the limestone we have already described, of sienites and of greenstones. Porphyry is rare, and, what is very singular, amid the vast variety of granitic boulders in this locality, all different from the masses in situ, few are porphyritic, although most of them are of the transition classes.

In proceeding from Kingston eastward, the first appearance of sienite is observable near the extremity of the Point, where it forms a low and slightly undulated beach for several hundred yards, and appears as if rising out of the bosom of the Great Lake. This sienite is covered with the lichens of ages, and from the colors they impart to it, would be mistaken for a stratum of the limestone, were it not observable that it is cracked and fissured into huge irregular tesseræ, and that its surface presents the remarkable waved aspect common to this rock in the vicinity.

As few boulders lie on the west and south-west shores, the character of the rock may here be seen to great advantage, whilst further eastward, the coast is so strewed with them, that its nature can be seen only with difficulty.

On this western shore, the limestone every where visibly overlies the granite, and may be observed in various ways. One of its most curious features is that of a thin stratum (of only a few inches in thickness) overlapping the granite for some yards. This stratum is probably the crust which has resisted the weather. It covers the granite as a paste would, and is very hard. Its color is greenish blue, and it is highly calcareous, a very slight effort with an iron point affording a very white streak.

This change of color, from the usual grey or blue of the Cataraqui limestone, appears to take place all along this shore, wherever the granite and calcareous masses are in immediate contact, for on proceeding to the south-west, as soon as we lose this thin coating over the granite and observe the other layers of limestone begin to form a sort of low cliff, we perceive that the thin bed, which immediately overlies the sienite, becomes very dark, (of a deep blue green) and that it is (at least at the outside) split into innumerable little cuboidal fragments resembling charcoal, but the strata directly above present little alteration.

After passing round the extremity of the Point, the granite is soon lost, but it evidently gives the shape which the hill above possesses. This hill is mostly covered with soil, on which rest small boulders, and presents towards the west end of its summit a new aspect. Here in excavating, a singular variation of the granitic aggregates was discovered, and which runs for some distance towards the north-east.

It is a very dark grey compound, composed of a paste of minute grains, highly calcareous and traversed, in a beautiful manner, by veins and knots of very red felspar. Where it has been uncovered, its surface is wave-like, and furrowed by smooth and almost polished channels following the direction of the ridge. Its hardness is so extreme, that it is exceedingly difficult to work, although in small specimens its fracture is comparatively easy. The component parts appear to be felspar, hornblende, lime and quartz, and it exhibits brilliant plates of micaceous iron. The structure is compact, the fracture splintery and uneven, and the streak white. From the masses lying about, it appears to be every where in contact with the limestone,* as some of its sides are quite flattened, and retain a little greenish grey lime in their unevennesses.

It is probably one example, of the great struggle between amphibole and felspar in the transition series of granitic aggregates, and may perhaps, as we have already said, be classed under a new species of greenstone ; its highly calcareous quality being a very singular feature. This rock after running to the north-east a few hundred yards, bends by a gentle curve to the north-west, and is lost again in the Bay.

On the sloping surface of the hill where this rock is now observed, are many boulders, but none of large size, and there are also some flat tables of limestone, very thin and of a dark grey color, with a glimmering lustre when broken. These are seldom more than a few feet in length, and I have hitherto found them invariably with soil under them ; I cannot say whether they are in situ, or otherwise. Their upper face is quite white and flat, excepting where whelks and knobs of quartz, felspar and granite jut beyond it. Of these it is so full as to be a perfect breccia ; and as these masses generally penetrate through the tables and appear, as it were, fused into them, the lower surface, where the weather has not eaten away the limestone, would, if polished, present a variegated face of all these minerals imbedded in and intermixed with the limestone, as they appear to be actually interlaced with it. On the upper surface where these hard substances uniformly project, are seen numerous vestiges of that orthoceratite newly named haronia, with others much weathered, as, of course, is the limestone itself. Not far from these tablets, which are disappearing very fast, and will soon be gone altogether, the limestone, wherever it appears above ground, has its upper face curiously punched with indentures resembling crow's feet† of minute size, and entirely covering the exposed surface. If as I strongly suspect, these singular tablets, the memorials of a former age, are in situ, we have here the surprizing fact, that animal remains occupy the places where the feldspathose and hornblendic families of rocks hold almost despotic sway ; for, in many instances in the neighborhood,

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* Which runs into it in the manner hereafter described in the granite.

† I do not at present, recollect the name of the fossil whose body formed these cavities.

red felspar may be observed in large masses in the limestone, rendering it porphyroidal, whilst in the calcareous greenstone to which it is attached, and into which it also runs in large veins, hornblende forms a most considerable part, and we shall soon perceive that near where the junction of the sienite and limestone occurs, the roughly porphyroidal structure is yet more common,* whilst the still more surprizing circumstance is yet to be detailed, that distinct and very perfect testaceous organic remains exist in the rock at points where the granite and limestone are actually interlaced and intermixed, where limestone is penetrated with quartz and with hornblende from a rock in which felspar holds the most conspicuous and prominent feature.

(To be continued.)

Art. XIX.—*Mineralogical examination of the Sulphate of Strontian, from Kingston, (U. C.);*† *with miscellaneous notices of the Geology of the vicinity; by* Lieut. Baddeley, of the Royal Engineers.

(Communicated for this Journal.)

REMARKS BY THE EDITOR.

We have for several years, observed with much satisfaction, that science has obtained a good foothold, and is fast gaining ground in Canada. Numbers of intelligent gentlemen, especially in Lower Canada, are investigating its natural history and resources, and have

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* Similar associations occur in the Carinthian Alps and in the limestone of the Tarentaise, and in the little St. Bernard, "This phenomenon of the association of lime and felspar," Humboldt observes, "is so much the more remarkable, as lamellar felspar and granular and compact limestone appear to manifest every where else in their geognostic relations, a kind of repulsion much stronger than what is observed in some countries, between hornblende and limestone."

† In the Transactions of the Literary and Historical Society of Quebec, just published, may be seen an article by Capt. Bonnycastle, R. E. on the characters of this mineral; but as we differ as to the name, and I believe in other particulars, I have thought it not superfluous to give the characters as they appeared to me, particularly as they have been taken without access to Capt. B.'s paper.§

§ I have seen Capt. Bonnycastle's notice of this controverted mineral, (Quebec Trans. p. 70) but such is the similarity between the two natural sulphates, that no one of the characters which he has named appears to be decisive; the taste of the mass, which had been ignited upon charcoal, is the most so, but I have found that both these sulphates are decomposable by charcoal in the furnace, and that both give the taste referred to after being ignited by the blowpipe upon charcoal; but this taste is very re-

recently, on this and other topics, given substantial proofs of their industry and zeal, in the first volume of the Transactions of the Literary and Historical Society of Quebec, of which Lieut. Baddeley, the author of the following paper, appears to be an efficient member. In a letter accompanying the present communication, he mentions the importance of observing and registering facts in natural history, although (with how little necessity will be apparent on reading his paper) he disclaims the character of an adept, or, to use his own word, of being one of the initiated.

Sulphate of Strontian, &c.

Color, milk and water white; translucent; structure, fibrously laminar; the mineral being composed of long bladed laminæ, aggregated together: these laminæ often appear to radiate from a centre, and diverge like the sticks of a fan; sometimes they are interlaced. The lustre on the faces of the laminæ is pearly and shining, and points of iridescence occasionally appear. It breaks easily, particularly in the direction of the fibres, into fragments which are long rather than broad, and often wedge-shaped; these are further easily reduced to white powder, rather soft to the touch, and slightly gritty to the taste. Its hardness is very little greater than that of some calc-spars, while it is less than that of many; the magnesian varieties for instance, with which (judging from their pearly lustre and often curvedly laminar structure) it is frequently associated. Its sp. gr. lies between 3.9 and 4.1. Cold diluted muriatic acid produces *apparently* no effect upon it, with the exception that a few bubbles of gas sometimes escape with effervescence: a change however has evidently taken place, because, if a small piece of stick be inserted into the powder of this mineral, which has been previously *moistened* with the acid, and if the stick* be afterwards drawn over the wick of

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markable in the case of sulphate of barytes, and feeble in the sister mineral. The sp. gr. stated by Lieut. Baddeley, is in favor of the sulphate of strontian, and so is the red color produced in the candle, although it is not easy to understand how the muriatic acid should decompose the sulphate of either of these earths, contrary to the order of the affinities, unless indeed it has prevailed by quantity; or, by mere possibility, some carbonate of strontia may have been present. There can be no doubt that mineralogical and physical characters may settle the question, and probably it is settled before this between these gentlemen: if not, chemical trials will undoubtedly bring it to an issue.—*Ed.*

* The stick should be blunt and brushy at the end which is inserted into the powder and flame, in order to exhibit this character to the greatest advantage, but it is not absolutely necessary.

a lighted candle, a portion of the flame will become of a beautiful rose-red color; and it is this character which peculiarly distinguishes this mineral from the sulphate of barytes. Its sp. gr. is also less. Several attempts to develop the rose color, by dropping gradually the powder of this mineral into inflamed spirits of wine, as directed by some authors, were unsuccessful. It is insoluble in sulphuric acid, in which, according to Griffin, sulphate of barytes is soluble. Before the blowpipe on charcoal, it fuses slowly in the interior flame, into a dull white enamel; this enamel, when cold, has a slight hepatic odor, and a very nauseous flavor, like a mixture of rotten eggs and caustic lime. When the platina forceps are used, the enamel produced is shining and pearly, and the hepatic flavor is not perceived.* With borax on charcoal (after roasting) it effervesces and forms a glass, which, when cold, is of a reddish brown or yellow color.

The characters in which this mineral appears to differ from those described by different writers, as belonging to sulphate of strontian, are two in number, viz.:—1st. Sulphate of strontian is described by Griffin as decrepitating in the exterior flame of the blowpipe. Neither Phillips nor Cleaveland, however, mentions such a character as belonging to celestine. Berzelius, who appears to be Griffin's authority, says, that "the crystallized mineral decrepitates." The mineral in question has not the least disposition to decrepitate with heat. 2nd. Berzelius also describes sulphate of strontian as yielding a globule of enamel in the interior flame of the blowpipe, which communicates to the palate a caustic and hepatic flavor; characters agreeing precisely with those of the mineral under examination: now Cleaveland makes the hepatic flavor a distinguishing character between sulphate of barytes and sulphate of strontian, to the former of which minerals, according to him, that character belongs, and *not to the latter*. I have already shewn that it belongs to the mineral

* Query, (by the author,)—does the presence of the metal prevent the formation of the sulphuret? Answer—the presence of the charcoal is essential; it acts by detaching the oxygen of the sulphuric acid, and leaving the sulphur in combination with the base; of course, the platinum support, not attracting oxygen, cannot produce this change. It is however much more remarkable in the case of sulphate of barytes than of strontites, but it is exhibited by both. It may be observed also that both sulphates in fine powder, are soluble in a large excess of strong sulphuric acid, and that water precipitates both by attracting the acid, which holds the dissolved sulphates by a feeble affinity.—*Editor.*

in question when fused on *charcoal*, although I should conceive there can be no doubt that it is a sulphate of strontian.

This mineral is associated with calcareous spar, generally flesh-colored; often with the sulphuret of iron, (arsenical?) occasionally with the sulphuret of zinc, (black, and more rarely yellow, blende.) Two or more of these minerals form rounded concretions in horizontal limestone, and vary from the size of a small potatoe to that of a large cocoanut.*

The limestone is of a bluish grey color, a compact and uncrystalline structure, and is slightly translucent on the edges. Its odor, when struck, is like that produced by siliceous matter, and it appears to be entirely destitute of organic remains, like most of the limestones of Kingston, which exhibit distinct traces of these natural antiquarian remains only among the uppermost strata, while the lowermost rest upon a crystalline rock, which is here an aggregate composed of felspar and quartz, and there an aggregate composed of felspar and hornblende, the one and the other occasionally seamed and studded with schorl and epidote. The geological fact which attracts the most notice here, is the conglomerated character of the limestone in contact with this crystalline rock, which appears sometimes to be a granite, (though mica is rarely present) sometimes a syenite, and sometimes a greenstone or trap.

This conglomeration, in some cases, consists merely of rounded pebbles of quartz inserted into the limestone; in other cases, the intrusion is of a much more violent character, when large masses of the aggregate itself, both rounded and angular, appear detached from the parent stock, and lie insulated and enveloped by the limestone. In ordinary cases, the limestone appears always to adapt itself to the surface of the rock which it overlies.

I have said, that organic remains appear to be confined to the uppermost strata of limestone, and that the lowermost strata are entirely destitute of them. However near this may be to the fact, it is not exactly so. Capt. Bonnycastle, R. E., has a specimen, in which is the distinct impression of a shell (terebratula?) at the line of junction of the limestone and granite, (felspar and quartz.)

In many specimens the union of the two rocks is very intimate, and although in all cases you may trace the line of separation, yet

* A rounded mass, composed entirely of strontian, found detached on the north shore of Lake Ontario, near Kingston, and now in my possession, weighs about ten pounds.

there appears to have taken place an exchange of minerals along the frontier, the quartz having entered into the limestone as a hostage for the lime in the granite. Capt. Bonnycastle has observed that in these cases it is always the quartz which is foremost; like the light infantry of an army previously to a general engagement, while the felspar, which is the main body is in allignment or column in rear. He also considers the fact to be corroborative of an opinion expressed by Humboldt in his Geognosy, viz. that there appears to be no reciprocity or sympathy in nature between limestone and felspar. I have not used the language of either of these gentlemen, but I believe the sense is the same.

The felspar, which is usually the predominating mineral in this aggregate, is generally of a deep flesh-color; and when this is joined, as it often is, to opalescent quartz, a beautiful compound is the result. The structure of the rock, when the felspar is the predominating mineral, is either compact or laminar: when hornblende abounds, it is generally foliated like gneiss, and sometimes porphyritic. It exhibits no distinct appearance of stratification, although I have sometimes imagined that such a feature did exist, and that vertical strata directed between south and south-west, could be obscurely traced. Schorl, epidote, and tremolite, are among the disseminated minerals. The schorl is usually in small imperfect crystals, studding the surface of the natural joints of the syenite or granite, while the epidote occupies a similar position in the greenstone; the former is also found in tolerably large pieces, (much intermixed with white quartz) imbedded in the granite. These pieces shew very little tendency to regular crystallization, but the shining coal-black faces of prisms, deeply striated, may often be seen. Although felspar usually envelops the schorl, it is seldom intermixed with it. A curious bed, composed almost entirely of epidote and tremolite, is met with in this neighborhood, holding a geological position which implies a contemporaneous origin with the crystalline rock above described. This bed, together with the frequent occurrence of schorl and epidote in this rock, affords the best support to its pretensions to be considered primary. The following is a mineralogical description of the bed in question, with which I shall terminate this paper.

This aggregate strongly resembles a verde antico, or a mixture of granular serpentine and white limestone; its colors are therefore green (dark) and white. The white mineral is the paste through which the other is distributed, usually in small rounded grains, though an aggregation of prismatic crystals or of laminæ may be occasionally seen. These grains are too small to allow me to dwell much upon their structure,* but it may be stated that upon fracture the shining faces of translucent laminæ occasionally appear. It scratches glass with ease, but is less hard than felspar. Acid produces no other effect upon it than to disengage a few bubbles of gas, with effervescence, which is owing to the carbonate of lime that enters partially into the composition of the aggregate. Exposed to the greatest heat of the blowpipe, it fuses at the point of the fragment, into a dark brown enamel, and by continuing to urge the flame, it intumesces by fits and starts, but the portion beyond the blue cone preserves its translucency and color.

Some of the grains are of a darker color than the others, but the exterior flame of the blowpipe appears to reduce them to the same shade. The darker grains resemble augite, as the lighter colored do olivine. From all varieties of the former it is distinguished by the result of fusion; from the latter, by its fusibility.

Most of the white mineral has a fibrously laminar structure. It is translucent; lustre distinctly pearly on the faces of the laminæ. It scratches glass slightly. In acid, owing to the carbonate of lime (magnesian?) with which it is associated, it feebly effervesces. Its powder, thrown on heated charcoal, phosphoresces with a beautiful light green color.† A small fibre fuses readily in the interior flame of the blowpipe into a colorless glass.

The sp. gr. of the aggregate is 2.96.

Weather acts unequally upon the surface of this aggregate, leaving it in small furrows and deep striæ, occasioned probably by the fact that the white mineral is more readily acted upon and removed. The effect of weather is not confined to the surface, as a reddish band forms a sort of incrustation upon it.

This aggregate appears to form a bed or thick vein in sienite or granite, (I know not which to call it) and lies in unconformable contact with transition limestone.

(To be continued.)

* Candor obliges me to add, that the crystallographic characters of minerals are those with which I am least acquainted; by neglecting them, therefore, there will be less risk of misleading.

† This phosphorescence is remarkable. In the exterior flame of the blowpipe, a beautiful luminous green light appears to pass through the mineral, rendering it, for the moment, highly translucent. This phenomenon is distinctly visible by candle light. This light bears a striking resemblance to that which is often seen to adorn the body of the fire-fly in the West Indies.

Art. XX.—*On the Vegetation of the First Period of an Ancient World;* by Henry Witham, of Lartington, (Eng.) F. G. S. &c. (Read to the Wernerian Society, 5th Dec. 1829.)

[Communicated to the Editor of this Journal by Dr. Bushe, through Dr. Ellet, of New York.]

Being firmly persuaded that the great objects of geology will be much advanced by a serious attention to the history of the vegetation of the different epochs, from the most remote period of organic creation down to the present day; being most anxious to promote a spirit of inquiry in this country, as ardent as that of our continental neighbors, I have devoted a certain portion of my time to the examination of different coal fields, to endeavor to corroborate by proofs, the assertions of that ingenious French naturalist, who has lately favored the world with many judicious remarks upon this dark, difficult, but interesting branch of science. I shall therefore now state to you the result of my limited investigation.

To the ardor of Mr. Adolphus Brongniart, in the researches he has so successfully made in collecting materials for the physical history of the formations which compose the crust of our planet, every geologist must feel interested; as well as to Cuvier, Sternberg, Boué, Brown, D'Urville, and others, for their able and unremitting exertions in this dark field of early existence. It has been reserved for this eminent young naturalist, to present to the public a classification so natural, and generally so clear, as greatly to facilitate the labors of those, who interest themselves in such pursuits; and greatly to aid them, in recording such particulars as may accidentally come under their immediate notice.

Impressed with the importance of this subject, I first of all availed myself of the kindness of Mr. Dolphin, head agent to Messrs. Hall & Co., who solicited me to explore a vein called Jefferie's Rake in the Derwent Mines near Blanchland, in the county of Durham. Having travelled up the adit about three-fourths of a mile, we began to descend by the assistance of ladders. At the depth of about fifty-five fathoms below the surface, in a bed of sand-stone nearly forty fathoms thick, we were gratified by a sight of some magnificent specimens of an ancient flora, belonging to Mr. A. Brongniart's first period of vegetable creation. The two varieties appear to belong to his third class, "the vascular cryptogamie." The first were Stigmariæ, (Lycopodiæ) the second were fine specimens of great circumference of Sigillariæ (Felicis.) Two of these last named specimens, which were situated in the space cleared out to get at the lead ore, stand erect, and their roots are firmly imbedded in a thin stratum of bituminous shale, much carbonized. I should think the height of one of these prodigious fern stumps may be about five feet, and its diameter probably exceeds two. The other, which has been kindly presented to me, may be seen in my museum, No. 14, Great King Street.

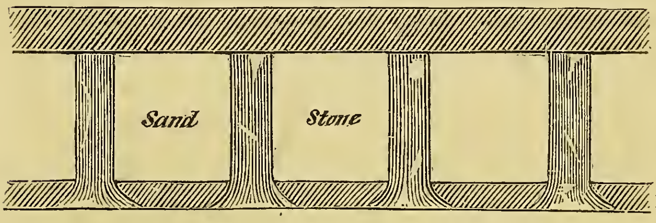
It has, I understand, been the opinion of some gentlemen, who have visited these ancient relics, that they have been washed into and deposited in their present situation by some aqueous revolution.

To this conclusion I must object, for two reasons,—first, because the roots are firmly imbedded in the shale, as if they had remained undisturbed in their original earthy envelop; and, secondly, because you may discover in each cheek of the vein, other trunks of these members of this ancient flora, in the solid rock, the position and the appearance of which are more consistent with the supposition that they grew on the spot where they were found. The confused heaping, fracturing and violence, which characterize diluvial action, are not seen here.

In proceeding towards the east, I received much valuable information from my intelligent friends, Mr. Buddle (an eminent coal-viewer upon the rivers Tyne and Wear,) and Mr. Hutton, of Newcastle, whose anxiety in pursuit of this branch of the science is so well known.

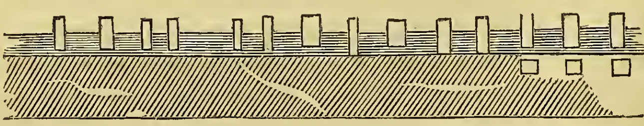
In the great Newcastle coal-field, the fossil plants are generally in horizontal position, or parallel with the strata, in the greatest possible confusion; much broken, and the parts far separated. Indeed, the confusion is the most serious difficulty the observer has to contend with. It is, however, difficult to trace the operation of a current of water, sweeping off the weaker vegetables and depositing them where we now find them so beautifully preserved. Notwithstanding this there are to be found in considerable abundance, in various positions, large and strong trunks of plants which appear to remain in their natural position, and which have been able to withstand the force of such torrents, if it can be proved that any such did exist. These vertical plants I have generally found to be the sigillariæ. The seginariæ, the stigmariæ, and Calamites, (speaking generally) on the contrary do not appear to have been sufficiently strong to have resisted any revolutionary influence. Below the high main seam (which, according to Mr. Forster's section of the strata is one hundred and fifty yards below the surface,) in a sand-stone, there are numbers of fossil plants standing erect, with their roots in a small seam of coal lying below. These stems, as you will perceive by the following diagram, are truncated, and lost in this seam, leaving room to believe they may have formed part of this combustible mass or bed.

HIGH MAIN SEAM.



10 inches.

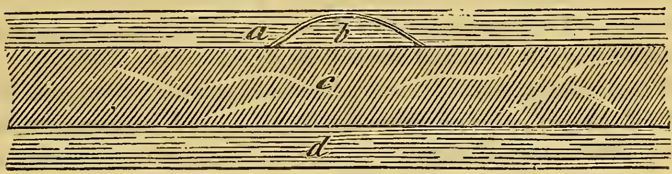
Again, in some of the seams, when the coal is worked away by the miners, the roof often falls. This is, to a considerable degree, owing to the number of vegetable impressions breaking the coherence of the stratum, and bringing these fossils along with it. It must be observed, that in almost every instance they are surrounded by a coating of very fine coal of about one-half or three-fourths of an inch thick, having a polished surface with very little attachment to the surrounding matter. This I doubt not is the cause of the fall; the fossil dropping out sometimes as much as three feet in length, leaving a hole in the roof almost perfectly circular. Often it falls in these large pieces, but sometimes the nature of the shale, of which its substance is composed, causes it to fall in portions of different thickness. It is to these falling pieces that the miner's expressive term (kettle bottoms) applies.



These fossil plants run from two to eight feet in circumference. The occurrence of numerous impressions which you may observe in the specimens of parts of different plants in the shale, forming the substance of these fossils, is to me, I must confess, very difficult of explanation. Some years ago a friend of mine found a kettle bottom at Old Kenton colliery, eighteen inches in diameter, coated with fine coal, the substance of which was entirely mineral carbon, or charcoal, with a mixture of earthy matter and pyrites. A portion of this specimen is in the collection of the Geological Society.

It is much to be regretted that hitherto none of these interesting fossils have been followed into the strata. We do not know how far they extend, or to what height they are standing.

Again, in the coal districts of Scotland, amongst the troubles which affect the roofs of coal, there is one of a very singular form, known by the name of *pot bottom* or *cauldron bottom,* and are from the size of a foot to five feet in diameter. One of these is represented in the annexed diagram:



a. Roof of Coal. Argil with sand.
b. Pot or Cauldron bottom.
c. Coal bituminous.
d. Pavement of Coal. Fire Clay.

In working the bed of coal, the miner generally knows that he is approaching one of these, by the coal becoming twisted, and more difficult to work, and this continues till this trouble in the roof is passed. The general form is that represented in the figure, when, of course, the mouth of the pot is always inverted. The sides of it are generally lined with coal from one-eight of an inch to an inch in thickness, and the pot or cavity is filled up with stone of the argillacious kind, or fire clay, having generally less mixture of sand than is in the roof stone around. The under surface of the stone which fills the pot is irregular and waving, not smooth like the roof adjoining. Although the coal which lines the pot is connected with the main bed of coal, it is of a texture altogether different, having a bright appearance like jet, and breaks into very minute cubical pieces. Sometimes it has no bitumen in it, and is of the nature of glance coal. The sides of the pot are generally as smooth as glass, with small furrows or grooves in a vertical direction, so that there is very little tenacity between the sides of the pot and the stone which fills it up; this circumstance renders these troubles very dangerous, particularly when they are of a large size, as they fall without giving any warning. The peculiar singularity attending this trouble is the twisted texture and alteration which are found in the bed of coal immediately under and adjoining it, without any mixture of the stone in it which fills up the pot. There is sometimes no lining of coal, and it generally happens that a piece of the stone which fills up the pot adheres to the upper part of the cavity, so that the trouble may go farther up into the strata than is imagined. This trouble requires to be minutely investigated, and the pavement upon which the coal rests should be examined under the trouble, to ascertain if it is in any way altered in its structure, as is the case with the coal. I am indebted to my much respected friend, Mr. Bald, for this latter information. I am happy to say that it is his intention, at an early period, to devote his attention to these singularly curious objects.

Were further proof of the vegetable origin of coal wanting, the fact of finding impressions of the seginariæ in the solid coal, the thin layers of incoherent carbonaceous matter, having much of the silky aspect of charcoal, alternating with layers of good bituminous coal, and bearing the form of the calamites most perfect, should go far to establish the vegetable origin of these combustible beds.

Having now troubled you with the few facts I have been able to collect in the coal districts further south, to which I have added some remarks on the troubles in the Scotch coal basons, I shall add some short observations on the neighborhood of this city. Here again I have been fortunate in obtaining many specimens of vascular cryptogamic plants, whose natural substances have been transubstantiated into the sedimentary deposits in which they were entombed, with the exception of their bark or outer coating, which is always much carbonized. The prevailing plants of this district, like those of the Newcastle field, appear to be the segillariæ, the seginariæ, the stigmariæ, with a number of calamites.

I beg leave here to mention, that in the neighborhood of Burntisland, in Fifeshire, one of these vegetable fossils, the stigmaria of Brongniart, the lepidodendron of Sternberg, with strong impressions of their leaves, occur in a limestone. This is a circumstance by no means of common occurrence. This limestone is devoid of any testaceous or coralline remains, and in appearance, and composition by analysis, varies little from the limestone of the Portland öolite.

A deposit of limestone also occurs at Hatton near East Calder, containing terrestrial vegetable impressions.

I now take the opportunity of introducing an account of that fossil member of early vegetation, discovered in the year 1826 in the quarry of Craiglieth. The length of time which has been allowed to elapse, without attempting to obtain the necessary information respecting this singular plant; add to that, the peculiarity of its structure and composition, has induced me to take much pains upon this point. I therefore laid a well cut transverse, and also longitudinal section of this fossil tree, before Mr. Hincks, Botanical Curator to the Philosophical Society of York. His opinion is, that it is a monocotyledonous plant; as a pithy substance fills up the interstices between the vessels, and that there has been no bark or concentric arrangement of layers. He also observes a striking resemblance to *certainly* monocotyledonous stems, which he has before examined. On the whole, Mr. Hincks says, "having made the examination of this curious specimen, submitted to me with the greatest care, I can scarcely admit of a doubt upon the subject."*

The internal structure, its singular color, when contrasted with the block of sandstone in which it was found, induced me to request my friend Mr. Nicol to analyze it, the following was the result:—

60 per cent. of carbonate of lime.
18 per cent. of oxide of iron.
10 per cent. of alumine.
 9 per cent. of carbonaceous matter.

The height of this gigantic plant was thirty six feet, three feet diameter at its base, and lying in nearly horizontal position, corresponding with the dip. No branches were found.

This, therefore, with a few others I could here mention, and which I trust will ere long be submitted to your consideration, form but trifling exceptions to the general distribution of early vegetation.

Thus in these great coal fields, (exclusive of the many varieties of plants found in the bituminous shales, which I am happy to say will shortly be submitted to the public in a work entitled the Fossil Flora of Great Britain, by Mr. Lindley, Professor of Botany in the

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* Since writing this paper, I have received a kind communication from Mr. A. Brongniart, through Mr. Philips of York, to the following effect,—"Please to inform Mr. Witham I have received his specimen of the Craiglieth fossil plant. It has much surprised and interested me. Having had so little time for examination, I cannot now give a final, but only a conditional opinion. It is, that I believe it to be a section of a monocotyledonous plant."

London University, and my friend Mr. Hutton, of Newcastle ;) we find the opinion of Mr. Brongniart most completely verified ; namely, that the vascular cryptogamic plants, had a vast numerical proportion, and, in fact, of two hundred and sixty species discovered in this Terrain or period, two hundred and twenty belong to this class. "Should, however," adds Mr. Brongniart, "more precise observation, or new discoveries, make known in the old formation some plants of more than one of the classes which we have admitted, or even some species of one of the classes, which have appeared to us to be wanting at this epoch, still the essential relations of these classes to each other, would be but slightly modified. Thus, it might be proved, that certain, yet little known genera of the coal formation are true dicotyledonous plants, yet it would not be the less certain, that the vascular cryptogamic plants were, by much the most numerous vegetables during the first period of vegetation." The same remarks he makes respecting the Lias, and other formations. Thus, whatever new discoveries may be made in the vegetables of this period, from the first deposit of the transition rocks, to the top of the coal field, yet the essential characters can be but slightly modified, and this period will always remain perfectly distinct.

The more gentlemen will therefore interest themselves in promoting the examination of the ancient relics, the more likely are they to perceive the time fast approaching, when we shall be able, with greater certainty, to ascertain each deposit, by the peculiarity of its vegetable fossils.

The essential character, therefore, of this first period of vegetation, is proved to be the predominance of vascular cryptogamic plants ; and we have here a most striking example of the great development which the species in question had attained in this first period of vegetable creation ; when the two principal agents, heat and moisture, had evidently exerted an extraordinary influence.

Geologists have entertained, and do entertain, very different notions respecting the origin of coal.

It appears very probable from the singular development of the vegetation of the first period, that these different combustible beds may have been deposited as a kind of peat of greater or less extent, formed from the remainder of vegetables, and on which other vegetables still grow. This opinion is, I should think, greatly confirmed by the description just given of the Newcastle coal field.

It appears also the more probable, as it is well known that many plants of the families composing this early vegetation grow abundantly in localities of this kind. The Equisitum (horsetail,) the Os munda regalis (royal moonwest,) and the Lycopodium (club moss,) are all indigenous in our peat soils. Again, we can scarcely doubt, that at this remote epoch, our atmosphere had a very different composition from what it now has, and that its difference exerted a powerful influence upon the formation of those bodies of vegetable combustion.

The comparison of the successive development of vegetables and animals, is not one of the least remarkable parts of the the study of these fossil organized bodies. This is beautifully expressed by Mr. Adolph. Brongniart. He displays by philosophic reasoning the effects produced by a supposed cause. He states with great perspicuity, why land animals did not exist at one period, why cold-blooded animals became more numerous at another period; and, lastly, he gives cogent reasons for the appearance of animals of a more complicated structure, the mammiferæ and birds in the fourth period.

Mr. A. Brongniart's reasonings upon this subject are so well epitomised by Professor Jameson in the Philosophical Journal for March, 1829, that I should think it improper at present to enter more minute details.

The study of this occult science truly opens a hidden field of animated beings and things, whose early call into existence proves the omnipotence of the design. It brings into view a world little looked into or thought of, owing to the obscurity with which it was surrounded. It develops the early, the sublime, the successive works of the great Creator, which before were all supposed to be drowned and scattered about by the mighty burstings of a universal deluge. In other words the contemplation of these stupendous operations is the true philosophy of the science of geology.

If, therefore, the attention lately paid to the study of fossil conchology has been so highly instrumental in clearing up the many doubts respecting the different sedimentary formations: If the works of Baron Cuvier and others, founded on the early observations of Werner, have afforded us so many interesting proofs of successive creations, from those of the early inhabitants of the deep, up to the more complicated structure of the quadruped; may we not expect equal pleasure and instruction from an application to the study of these ancient vegetable remains, which when once properly examined, will facilitate our knowledge of the forms, characters, and qualities peculiar to each epoch, and of the degree of temperature and humidity which must have existed during each successive period.

Edinburgh, 6th December, 1829.

Art. XXI.—*A description of the advantages derived from the use of an intermixture of the Anthracite Coal of this country, with the materials made use of in the making of Brick, rendering the burning of them more perfect and uniform, and greatly improving their texture and durability, as practiced last season, at one of the Brick Yards on the North River.* Communicated to the Editor, by William Meade, M. D.

To the discoveries which have been made within these few years in the physical sciences, do we owe the most important improvements in agriculture and manufactures, both mechanical and chemical; those discoveries would escape the notice of the greater part of the community, were they not widely circulated through the medium of the public journals. Having lately received some information on the subject of brick making, which is of some importance, but which would probably remain confined to a few individuals, did not your valuable Journal afford the means of general circulation; I am induced to offer you, in detail, some observations on the improvements which are suggested in the manufacture of this article.

The rage for building, not only in the great cities of this country, but in the small towns, which are gradually springing up in every part of the Union, in consequence of the extended and growing population, has given rise to an increased demand for the necessary materials for the structure of houses. Brick-making has, therefore, become one of those manufactures which is extending itself in every direction. The texture and durability of those essential requisites for building has, however, not been brought to the same perfection as in other countries. This has arisen from a want of due attention to the selection of the materials, a proper intermixture and preparation of those materials, and above all, the want of due management and regulation of the heat in the process of burning, upon which chiefly their strength and durability depend.

Few who know the value of a dry and comfortable house, will dispute the importance of a proper selection of one of the materials which principally contribute to this purpose.

It is not my intention, at present, to enter minutely into the process of brick-making, which requires more skill and management than is generally imagined. My only object is to call the attention of the public to an improvement which has lately been suggested in the art of brick-making in this country, which promises not only greatly to reduce the price of so necessary an article, but also to improve them in all the essential qualities of strength and durability.

In the neighborhood of the town of Newburgh, the trade of brick making has been carried on extensively for many years. The situation on the banks of a navigable river being extremely favorable for that purpose, as affording great facility to the New York market; the materials also on the spot are particularly well calculated for the manufacture of brick or tiles, and from the superiority of the article, the reputation of their bricks has always commanded the highest price in the market. But the price of wood for fuel increasing annually here, as in every other quarter, it required a considerable capital to insure a sufficient supply for the season; any substitute, therefore, for this essential requisite, or which contributed in any degree to lessen the consumption of fuel, seemed to be a great desideratum. For this purpose, a person of the name of Wood, a native of England, residing at Haverstraw, on the North River, and extensively engaged there in brick-making, commenced a series of experiments on the use of the anthracite coal of this country, not in the usual way, as an article of fuel, but mixed in certain proportions with the brick earth when preparing it for the manufacture of brick. It is not for me to say whether the idea suggested itself to him from the knowledge of the mode of making brick in all parts of England, but particularly in the neighborhood of London, where coal ashes is a necessary ingredient in the materials of all bricks, indeed, so imperatively, that according to an act of parliament, no bricks can be made without a due admixture of breeze, (that is, cinders,) and coal ashes, the quantity of which is regulated by law. Now when it is recollected that those ashes consist of the cinders of sea coal, as well as the small coal which passes through the grate without being ignited, it will naturally suggest itself that the refuse or finer parts of the anthracite coal of this country may be used in the same manner, and for the same purpose. The object of using those ashes in England, is not only to save the consumption of fuel, but to assist in more perfectly and uniformly burning the brick, rendering them much harder than formerly, and consequently more durable and less pervious to moisture: the manner of using these ashes is well described in Malcomb's treatise on brick-making, and consists in mixing uniformly the sifted ashes with the brick earth; each layer of this earth when duly prepared, about six inches thick, being covered with a thin layer of the coal ashes or sifted cinders, usually called breeze, and intimately incorporated with it, and so precise are the regulations in England on this subject, that it is provided by law that seven hundred and twenty bushels of coal ashes, and neither more or less, should be mixed with the quantity of earth required to make one hundred thousand bricks; and some idea may be formed of the value of this article of coal ashes, and the quantity of it used in the manufacture of good brick, from a circumstance which is detailed in one of the numbers of a periodical journal called the Emporium of Arts and Sciences, published in Philadelphia, in the year 1814, by Doctor Cooper, now president of Columbia College, South Carolina, a gentleman from whose distinguished talents in every branch of science, the public are indebted for much valuable information, and who by his exertions in the dissemination of useful knowledge, seems to have given the first impulse to the rapid progress which the arts and manufactures have made in this country. In one of the numbers of this useful journal, when referring to the progress of brick-making in England, he says: "I can well remember when the parish of St. James', Westminster, paid the scavengers seven hundred pounds sterling annually, for their services in removing the ashes, and in the course of five years, received twelve hundred pounds sterling from them for the privilege of taking it away for the purpose of brick-making."

From the want of breeze in this country, that is, cinders or sea coal ashes, great waste of fuel has taken place, and more time is required to burn the brick than in England; besides they were seldom thoroughly burnt to the centre, which rendered them pervious to water, and liable to crumble when exposed to the atmosphere.

The success attending Mr. Wood's experiment in the substitution of anthracite coal dust for the ashes of sea coal as used in England, was so complete that he was induced to take out a patent for the exclusive right to the use of it in the burning of brick; the patent, it seems, did not enter into a particular specification of the manner of using it, but merely refers to the general application; whether, after what I have stated of the acknowledged and ascertained value of the admixture of cinders and ashes of sea coal, and the constant use of them in England for many years, such a patent can be considered as tenable and valid in this country, must be decided by those who are more conversant with the subject than I am, but those who are acquainted with the particular qualities of the anthracite coal, will be at no loss to understand in how many respects it resembles the cinders of English coal, or the coak which is made from it by depriving it of its bitumen: this substitute for it was therefore as ingenious as it was successful, and I shall now proceed in describing the mode of using it here, as experience has suggested.

The materials for the making of brick at Newburgh, Cornwall, and Haverstraw, do not differ materially in any respect except color, which in some places is blue in others yellow. The clay is a heavy tenacious loam, consisting principally of argil, some silex and oxide of iron. I have found, by experiment, that it contains so little calcareous earth, that no effervescence takes place when it is submitted to the action of dilute marine acid. This clay is prepared in the usual manner; being first dug from the pit, and then frequently turned for some time and exposed to the air and frost, for at least one season. When it has undergone this necessary preparation, it is again turned and tempered by treading; in this state it was formerly the custom to prepare it for moulding, but since the discovery of the value of an intermixture of a certain quantity of anthracite coal, the clay should be deposited in layers of five or six inches, on which is laid the proper proportion of anthracite coal, powdered and skreened through a wire skreen, the opening of which should not be so much as half an inch wide; it should thus be mixed in alternate layers with the prepared clay, and duly and regularly incorporated with it, previously to its being moulded in the form of bricks, which are first dried in the air and afterwards placed in the kilns in the usual manner, to undergo the process of burning. Kilns of the average size, contain about one hundred thousand bricks; to burn these effectually in the accustomed manner, required about forty five cords of good wood, and the operation was seldom completed in less time than ten or twelve days.

The value, however, of this new method of burning the brick becomes now apparent, as the process of burning which formerly took ten or twelve days, is now completed in five, and instead of its consuming forty five cords of valuable wood, it requires not more than fifteen cords, whilst at the same time the bricks are more completely and equably burnt to the centre, and as far as we can at present, judge by experience, they are rendered as hard and as durable as the English brick. Thus, a saving of thirty cords of wood valued here at one hundred and fifty dollars, is made, in the burning of one hundred thousand bricks, while the process of burning them is completed in half the time.

In a former number of this Journal, I detailed the effect of some experiments which were made in Boston several years ago, on the value of anthracite coal in the burning of brick, which were not successful in consequence of the intense heat which was produced by the use of an over quantity of it, vitrifying part of the contents of the kiln; the same effect would be produced even in the manner now recommended, if too great a proportion of it was intermixed with the brick earth. I have seen this take place and several of the bricks altered in shape and converted into scoriæ, a sort of semi-vitrification taking place in the centre. As far as present experience affords a criterion of judging, it will not require half the quantity of powdered anthracite coal to produce the same effect as is generally allowed of coal ashes in England; less than half a ton of anthracite coal will be sufficient for one hundred thousand bricks, while seven hundred and fifty bushels of breeze and ashes are allowed in England for the same number. The price of this sifted anthracite or refuse coal is scarcely worth mentioning, as it is not calculated for domestic use, and in Rhode Island, in particular, is found an incumbrance by the proprietors of the colliery. But it should be understood that the principle upon which the value of each depends, is nearly the same; the anthracite is nearly a pure carbon, unmixed with any ashes, and not being deprived of any part of its carbon by being partly consumed in the grate, as is the case with respect to the cinders of bituminous coal, much less of the anthracite will therefore be required to produce the intended effect; it should also be made much finer, by passing it through a smaller skreen, otherwise in the process of burning particles of it will remain unconsumed, rendering them liable to crack and blister, as I have occasionally noticed. In the regulation of the quantity of the anthracite coal, attention must also be paid to the nature and qualities of the earth which is used for the manufacture of brick; if it is nearly a pure argil with a proper proportion of silex only, vitrification in the kiln will not so easily take place, and more of the coal dust may consequently be mixed with it; but if the earth contains a large proportion of calcareous matter it forms a mixture of a very fusible nature, and consequently not so suitable for good brick, nor requiring the same proportion of coal. The test of submitting a little of this earth to the action of marine acid may easily be made use of, by any individuals, in calculating the quantity of anthracite which it would be proper to mix with the clay in the composition of brick.

It has occurred to me, and I would suggest that great advantage and economy in the process of burning would arise, if the interstices between the different layers of bricks in the kiln were filled with small coal, thus assisting in thoroughly and uniformly burning all parts of the brick and improving their quality. It appears to me that no danger would attend this method, nor would vitrification take place if proper care was taken; this practice prevails in England, where the coarser cinders, which are not allowed to pass through in skreening, are constantly made use of, by strewing them between contiguous layers of the brick, as they are built up, tier upon tier, in the kiln.

I have thus endeavored to lay before the public the principal details of this new process in brick making, the advantages of which can scarcely as yet be duly appreciated; further experience in the use of it will doubtless tend to render it more perfect. It appears to me however sufficiently decided, that by adopting the use of anthracite coal, in the manner pointed out, a saving of time and expense may hereafter be calculated on, sufficient to reduce the price of this indispensable article in building nearly fifty per cent., besides rendering their texture and quality superior to those which have heretofore been manufactured in this country.

Art. XXII.—*Description of a frame Bridge;* by Geo. W. Long, Lieutenant United States Artillery.

(Communicated for this Journal.)

Fort Jackson, January 30th, 1830.

TO THE EDITOR.

Sir—I offer for the American Journal of Science and Arts, the following description of a frame bridge, which I claim as my invention, and which I have taken measures to secure to myself by letters patent in the U. States.

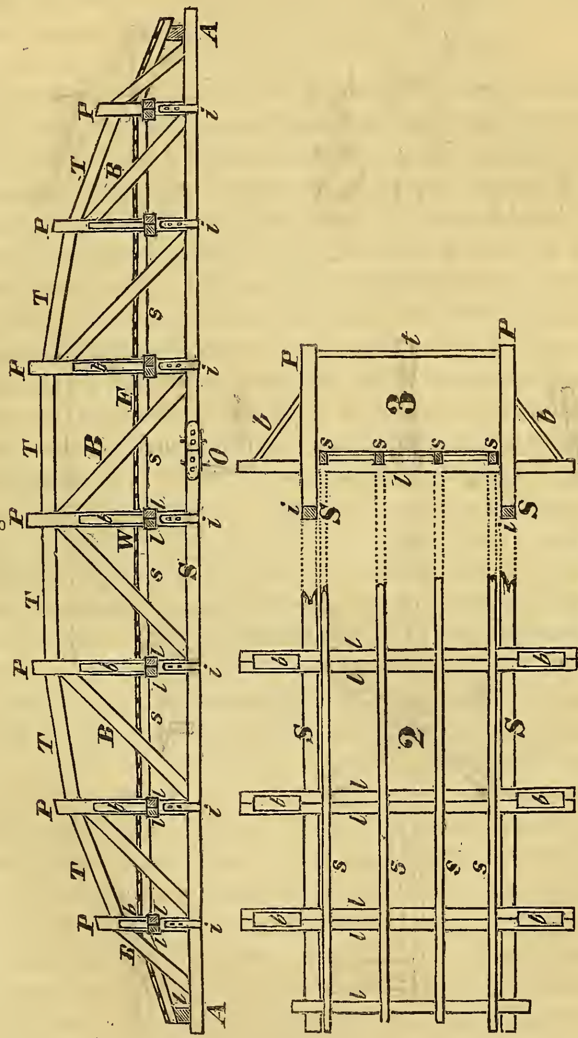
The object of the invention is to secure in a frame work some of the most essential properties of a solid beam; such as gaining strength by great depth of beam, and using great economy in material, by reducing the beam to such a shape that it will be equally strong throughout. The latter property is of material consequence in beams of great length, as for bridges, whose weight of material would be nearly a load for the bridge. In a solid beam of uniform width, the actual strength is directly as the square of the depth, and inversely as the rectangle of the distances from the supports; which will be constant when the beam is a semi-ellipse. A similar shape I have adopted for the frame bridge, as being of the most convenient construction, and of good appearance, although the actual strength will be as the depth of the frame divided by the above rectangle, which would give a curve differing not greatly from the ellipse: for instance, let the depth of beam be 2 and the length be 12; let the ordinate $\frac{1}{4}$ from either end be y, then the weight at the centre is to the weight on the ordinate as $\frac{y^2}{3\times9}$ is to $\frac{4^{(2\times2)}}{6\times6}$, or the weights being equal $y=\sqrt{3}=1.7$ nearly; and in the other instance the weights are as $\frac{y}{3\times9}$ to $\frac{2}{6\times6}$ or $y=1.5$ a difference of .2 only.

How these advantages are secured by this invention, will be seen in the arrangement of the timbers in the following plan, which is a complete draft of a model constructed at this place. The draft is on a scale of $\frac{1}{24}$ of the model, which was of cypress timbers $1\frac{1}{8}$ inch square. The model, ten feet long, eighteen inches high, and two feet in width, was loaded with fourteen men, whose weight amounted to 2,140 lbs. and yielded or sayed less than $\frac{3}{4}$ of an inch. This experiment is deemed conclusive as regards the superior strength of a bridge of this construction.

I will be further seen, that the stress arising from a weight placed on the bridge, on each timber, will be in the strongest direction of that piece. Let a weight W be placed on the center of the bridge, it is immediately received on the middle posts, which are supported by the main braces B, in the plan, and all the downward force is transferred to the next outer posts, and thus continued to the abutments A A. By this the strain on the string S is only in a horizontal direction, and is in tension; that on the posts P P is also in tension in a vertical direction. The strain on the braces B B, and on the timbers T T, is of an opposite kind or in thrust, either of which is the strongest and most economical method of arranging timbers in structures of the kind. The advantages of such a bridge are too obvious to need particular discussion. The carpentry is of the plainest kind, and the saving in piers and abutments, such as are necessary to support arches, &c., is of no inconsiderable account. The abutments necessary for this bridge have merely to support the weight of it, and its load in a vertical direction.

It is estimated that a bridge of this kind may be built of one hundred yards span, and possess all the strength necessary for common use. Indeed, from the particular arrangement of the timbers, it is evident that one built on this plan, can be carried to as great a span as can be made of wood or iron.

Fig. 1.



REFERENCES TO THE PLAN.

S S &c. are the strings, (*O* a joint, if of wood) Fig. 1, 2, 3.
P P " are the posts, secured to the strings by the bands of iron, well bolted, as represented by *i i* &c. Fig. 1, 3.
B B " are the main braces, Fig. 1. *T T* &c. timbers to support the posts from the action of the braces, Fig. 1.
l l " are sills—and *s s* are sleepers to receive the flooring *F*, Fig. 1, 2, 3.
b b and *t* are braces to ensure the stability of the bridge; the former brace the posts from the projections of the sleepers over the sides of the bridge, Fig. 1, 2, 3.

Art. XXIII.—*Mineralogical Journey in the northern parts of New England; by* Charles Upham Shepard, Assistant to the Professor of Chemistry and Mineralogy, and Lecturer on Botany in Yale College.

(Continued from Vol. XVII, p. 360.)

4. *Precious Garnets of Hanover.*

The precious *Garnets* of Hanover, N. H. next invited our attention. This locality, from its vicinity to Dartmouth College, has long been known; and specimens from it are now common in most collections. It is situated directly in the rear of the Medical College. The gneissoid hornblende, which forms the gangue of the Garnet, here crops out over an extent of several acres, and so abundantly, as to present the aspect of an almost unbroken ledge. This rock, composed principally of hornblende and quartz with occasional scales of black mica, has been called greenstone: from the large proportion of hornblende it contains and its schistose structure, some geologists might still be disposed to call it greenstone slate; but its characters and connexions appear to me, to bring it, more correctly, under gneiss. Its geological disposition is very decided and uniform; the strata constantly preserving a vertical position, and a direction varying but slightly from north and south. Nearly perpendicular to its stratification, exist frequent seams or joints; by which, in quarrying, it separates into imperfectly rhomboidal layers or blocks,—a character no doubt dependent upon the preponderance of hornblende in its composition. The Garnets are every where dispersed through it, at distances varying from immediate contact to half or three quarters of an inch apart; generally without any perceptible order, though, occasionally, following the plane of stratification.

The peculiar interest of this Garnet to the mineralogist, consists in the uniform simplicity and perfection of its crystals. In size they rarely exceed that of a common pea; but their form is invariably that of the dodecahedron, unmodified by the slightest replacement; (and what appeared to us as very remarkable also, considering the immense quantity in which they occur,) their planes are, in every instance, equally produced and perfect. Scarcely less strict is the uniformity observable among them in color, transparency and lustre.

In passing through the town of Piermont, twenty miles north of Hanover, we noticed by the road side, for a distance of several miles, an abundance of *Garnets* scarcely larger than those above described, and like them remarkable on account of their uniformity in shape; which, in the present case, is that of the elongated dodecahedron. Their gangue is a mica-slate rock, consisting, almost entirely, of a greyish white mica, with a very small proportion of quartz. Where it is traversed by large seams of quartz, a delicate blue Cyanite is sometimes observed, as also crystals of Rutile.

5. *Staurotide of Mink Pond.*

In the town of Landaff, about eight miles beyond Bath, on the road to Franconia, we visited a deposit of *Staurotide*, the most remarkable in the United States, if we consider the size and perfection of the crystals, their abundance, and the readiness with which they are capable of being disengaged from their gangue. It was first made known to us by Gen. Field of New Fane, by whom, if I mistake not, it was discovered. It occurs directly opposite Mink Pond, by the side of which the public road passes. Leaving this road, a few rods east of a small dwelling house, and ascending a moderate rise of ground, we passed over enormous tables and uptorn masses of gneiss, completely covered with, and penetrated by, the crystals of Staurotide. The gneiss is composed of quartz and feldspar, in fine grains, imperfectly separated into layers by minute scales of black mica; its texture is rendered very weak, in consequence of an incipient disintegration and the abundance of the imbedded mineral.

The crystals which vary in dimensions from one half of an inch, to two inches in length, are of a reddish brown color and translucent on the edges. They occur, for the most part, singly, and in the form of the primary crystal of the species, a right rhombic prism, with the exception of the very slight truncation of its acute lateral edges. More rarely, crystals are observed having these narrow secondary faces enlarged until they nearly equal in width the adjacent primary planes, thus forming the equilateral six sided prism; (*perihexaèdre*, H.) The compound forms are still less common; though the two usual kinds (*géminée rectangulaire* and *géminée obliquangle*, H.) are occasionally met with, the composition being formed of individuals of the same shape with those first described. Crystals of dodecahedral Garnet frequently penetrate the Staurotides; but without any observable uniformity in the position of the axes of the penetrating crystals, like what, under similar circumstances, is seen to obtain between the Staurotide and Cyanite of St. Gothard.

On gaining the high ground to the east, after leaving Mink Pond, the White Mountains, still twenty miles in advance, came into full view, together with the Franconia range, (a south western spur of those mountains) whose lower peaks were separated from us only by a fertile valley of two or three miles in width. It was but the commencement of November; yet the summits of Mount Washington, Adams and La Fayette, were already capped with snow; whose dazzling whiteness, as reflected to us by the declining sun, served to render still more sombre the dark foliage of the firs by which their sides were mantled. The view of these elevations from this road is certainly not surpassed by any to be obtained upon this side of the range; which to travellers visiting these mountains, should, I think recommend it above the one commonly taken, and which lies several miles to the north.

6. *Franconia minerals.*

A wish to visit the iron mine of Franconia had been one principal reason of our journey to the north; and the specimens from thence which we had met with in the different cabinets upon the route, had only served to heighten this desire. We therefore remained here nearly a week; during which time, we spared no pains in investigating, to the best of our ability, its mineral riches. A longer space, I am aware, would have been requisite for doing it full justice; and I have no doubt that many facts, relating both to its mineralogy and geology, still await future observation.

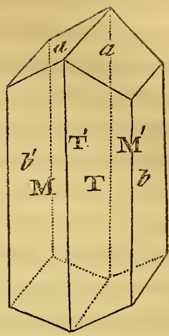
The mine is situated upon a mountain of moderate elevation, mostly covered with wood; and at a distance of four miles from the little village of Franconia. Nothing worthy of notice occurs, until you arrive within three quarters of a mile of the excavations for the ore. Here we begin to observe in the boulders and loose stones by the road side, brownish black crystals of *Staurotide*, very nearly of the same size with those described above, but differing from them as respects their modification and tendency to composition. They are shorter in proportion to their diameter, and have the six lateral faces nearly of the same breadth: and it is almost as rare to meet with a single crystal among them, as it was a compound one at Mink Pond. At this spot, also, and particularly in a large boulder just beyond the last house as you ascend the mountain, are found dull black *Garnets*, in very distinct dodecahedrons, from half an inch to one inch in diameter. They are so thickly imbedded as often to be in immediate contact, and when the rock is broken, which is very difficultly effected, great numbers of them fall out, leaving impressions upon the sides of the detached masses, as smooth and polished as the crystals themselves. The rock in this instance, as well as in that of the Staurotide, is a variety of the common gneiss composing the mountain, which here possesses more mica, with less quartz and felspar than usual; the mica being in fine scales, and much contorted in its arrangement.

About half a mile beyond the house above alluded to, at a place where the road is carried round a steep declivity of the mountain upon an artificial basis, and where it is so narrow as scarcely to afford room for a carriage, are found the noble crystals of Epidote for which Franconia is remarkable; and which vie in point of size and finish, with those of Arendal in Norway. The strata, here, are mostly concealed by a covering of soil supporting large trees; yet where the path is narrowest, they become partially visible in the bank upon the left side. It is in a vein of quartz, two or three feet in width, whose situation is vertical, and apparently at right angles to the general stratification of the mountain, that these crystals occur. The vein comes out quite into the carriage path; but owing to the accumulation of soil above, it remains in view only for a few feet in extent. No blasting is required, for the quartz is already separated into blocks by numerous fissures, and needs only the aid of heavy iron bars to lift them out of their place. On breaking these to pieces, the Epidote is found every where disseminated through them, sometimes in veins, and sometimes shooting its crytals into cavities; many of which are otherwise empty or contain only oxide of iron and soil, which has found its way into them through the crevices from above; others are partially occupied by capillary fibres of Hornblende, Calcareous spar, and crystals of Quartz and of Felspar; while others still are filled up by green, earthy Chlorite, through which are occasionally dispersed small crystals of Iron-pyrites. The crystals penetrating these cavities are beautifully terminated, as well as those which are completely engaged in the quartz; these last, however, being free from all entanglement with the Hornblende and other matters, are more apt to be perfect at both extremities, than the former.

Much simplicity is observed in the modifications they affect; nearly all of them belonging to the form illustrated by the annexed figure and measurements,—the *amphihexaèdre* of Haüy.

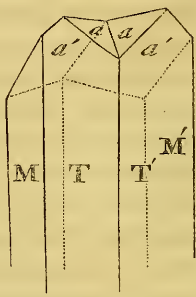
Inclination of

M on T	Reflec. G.		115°	36′
T on b . .	"	" .	128	35
b on M′ . .	"	" .	116	26
a on a . .	"	" .	109	24
a on b . .	"	" .	125	32



Besides this form, the following twin-crystal was frequently noticed.

M on T, or M′ on T′.	Reflec.	G.	115°	36′
T on T′	"	"	129	35
a on a'	"	"	109	24
a' on a'	"	"	138	32

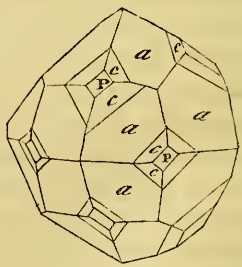


In size, they vary from half, to one and a half inches in length, by one eighth, to one inch, in diameter. Their planes are very symetrically extended, free from striae, and in general possessed of a high degree of lustre. Their color is yellowish green, often quite dark; and the smaller crystals are semi-transparent. In turning them round very near my eye upon the axis of the Reflective Goniometer, I noticed in them, a dichroism, hitherto unobserved, so far as my knowledge extends, in this species. Whenever the edge formed by the meeting of the planes M and T came opposite my eye, the light which flowed through the crystal was of fine emerald green color; whereas opposite the other edges, it was of a yellowish brown.

The *Magnetic Iron Ore*, in veins from eight inches to several feet in width, and obeying the stratification of the rock, occupies the south western summit of the mountain, traversing the gneiss, whose strata are here nearly vertical. The surface being quite steep, no difficulty has been encountered from water in following the ore. One vein has been pursued up the mountain for a distance of several hundred feet, and to the depth of fifty feet. Throughout its course thus far, it has consisted of very excellent ore; though its width has rarely exceeded three feet. A few rods higher up the mountain, what appears to be the same vein is now working by a perpendicular shaft, sixty or seventy feet in length, by fifteen or twenty wide; and which is already sunk to the depth of upwards of forty feet. The ore here does not seem to follow any regular course; but occurs in bunches throughout the veinstone, which consists principally of garnet. One of them, encountered not long ago, measured eight feet in diameter; but at present it is uncommon to meet with masses above one foot in diameter. Still another vein is wrought ten or fifteen rods to the north, whose veinstone is mostly epidote and hornblende. Its ore is said to yield bar iron with more facility than that of the other workings. No perceptible difference, however, is discernible in the ores; and if there is no mistake upon this point, it may perhaps be accounted for in the different nature of the veinstone, from which the ore is never wholly freed in the process of picking. The ore of this place possesses some peculiarities when compared with that of other mines in our country. It is remarkably uncrystalline and compact; but breaks with the slightest blow of the hammer into rhombic prisms of from 100° to 120°, whose faces offer a glimmering, steel-like lustre. This cleavage, which no doubt depends upon the appropriate structure of the species, is of great importance both in the operation of mining, and in that of preparing the ore for the furnace. Indeed, so strong is it, that the simple process of heating the ore in heaps over a fire of charcoal in the open air, is sufficient to produce its separation in these directions; which materially assists in its subsequent reduction in the crushing mill. The only perfect crystals of it, which we observed, were a few of the dodecahedral form, imbedded in the compact epidote, so abundant as the veinstone of the most northerly excavation. These, as usual, were deeply striated in the direction of the longer diagonals of the rhombic planes. About the opening of the same vein, we found a few specimens of *Specular Iron ore*, in broad, brilliant, interlacing plates, presenting upon their edges the beautiful tarnish common to this species. They occupied veins in the gneiss, and were invested by calcareous spar. Crystals of *Iron Pyrites*, also, under several of its most common forms exists at the same place.

Leaving for the present, all farther notice of the ores of Iron, I proceed to describe those accompanying substances from which this spot derives its chief interest in the eye of the mineralogist. Of all these, the *Garnet* is the most conspicuous; vast heaps of which are accumulated about the two most southerly excavations, and which continues daily to be raised in great quantities, especially in the working of the shaft above alluded to. It is of a red color, and for the greatest part, massive; occasionally, however, becoming granular, and where grains of quartz or calcareous spar are intermingled, shewing faces of crystallization. When the quartz is in layers of considerable size, the Garnet sometimes crystallizes into it, in the most beautiful manner conceivable; so that on lifting off the layer of quartz from a mass of the garnet, we have a surface invested by crystals, the richest in point of color, lustre and finish, in which this species ever occurs. It is very rare, however, to find surfaces of considerable dimensions thus coated: those half an inch, or an inch over are pretty frequent. The individual crystals rarely exceed one eighth of an inch in diameter. Their color is that of a very dark and exceedingly rich blood-red, sometimes becoming nearly black. The most perfect of them have their faces wholly free from striae. The form of the crystal is, universally, that of the *triémarginé* of Haüy. In consequence, however, of the undue extension of the tangent plane (*a*), the bevelling planes (*c*) together with the primary faces (P), are so reduced as often to be scarcely perceptible; thus imparting to the crystals the general figure of the trapezohedron.

	Inclination of	
P on *c*	Reflec. G.	160° 54′
P on *a* . .	“ “ . .	149 50
a on *c* . .	“ “ . .	169 6



Where calcareous spar occurs in this mixture of magnetic iron ore and garnets, superb crystallizations of *Epidote*, of a fine pistachio green color, are often found; many of the crystals being regularly terminated at both extremities, and extremely complicated and various in their modifications. Among them, however, neither of the two preceding varieties of form ever occur. The smallest crystals possess a high degree of transparency, and present the curious dichroism, above described. At the lower extremity of the largest opening which has been made for ore, in a heap of stones, long since thrown out, masses of still another variety of this mineral frequently occur. They are made up of minute, but brilliant, imperfectly formed, and confusedly aggregated prisms; throughout which, small particles of white Felspar and Amianthus are disseminated. The color is a pale, yellowish green.

Upon either side of the last mentioned excavation, the Garnet, which lies in immense heaps, is less compact; and frequently contains small cavities, either partially, or entirely occupied by plates of *Schiefer-spar*, filaments of the variety of Hornblende called *Byssolite*, and imperfectly formed crystals of *Quartz*. The former of these minerals reminded us at first glance, by its high nacreous lustre as well as the crossing and interlacing of its laminæ, of the species Stilbite; but a nearer examination evinced the characteristic cleavages of calcareous spar, to which species it belongs, and of which it forms an extremely delicate variety. The Byssolite is implanted upon the crystals of Garnet and Quartz in little tufts, consisting of green filaments.

At the same place is found also, among the masses of gneiss thrown out from the excavation, white *Mesotype*, occupying narrow seams nearly perpendicular to its stratification. It exists in very closely aggregated fibres, an inch or more in length, and disposed in a sheaf-like manner. A single specimen of purple *Fluor* was likewise picked up in this vicinity.

With the crystals of *Hornblende*, which next to the Garnet, is the most abundant crystallized mineral of the mountain, I shall conclude my notice of the present locality. These, though not of large dimensions, we considered as very interesting on account of their high lustre and jetty black color. They are never regularly terminated; but their lateral planes are always perfect and constant in their inclinations to each other. The modification they affect, is simply that of the primary rhombic prism, having the obtuse lateral edges replaced by tangent planes: the primary planes inclining to each other under an angle of 124° 40′ and 55° 20′ (Reflective Goniometer); the inclination of the secondary plane to either of the adjacent faces being 152° 15′. The two northern excavations produce this mineral; though under somewhat different circumstances, at each. From the shaft, it is brought up contained in a mixture of chlorite and mica, forming seams, two or three inches in width, among the ore. This aggregate is every where penetrated by the crystals, which are disposed, for the most part in a direction nearly perpendicular to the sides of the seams. They are easily separated from the engaging matter, and when thus detached, form the most brilliant crystals of Hornblende with which I am acquainted; although, as has been observed above, they are defective as respects their terminations. The tangent replacement in them is so narrow as almost to escape observation; yet a careful search will always detect it. The variety from the other vein offers quite a different aspect. The crystals here, are, chiefly engaged in a fine quartzose gangue, often tinged green by an intermixture of Epidote: they are much more interlaced and liable to be curved; and besides, have the tangent plane, above alluded to, produced to an extent of five or six times that of the adjacent primary faces.

Franconia Iron Works.

The Franconia iron works are situated upon the south branch of the lower Ammonoosuc, which empties into the Connecticut River at Bath, sixteen miles distant; and are seventy-five miles north-west from Concord the capital of the state, one hundred miles west from Portland, (Me.) and one hundred and forty north north-west from Boston. There are two manufactories; the New Hampshire Iron Manufactory Company and the Upper works,—formerly, the Haverhill and Franconia Iron works. The first of these is situated in the village of Franconia, and the second, one mile above. The ore is nearly four miles distant from both, and costs them, delivered at their works $4,75 per ton: the price of raising and picking it, being $4, the ton, and its carting from the mountain the remainder. It yields fifty per cent. pig iron and thirty three per cent. bar iron. They manufacture at present, three hundred tons of bar iron, and three hundred, or three hundred and fifty tons of cast iron, annually; the largest part of which is required for the consumption of the neighboring country, and the remainder goes, either, over land or by water to Boston,—the transportation by land, being $25 per ton and down the Connecticut by water, $12 per ton. Bar iron is worth at Franconia $112 per ton, and Pig iron $40 per ton.

The works of the New Hampshire Iron Manufactory Company form much the largest establishment, consisting of a Blast Furnace, Forge, Trip Hammer, Shop and Mills. It employs sixty men in the various departments of mining, coaling, smelting, and forging; the operations of the trip hammer shop and mills, farming, &c. Their furnace, which is like those employed in the great iron mines of Sweden, is thirty feet in height, of an ovoidal form, and furnished with a powerful cylindrical machine for giving the blast. It is lined with a white granite from Landaff, composed principally of felspar, which the iron master assured us, formed a very durable and excellent lining. The furnace was heating up at the time of our visit for an operation to last eighteen weeks.

Captain Putnam, the enterprising agent of this establishment, informed us, that their manufactures for the last nine years had annually averaged forty tons of bar iron, and two hundred and sixteen tons of cast iron, in hollow ware, stoves, machinery and pig iron; with the yearly consumption of two hundred thousand bushels of charcoal, which costs them $3 75 per one hundred bushels. But in consequence of considerable improvements in their works which were just completed, they were beginning to manufacture at the rate of two hundred tons of bar iron, and from three hundred to three hundred and fifty tons of cast iron, annually.

The upper works are, at present, individual property; being owned and superintended by Mr. J. Richardson. He manufactures bar iron only; and produces one hundred tons, annually. This gentleman does not employ the high furnace for the reduction of his ore; but the more simple apparatus of the Catalan forge; which although it requires more charcoal, yet yields excellent wrought iron, and requires comparatively but a moderate capital. The ore after a slight roasting, and reduction in the crushing mill, is thrown, every few minutes by the shovel full (without any flux) upon the burning charcoal of the forge hearth, to which the blast is given from a common leathern bellows. When a loup, or cake of sufficient size has been accumulated in the basin of the forge, it is withdrawn, put under the hammer and forged at once. Thus, both the forge and furnace operations are united in one. These works consume seventy thousand bushels of coal annually, at an expense of four dollars the one hundred bushels; and furnish employment for twenty men.

Considerable expectation was awake, at the time of our visit at Franconia, respecting the discovery of fossil coal, said to exist twelve miles distant, in the town of Bath. From a specimen of it, presented to us by Mr. Richardson, it was extremely obvious, that it was the anthracite; and in its characters resembled closely the variety found at Worcester and Rhode Island, though, apparently, of an inferior quality. In our journey we had passed very near the spot whence it came; yet we saw no rock but gneiss: still, it is very possible that an anthracite formation may come into view in that neighborhood; and if so, it no doubt belongs to that of Rhode Island, which has already been traced as far north as the borders of New Hampshire. In a letter upon this subject, dated January 13th, Mr. Richardson remarks,—"Mr. Brooke the proprietor of the coal mine at Bath, remains very sanguine in the belief that he shall find coal. He informs me, he has found specimens that would burn very well with the aid of a small portion of charcoal to effect their ignition. He continues to excavate slowly; and has been encouraged by two English coal miners who have lately visited him, and offered to be at the whole expense of excavating, on being allowed two thirds of the profits." If, however, the anthracite should be found, I fear it will afford no advantage to the Iron manufactories; since all attempts to apply it to use in the reduction of iron ores, so far, at least, as have come within my knowledge, have failed of success.

(To be continued.)

Art. XXIV.—*Notice of the American Antiquarian Society; abridged from a letter* addressed by Dr. Jacob Porter to M. Fursi Laisné*, of Paris.

This Institution was established at Worcester, Mass. in 1812, a charter having been given by the legislature of that state. From a notice of the society published in 1813, it appears that its object is neither personal, local nor temporary; nor coincident with that of any other society established in the United States, there being no other institution whose object is exclusively retrospective.

Although American antiquities, natural, artificial and literary, have the first claims on the attention of the society, it desires and receives also those from other countries, and all of them are not only interesting to the curious but highly instructive to the philosopher and historian, often presenting a mirror of other times and frequently symbolizing them by tangible memorials.

The society has wisely chosen for its anniversary the 23d of October, in commemoration of the discovery of America by Columbus. The first anniversary was honored by an address from the venerable

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* All the facts respecting the Antiquarian Society have been preserved.

President, Isaiah Thomas Esq. who has been called the father of American typography, and who having for more than half a century contributed by numerous publications to disseminate useful knowledge, crowned his labors by founding this important institution.

In March, 1819, the society published an address to rouse the zeal of its members; at the subsequent anniversary, in October, a committee reported, that its interests were advancing with encouraging rapidity; and it was particularly mentioned, that the general government of the United States and the local governments of nine states, had presented to the society copies of their laws from the beginning, and of the journals of their legislatures in both branches. How far this wise measure has advanced towards maturity, we are not informed, but it is clearly very desirable, for the sake of the historian, the jurist, the statesman and the antiquary, that this collection should be rendered complete. The first volume* of the Transactions of the Society appeared in 1820, and excited much interest, especially by the account and drawings which it contained of the ancient fortifications, mounds and other antiquities of the long extinct race that once inhabited the western parts of the United States. This volume contained also a vocabulary of the Shawanoese, and of the poetry and music of the Osages; and an account of the Caraibs, the aborigines of the Antilles.

President Thomas, at the first anniversary, strongly recommended the erection of a suitable building, as being indispensable to the prosperity of the institution, and very properly indicated the advantages presented by a small inland town, as being comparatively secure from invasion and from fire. In August, 1820, this munificent gentleman presented the society with a noble hall, erected at his own expense. On this occasion, an appropriate address was delivered, by Mr. Isaac Goodwin. The building is of brick, and is large, convenient and pleasantly situated in the environs of Worcester, which is one of our most beautiful inland towns, adorned by many houses of gentlemen of wealth and distinction and honored by the residence of the present governor† of the state. Its environs are picturesque with villas, indicating taste and comfort, and rural beauty is every where conspicuous.‡

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* For a notice of this volume, see the North American Review, April, 1821, and this Journal, Vol. III.

† The Hon. Levi Lincoln.

‡ A canal now connects Worcester with Providence, at the distance of thirty miles, at the head of the grand Narragansett Bay, one of the finest bays in North America.

The library, consisting of about seven thousand volumes, occupies three rooms; two below, and a spacious one above. At one end of the larger room is a likeness of Columbus, at the other, of Professor Ebeling. In works relating to the early history of America, it is comparatively rich, containing many, that are rare and curious. In magazines and other periodical works, the collection is copious and diversified. Of newspapers it contains about a thousand volumes neatly bound.

The collection of bibles is large and valuable. The most curious is a Latin bible, "printed at Venice in 1476, only seventeen years after the invention of cast metal types by Schaeffer in Mentz, which was in 1459, and but thirty two years after the first use of metal types with engraved faces by Gienofleiche and his brother Guttemburg, in company with Faust or Faustus, at Mentz, in 1444." It is a copy of the ancient Vulgate, and the paper is an imitation of fine clear vellum, the types semi Gothic, differing from either ancient or modern blocks. This edition is mentioned by Le Long in his Bibliotheca Sacra, and by Clarke in his Bibliographical Dictionary, in these terms. "This is a beautiful ancient edition; it has a copious index at the end, which enhances the value of it. As it is not described by Clement, or mentioned in the Harleian Catalogue, it is undoubtedly rare in Europe. De Bure mentions it as 'une edition rare, fort recherché des curieux.'" It is very particularly described in the first volume of Thomas's History of printing. Besides a Polyglott Bible in eight large folios, the library contains a Polyglott New Testament in twelve languages, a Hebrew Bible of 1587, Luther's German Bible, Archbishop Cranmer's Bible, Elliot's Indian Bible, the Serampore translations, (the last present by the lamented Ward,) the Spanish Bible of father Scio, published and presented by the American Bible Society, with various others too numerous to be mentioned in this sketch.

Among the ancient books, are the remains of the libraries formerly belonging to the venerable Increase and Cotton Mather, the most ancient in Massachusetts, if not in the United States. To the antiquary these are the more interesting, from being kept in the very book cases of the original owners.

Two of the alcoves are devoted to a collection of German books, received as a legacy from the late Dr. Bentley of Salem, an officer and ardent friend of the society.

Among the works from Paris, are the Memoires de la Société Royale des Antiquaries de France, in three volumes, and Memoires de l'Académie Celtique, in five volumes, both presented by the Parisian Society of Antiquaries.

The plan of the library is very extensive, including every thing from the Encyclopœdia down to the newspaper and almanac.

The collection of manuscripts is considerable; among the most interesting of which is a copy of the Koran, elegantly written in the original Arabic. The society is in possession of several ancient paintings.

The cabinet contains a very valuable collection, particularly of Indian antiquities, such as arrow heads, axes, pestles, pipes, war clubs, with many specimens of the costume of our predecessors, the sons of the forest. It contains also a considerable collection of minerals, shells and coins.

Materials are already on hand sufficient for one or more volumes. These, it is much to be regretted, cannot be published at present for the want of funds. It is exceedingly desirable that a catalogue of the library and cabinet should be made out and published. It would also greatly increase the usefulness of the institution if a librarian and cabinet keeper were appointed, with an adequate salary, to attend regularly at the institution.

The collection of the Worcester Lyceum of Natural History is deposited by permission, in one of the rooms of the Antiquarian Hall.

Art. XXV.—*Notice of the Osseous remains at Big Bone Lick, Kentucky.**

No place, perhaps, in the western country, is so interesting to the geologist, as Big Bone Lick, in Kentucky. This wonderful spot is a small valley situated twenty miles south west of Cincinnati, and two from the Ohio river. In a number of places, the ground is so soft for several rods, that a pole may, with ease, be thrust down many

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* The anonymous author of this paper is requested to communicate his name and address to the editor, that he may be referred to should there be occasion. The statement of facts corresponds with what we have before heard, but it is proper that it should be supported by a name.

feet. In these soft places, saline and sulphurous mineral waters arise.* The earth around these places is dry and solid.

The ground for several rods around these springs, is entirely without vegetation, owing to the salt with which it is impregnated ; and a manufactory of salt was formerly established here, but it is now discontinued.

This was formerly the rendezvous of vast herds of quadrupeds. Their trails, when the country was first settled, extended from the Lick, for miles in several directions, like the roads from a metropolis. Vast numbers of these quadrupeds perished in the quagmire ; some probably were slain in battles of emulation and ferocity, and many more were destroyed by carnivorous animals. Here are now found the bones of the mastodon, elephant, buffalo, elk, and of other, and now unknown animals ; they are in immense quantities—it is a complete charnel-house. The bones are generally under ground, and so numerous that you cannot dig a hole, to the depth at which they are usually found, without striking them. They are, however, generally bones of the buffalo.

On the east side of a rivulet that runs near the principal spring, they lie in a horizontal stratum, three feet below the surface where the ground is lowest, and eleven, where the ground is eight feet higher. As the ground is dry and solid over this stratum, it cannot be supposed that the bones have sunk through to their present level. Their position also excludes such a supposition, each bone lying horizontally, and the stratum also being horizontal. If the bones had descended when the ground was soft, it cannot be supposed that they would have arranged themselves into a horizontal stratum irrespective of the unevenness of the ground, and of the various depths, three and eleven feet, necessary to attain this horizontal range. It is therefore evident, that this part of the valley was level when these bones were deposited, that they lay on the surface and were subsequently covered with earth. As they have been covered without being displaced, or the horizontal position of each bone, or of the stratum, disturbed, the only admissible supposition is, that they have been covered by an inundation. They must have been long accumulating ; for there has been no accumulation since that event, which bears any comparison for quantity, with those thus imbedded. The

* The waters are beneficial to health ; but the place is not much resorted to.

inference also seems warranted, that quadrupeds have never been equal, either in number or variety, since that inundation, to what they were previously to it. As many of these bones are in a good state of preservation, we are led to conclude that the water has retired from the valley of the Mississippi at a later period, than it has from the Atlantic States: for although it is capable of demonstration, that these states have been inundated, yet the facts which constitute that demonstration, indicate also an earlier period.

The foregoing discussion relates to a part only of this valley; for the ground on the opposite side of the rivulet, is higher and presents a different class of phenomena. There the bones lie at promiscuous depths, without any stratification. We must, therefore, suppose that some other agent, than an inundation with its deposits, has contributed to the latter phenomena.

It may excite surprise, that these bones, which have lain here a thousand years, and perhaps thousands of years, should yet be in a state of entire preservation. But when it is recollected, that the earth here is strongly impregnated with salt, and when it is stated, that many of these bones are now entirely petrified, that surprise will be diminished.

Only a small part of the earth which contains these fossils, has yet been dug over. For centuries to come, these enormous bones, which have been the wonder of naturalists, will still be found.

Capt. Phinnel, who keeps the boarding house at this watering place, informed the writer, that he found within a space not more than six feet square, at the depth of three feet, thirty two grinder-teeth of the mastodon and elephant, one of which, he said, weighed fourteen pounds. They were all at one depth, and were supposed to have been collected in that spot, as they have never been found numerous in any other.

In the possession of that gentleman, I saw a large bone, twenty six inches in length, and weighing about sixteen pounds, entirely petrified, which had never belonged to any of the mastodon or elephant species, but to some animal now unknown. It had been part of the leg of a quadruped, between the knee and the pastern joints. It resembled in shape the bone of a hare, except being larger in proportion to its length. The quadruped to which it belonged was eleven feet high.

Art. XXVI.—1. *Bromine in American Saline Waters.*

1. *Hydro-bromic Acid and Potash in the Saratoga Springs.*—A. A. Hayes.
2. *Bromine in the waters of Salina.*—Editor.

The discovery of iodine with bromine, in some of the salt springs of England by Dr. Daubeny,* induced me to examine analytically, the saline contents of the Saratoga waters, in which, the presence of iodine has lately been announced, by Drs. Usher and Steel. The evidence which I have of the existence of hydro-bromic acid and potash in these waters, rests on the results of the experiments in detail.

I. A portion of the dry saline matter left after evaporating a large quantity of the water, was boiled with a few ounces of *pure* water in a vessel of glass, the clear liquor being decanted from the undissolved salt was evaporated, and the hydro-chlorate of soda crystallized out, till its bulk was much reduced and it had assumed a slightly yellow color; it was tested for metals, by hydro-sulphate of ammonia; and for earths, by carbonate of soda, assisted by heat; neither was discovered. A slight excess of carbonate of soda, rendered it colorless; when neutralized its yellow tint appeared.

II. To a part of solution I. a minute portion of soda was added, the slightly alkaline solution was mixed with its bulk of a weak solution of starch, and a drop of sulphuric acid introduced beneath the fluid, developed a violet color at the point where it was in contact with the liquor; a bubble of chlorine,† then caused the appearance of a deep blue, voluminous ioduret of starch. The mixture was exposed to a stream of chlorine issuing from a small tube, the whole became colorless, then deep orange yellow.

III. A part of the solution I. was placed in a suitable vessel, and a few bubbles of chlorine passed into it; the color rapidly deepened and became of a fine orange tint. Pure sulphuric ether by agitation with the solution, dissolved the coloring substances and became reddish brown, reposing on the now colorless fluid below it. The etherial solution was withdrawn, and a drop of solution of potash added to it, the color instantly disappeared, and a clear neutral solution remained.

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* Phil. Mag. No. XXXIII.

† M. Balard has proposed the solution of chlorine in water; great care is necessary to prevent mixing the solutions in this case, and it is far more satisfactory to use the pure gas.

By evaporation, minute, but distinct crystals of a rhombic, or cubical form separated, and a crust of indistinct forms was left. A solution of this salt in water, did not occasion any precipitate when added in successive portions, to a drop of a solution of bi-chloride of mercury; with pro-nitrate of mercury, there was an abundant white precipitate; also with nitrate of lead, a white precipitate.

IV. Another part of solution I. was evaporated, and the dry salt digested in pure alcohol; by evaporating the solution, a salt, in milk white cubes separated, and a crust of apparently prismatic crystals remained. Alcohol dissolved them without leaving any residue, and the solution being mixed with a drop of chloride of platina, potassa chloride of platina, in the form of fine yellow powder, was precipitated. The proportion of hydro-bromic acid in these waters, seems by the action of reagents, to be much less than that of hydriodic acid; the quantity of potash is also inconsiderable. As it is probable that bromine in combination, exists in many of our waters, a convenient method for ascertaining its presence is desirable, particularly, as a minute scale of experimenting is unavoidable. The characters observed in I. led me to adopt the following. A few drops of pure water are mixed in a conical glass, with a drop of sulphuric acid, and half a volume of a cold solution of starch; a few bubbles of chlorine are passed through the mixture, which is then left at rest, that the diffused starch may unite at the bottom. A glass rod dipped in the fluid supposed to contain bromine, is then applied to the surface of the fluid in the glass; orange colored, dense striae descend from the rod, and rest for some time on the starch, if bromine alone is present. If the solution contains iodine also, the appearance is the same, but the striae are deep blue; in a few seconds the blue disappears, and the characteristic orange yellow of the solution of bromine remains; *extremely* minute quantities of these substances may be thus distinguished.

Bromine in the natural brine of Salina.

Having enjoyed, during the late winter, some opportunities of observing the remarkable properties of bromine; and having learned also that it has been discovered in various saline waters in England,* and other countries, I was desirous of ascertaining whether it exists in any of the saline waters of this country, to which I have access.

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* By Dr. Daubeny and Mr. Murray.

According to the original process of the ingenious discoverer, M. Balard, I tried first, the bittern of the sea water evaporated upon this coast, for the purpose of obtaining common salt, but, a stream of chlorine gas, passed through it, produced no change in its color, except what might be attributed to the solution of the chlorine. I next tried the bittern of Salina, in the state of New York, where is a well known and extensive manufactory of common salt, obtained by evaporating the salt water which there rises in great abundance. On passing a stream of chlorine gas through a strong solution of this bittern, there was an immediate change to yellowish red, and a peculiar odor resembling that of a mixture of chlorine and bromine was perceived; the peculiar color and odor acquired their maximum in the course of a few minutes, and I then agitated the entire fluid with very good ether; immediately, the ether became highly colored and floated on the aqueous solution of the salts contained in the bittern; a distinct line of separation being observed between them. The limited quantity of the bittern in my possession, (only a few oz. measures,) precluded the hope of obtaining the bromine in a separate state, by distillation. It must however be obvious, to all who have studied the properties of bromine, that these appearances decisively prove its existence in the Salina waters, and it would seem in considerable proportion. If I can obtain a sufficient quantity of the bittern liquor of that place, I shall hope to extract the bromine, and in the mean time, I should be pleased to hear that it has been done by others; and it is probable that similar results may be obtained from our numerous salt springs and fountains in the west.

The subject is one of much practical interest, for such active agents as iodine and bromine may produce important variations in the quality of salt, and it may become necessary for the manufacturer to know how to separate them.

In a theoretical view, iodine and bromine are among the most energetic and interesting of the bodies (considered as elementary) that have been hitherto discovered, and we may expect much from the farther development of their history and properties. The observation on the existence of bromine in the Salina waters was made and communicated to my audience of pupils, in the first week of February, 1830.

The bittern of this coast contains abundance of muriate of magnesia, but very little muriate of lime; just the reverse is the fact in the bittern of Salina.

SCIENTIFIC INTELLIGENCE.

Translated and Extracted by Prof. J. Griscom.

CHEMISTRY.

1. *Cement for hard stones, porcelain and glass.*—This cement is a natural product, which, without being abundant, is in sufficient quantities for all ordinary uses. The large snails which are found in gardens and woods, and are sometimes used for food, have a vesicle at the extremities of their bodies filled with a whitish substance, having a greasy and gelatinous appearance. If it be applied between two surfaces, whatever be their hardness or compactness, and the surfaces be brought together throughout, so strong an adhesion is ultimately occasioned, that if violent blows or thrusts be given to the substances, they frequently break elsewhere than at the junction. A flint about the size of a fish having been broken into two pieces, and rejoined by these means, being thrown with violence on the pavement, broke into fragments by fresh fractures crossing the former junction, but not going along with it. All that is necessary to give this cement its full power is to allow it time to dry.—(Bull. Univ. E. XII, 107.)—*Quarterly Journal, Sept.* 1829.

2. *Preservation of butter.* (Bull. Univ. D. XII, 155.)—M. Thénard recommends the method used by the Tartars; which consists in fusing the butter in a water bath at a temperature of 190° Fahr., and retaining it quiescent in that state, until the caseous matter has settled, and the butter become clear; it is then to be decanted, passed through a cloth, and cooled in a mixture of salt and ice, or, at least, in spring water, without which it would crystallize, and not resist so well the action of air. Preserved in close vessels and cold places, it may be kept for six months as good as it was on the first day, especially if the upper part be excepted. If, when used, it be beaten up with one sixth of cheese, it will have all the appearance of fresh butter. The flavor of rancid butter may, according to M. Thénard, be removed almost entirely by similar meltings and coolings.—*Quarterly Journal.*

3. *Artificial preparation of ice.*—After numerous trials made by M. B. Merjilink, with different salts, for the purpose of converting

water contained in a tin vessel into ice during their solution, he ultimately gave the preference to a mixture of 4 ounces nitrate of ammonia, 4 ounces sub-carbonate of soda, and 4 ounces of water. This mixture, in three hours, produced ten ounces of ice; whilst with the mixture of sulphate of soda and muriatic acid, he obtained ice only after seven hours.—*Idem.*

4. *Action of iron on ammonia.* (Le Globe, Avril 14.)—M. Despretz announced some time since, that when heated metals were subjected to the action of ammoniacal gas, they underwent a considerable change in their weight, in consequence of combining with some part of the ammonia. He now states that the weight of iron is sometimes increased as much as 11.5 per cent. in such an experiment, in consequence of the combination of nitrogen with it. If the temperature applied be too high, the nitrogen is expelled, and the compound destroyed.—*Quarterly Journal, July to Sept.* 1829.

5. *Effect of muriatic and sulphuric acid on hydro-cyanic acid.* (Annales de Chimie, XL, 441.)—It is well known that hydro-cyanic acid may sometimes be preserved for years unaltered, and, at other times, changes and undergoes decomposition in eight or ten days after its preparation. Whilst searching for the causes which influenced the spontaneous change of the acid, M. Kuhlman examined into the action occasioned by mixing other acids with the hydro-cyanic compound. A mixture of muriatic and prussic acid being made and set aside, in twelve hours the bottle containing it was lined inside with yellow cubical crystals; some were less colored than others, and those formed after a longer interval of time were colorless. The fluid part remained limpid, but was diminished to one half. The experiment was repeated with recently prepared prussic acid, mixed with its bulk of muriatic acid. No yellow crystals were obtained, but a large quantity of colorless ones, similar to those last obtained with the former liquor. With the exception of the coloring matter of the first crystals, (apparently depending upon the smaller quantity of muriatic acid in that experiment,) they all appeared to consist of muriate of ammonia only. No gas was evolved by the mixture and action of the acid.

Equal parts of sulphuric and prussic acids were then mixed, though with some little difficulty. A slight elevation of temperature took place; after two days, no crystals were formed, no color produced, no gas evolved. Heat being then applied, a little prussic acid was volatilized, but that soon ceased; much inflammable gas, probably carburetted hydrogen, was formed, and the colorless liquid, on cooling, became a crystalline mass of transparent needles, easily recognized to be sulphate of ammonia.—*Quar. Jour. July to Sept.* 1829.

6. *Phosphorus in vacuo.*—The following experiment is mentioned by Berzelius as due to Van Bemmeleer: sprinkle a stick of phosphorus here and there with resin and sulphur, put it under the receiver of an air pump and exhaust: The phosphorus will become more luminous at the parts powdered than on the other parts, and ultimately inflame.—*Idem.*

7. *Combustibility of carbon increased by platina and copper.*—The following experiment is due to Woehler:—Rasped cork is to be heated in close vessels with ammonia, muriate of platina, or verdegris, when a charcoal will be obtained, which though it will not inflame spontaneously, does so if slightly heated, and then continues to burn of itself. The charcoal obtained from cork without these additions does not inflame at so low a temperature, nor continue to burn in small masses if once inflamed and left to itself. This effect is analogous to that discovered by Dobereiner, as belonging to platina; but as regards copper, a more curious one of the same nature is shewn very easily by a common green wax taper. These tapers are colored with verdigris, and when burnt, the copper of the verdegris is reduced for a time in the wick. If such a taper be lighted, and the flame then blown out, leaving the wick glowing, combustion of the wax will still proceed, slowly indeed, but for hours and days together, until the whole of the wax is burnt, or until the combustion has reached some part where it is extinguished by the neighboring bodies. This does not happen with white tapers, and hence they are safer for ordinary use.—*Idem.*

8. *Decomposition of sulphates in water by organic matters.* (Ann. de Chimie, XL, 433.)—M. Vogel has made some direct experiments on this subject, and has found that a very weak solution of sulphate of soda, and a saturated solution of sulphate of lime, mixed with sugar, gum arabic, glycyrrhezine, or an infusion of woad, and preserved for a long time in jars, away from the light have been decomposed; sulphuretted hydrogen, carbonic acid, and acetic acid were formed; the waters had a strong odor of sulphuretted hydrogen, and, being boiled, gave that substance mixed with carbonic acid.

These observations may explain the formation of a great number of hepatic mineral waters. M. Dumenil had already observed the presence of acetic acid in some mineral waters, and the observations have been confirmed by M. Vogel.—*Idem.*

9. *Instantaneous light apparatus.*—Amongst the different methods invented in latter times for obtaining a light instantly, ought certainly to be recorded that of Mr. Walker, chemist, Stockton, upon Tees. He supplies the purchaser with prepared matches, which are put up in tin boxes, but are not liable to change in the atmosphere, and also with a piece of fine glass-paper folded in two. Even a strong blow will not inflame the matches, because of the softness of the wood underneath, nor does rubbing upon wood or any common substance, produce any effect except that of spoiling the match; but when one is pinched between the folds of the glass paper, and suddenly drawn out, it is instantly inflamed. Mr. Walker does not make them for extensive sale, but only to supply the small demand that can be made personally to him.—*Idem.*

10. *Sympathetic Ink.*—A weak solution of nitrate of mercury forms a good sympathetic ink on paper. The characters become black by heat.—*Idem.*

11. *On a peculiar principle in blood, distinctive of its source.* (Ann. D'Hygienne publique.)—This principle has been remarked and described, and its utility in medical jurisprudence stated by M. Barruel. Whilst preparing the coloring matter of blood according to M. Vauquelin's process, the clot of ox blood was boiled, with a large excess of sulphuric acid of moderate strength; on which occasion a strong odor of beef was observed. Some time after, having occasion to operate upon the blood of a man who had taken opium, the fluid was first coagulated by heat, and divided; after which, it was boiled with weak sulphuric acid: immediately so strong an odor of the sweat of man was evolved, as to infect the whole laboratory, and render it necessary for the persons to leave the place. This and the former fact combined, induced M. Barruel to extend experiments on these subjects, and the following are the results.

I. The blood of each species of animal contains a principle peculiar to each. II. This principle, which is very volatile, has an odor resembling that of the sweat, or the cutaneous or pulmonary exhalation of the animal from which the blood was taken. III. In the blood this volatile principle is in a state of combination, its odor being then insensible. IV. When the combination is broken, this principle is volatilized, when it is easy to recognize the animal to which it belongs. V. In each species of animal, this principle is more decided, or has more intensity of odor in the male than in the female; and in men, the color of the hair accompanies certain variations in this principle. VI. This principle is in a soluble state in the blood, and may be found, therefore, either in the unaltered blood, or after the fibrine has been removed, or even in the serosity of blood. VII. Of all the means of setting this principle at liberty, concentrated sulphuric acid has succeeded best.

To obtain these results, it is only necessary to put a few drops of blood, or the serosity of blood, into a glass, to add concentrated sulphuric acid, to the amount of one third or half as much as of blood, and to stir the whole together with a tube: the odoriferous principle is immediately rendered evident. By these means, M. Barruel can readily distinguish the blood from the following sources.

I. That of a man disengages a strong odor of the perspiration of man, which it is impossible to confound with any other. II. That of a woman by a similar odor, much weaker, and resembling the perspiration of women. III. That of the ox, a strong odor of oxen or a cow-house, or of cow-dung. IV. That of the horse, by a strong odor of the perspiration of the horse or of horse-dung. V. That of a ewe, by a strong odor of wool, impregnated with the perspiration of that animal. VI. That of a wether, by an odor analogous to that of sheep, mixed with a strong odor of the goat. VII. That of the dog, the odor of the transpiration of a dog. VIII. That of a pig, by the disagreeable odor of a piggery. IX. That of a rat, by the bad odor belonging to the rat.

The same result has been obtained with the blood of various kinds of birds; and even with the blood of a frog, which gave the strong odor of marshy reeds, &c.; and with that of a carp, which gave a principal smelling like the mucus which covers the bodies of fresh water fish.

Upon trials made to ascertain whether spots of blood could be distinguished, and referred to their source, M. Barruel found, that to a certain extent, a pretty sure judgment could be given, even after fifteen days or more. The spotted linen is to be cut out, put into a watch glass, and being moistened with a little water, is to be left for a short time at rest. When well moistened, a little concentrated sulphuric acid is to be added, and stirred about with a tube; then by respiring near it, the odor may be perceived. M. Barruel is not sure that the distinction could be ascertained after more than fifteen days, and therefore recommends legal officers to allow of no delay in any intended experiments which have to bear upon cases of judicial investigation.—*Quarterly Journal, Jul.—Sep.* 1829.

12. *On the Formation of Acids in Vegetables*, by M. Vauquelin. (Ann. de Chimie, XLI, 59.)—I have thought that in a great number of cases, the developement of acids in vegetables was occasioned principally by the presence of alkalies. We find, in fact, the acids almost always neutralized altogether, or in part by various alkalies, as lime, potash, soda, magnesia, and sometimes by vegeto-alkalies; and I do not know that the latter have ever been found in a free state in the vegetable kingdom.

The alkali which plays the greatest part in this respect, is certainly lime, for it is most generally diffused, is most abundant at the surface of the earth; and powerfully attracts acids. It does not, certainly, enter into the organic kingdom in the state of lime, but as carbonate, which, without exerting any deleterious action on vegetables, still retains sufficient alkaline force to determine the formation of acids, and particularly the oxalic, which it prefers to all others.

We may thus, as I have said elsewhere, explain the effect of calcareous manures on vegetables. Immediately after its introduction into the organs of plants, the carbonate of lime determines the developement of an acid which decomposes it, and sets its carbonic acid at liberty, which by means of light, is turned to account in the vegetable kingdom. From hence, it may be concluded that calcareous manures fill two important functions; namely, the division of the soil, and the nutrition of the plants.—*Quar. Journal, Jul.—Sep.* 1829.

13. *Proportions of Oil in different Oleaginous Plants.* (Allgem. Hand. Zuitung.)—According to some experments of MM. Schubler and Bentsch on the oils of Germany, the following species of plants yielded per cent. of oil.

Filberts, - -	60.	Summer rape, -	30.
Garden cress,	56 to 58.	Woad, - -	30.
Olive, - -	50.	Camelina, - -	28.
Walnut, - -	50.	Hemp seed, - -	25.

Poppy, -	47 to 50.	Fir, - - -	24.
Almond, - -	46.	Linseed, - -	22.
Navew, - -	39.	Black mustard, -	18.
White mustard, -	36.	Heliotrope, - -	15.
Tobacco seed,	32 to 36.	Beech masts,	12 to 16.
Kernels of plums, -	33.	Grape stones,	10 to 11.

Idem.

14. *Coloring Matter of Lichen Rocella.* (Antolo 101.)—M. Robiquet having undertaken a diligent examination of the Lichen Rocella, from which a beautiful blue color, used in dying, is obtained, has discovered and separated from the other matter, the coloring principle of this vegetable. The new and singular product which he has obtained, has a very sweet flavor, is easily soluble in water, colorless, crystallizes in beautiful flat quadrangular prisms; by means of a moderate heat, it may be volatilized without decomposing, and does not acquire the coloring property till it has undergone successively the action of ammonia, and of common air.—*Idem.*

15. *Researches respecting Platina,* by M. Dobereiner. (Jahrb. du Chemie, No. 12.)—(*a.*) When chloride of platina is dissolved in about 300 parts of water, and the solution rendered sour with muriatic acid, if zinc, in a metallic state, be plunged into it, a powder is gradually precipitated, which chemists have always, but doubtless erroneously, (according to M. Dobereiner) considered as pure platina; for in a state of dryness, this body becomes warm, and assumes a brighter color, if it be exposed to the air and moistened with alcohol; lastly it becomes incandescent, particularly after having been treated with nitric acid, when (in contact with the air) it is exposed to a current of hydrogen gas.

(*b.*) When chloride of platina has been treated several times successively with absolute alcohol, at a mild heat, there is obtained at last a brown mass, which easily burns at a higher temperature, but, which dissolved, in a great quantity of alcohol, affords a liquid very fit for being laid upon a glass, so as to form platina mirrors. For this purpose, dip the glass in the alcoholic solution, so that this last may be uniformily diffused; then bring it to a red heat in the flame of a spirit lamp. The coat of platina thus produced, affords the brilliancy of a mirror, and adheres so well, that it is impossible to detach it. But if a mirror of this sort be dipped in water mixed with muriatic acid, and at the same time a plate of zinc be placed in the liquid, the whole coat of platina adhering to the glass dissolves, almost instantaneously.

(*c.*) The decomposition of the oxide of carbon, by the dry oxi-sulphuret of platina, has always been observed by M. Dobereiner, although others have doubted the fact. He has found, that from 12 to 15 grains of the oxi-sulphuret (obtained by exposing sulphuret of platina prepared in the humid way to the action of the air during several weeks) are sufficient to decarbonate a cubic inch of the carbonic oxide gas, and that there remains exactly, in this experiment, half a cubic inch of carbonic acid gas, which proves (says M. Dobereiner) that the oxide of carbon is composed of equal volumes of carbonic vapor, and carbonic acid gas,—the protocarbonated and deutocarbonated hydrogen act differently; they are absorbed in great part by the oxi-sulphuret of platina, and transformed into acetic acid, without any influence of atmospheric air.

(*d.*) The sub-oxide of platina affords an excellent method of discovering the presence of alcohol, dissolved either in atmospheric air, or in any liquid; even the quantity may be determined by means of it. Thus, putting a drop of alcohol into a vessel of the size of 3 or 4 cubic inches, and filled with dry air, and inserting into the vessel a few grains of the sub-oxide of platina on a small plate suspended by a platina wire, at the end of a few minutes it is observed that the whole interior surface of the vessel becomes moist, and that this moisture collects into small drops which make litmus paper red. This experiment succeeds well, particularly under the influence of light, and the sub-oxide becomes hot, although the acetic acid evaporates at the very moment of its formation. To determine the quantity of alcohol contained in a liquid, as in wine, beer, &c., a particular apparatus is to be employed, which communicates with a graduated glass jar filled with oxygen gas. In this apparatus, small quantities of the liquid containing alcohol are rendered acid in a few hours; and from the volume of oxygen consumed, the quantity of alcohol contained in the liquid subjected to experiment is calculated, (100 parts of absolute alcohol combine with 69.5 parts of oxygen to pass into the state of acetic acid.) M. Dobereiner promises ample details respecting his apparatus, to which he gives the name of *Acetogenator.*—*Idem.*

16. *Process for Preserving Milk, for any length of time.* Bull. des Sc. Agric.)—This process, invented by a Russian chemist named

Kircoff consists in evaporating new milk by a very gentle fire and very slowly, until it is reduced to a dry powder. This powder is to be kept in bottles carefully stopped. When it is to be employed, it is only necessary to dissolve the powder in a sufficient quantity of water. According to M. Kircoff, the milk does not by this process, lose any of its peculiar flavor.—*Idem.*

17. *Decomposition of carburet of sulphur, by weak electric action.*—Place in a tube some carburet of sulphur, and over it a solution of nitrate of copper which has a less specific gravity, and plunge a strip of copper in both fluids. This establishes a pile. The carburet is decomposed as well as a part of the nitrate; a large quantity of crystals of protoxide of copper is deposited on the strip, and of carbon on the sides of the tubes in thin plates of a metallic aspect.—*Acad. de sc.* 27 *Juillet.*

18. *Combinations of bromine, by* C. Löwig.—*Bromate and bromide of mercury.*—These two salts are easily obtained by mingling together oxide of mercury, bromine and water. Alcohol separates them dissolving very little of the bromate.

Bromide of Lead.—Minium digested with brome and water, produces bromide and the puce colored oxide of lead. By filtering the liquid, after warming it, the bromide crystallizes in splendid white needles. Its properties are similar to those of chloride of lead.

Bromate of silver is soluble in ammonia but not in nitric acid. It deflagrates on charcoal like saltpetre.

Bromate of potash.—A mixture of this salt with sulphur inflames by means of sulphuric acid, or by percussion.

Hydrate of brome is formed very easily at a temperature of 4° to 6° cent. by passing the vapor of brome into a tube moistened with water. In a quarter of an hour the tube is filled with the hydrate.

Bromide of potash.—Brome acts upon carbonate of potash exactly like chlorine. The compound destroys colors almost as promptly as chlorine, and the weak acids separate the bromine. Caustic potash acts differently; it forms instantly bromate of potash and bromide of potassium, and does not destroy colors.

Bromide of lime is obtained by adding bromine to an excess of cream of lime. The filtered liquid is yellow, and discolors in a high degree. Bromine and oxygen are disengaged by heat, and bromide of calcium remains. Acids disengage bromine. In a word, it has all the characters of chloride of lime.

Preparation of bromine.—The mother waters which contain it are reduced to a quarter of their volume in iron pots and left several days in repose, during which the greater part of the chloride of calcium crystallizes. The supernatant liquid, after dilution with water, is mixed with sulphuric acid as long as a precipitate ensues. The supernatant fluid is then decanted, and the residuum is subjected to pressure. All the fluids are united, evaporated to dryness, and the residue dissolved in order to separate a certain quantity of sulphate of lime. The bromine is obtained by treating the solution with sulphuric acid and peroxide of manganese.—*Ann. de Chim. Oct.* 1829.

19. *Preparation of bromine by M. Hermann from the mother water of the salt spring of Schönebeck.*—Twenty pounds of the mother water, much concentrated, are distilled with twenty pounds of sulphuric acid of a density about 1.520 the product is about fifteen pounds of hydrocloric acid. This product saturated with chalk, is decomposed by sulphate of soda. The liquid separated from the sulphate of lime, is concentrated, and the supernatant mother water is treated with sulphuric acid and peroxide of manganese. *Nothing but chlorine is disengaged.*

The fluid remaining in the retort, after the distillation of the hydrocloric acid, and which contained a great excess of sulphuric acid, is saturated with carbonate of magnesia, and the magnesian salt thus formed is separated by crystallization. The remaining mother water, treated like the preceding, *gives immediately a considerable quantity of bromine.*—*Idem.*

20. *Preparation of ioduret of azote*, by M. Serullas.—Saturate alcohol at 33° with iodine, filtering or decanting to separate some impurities, which are always present, and adding liquid ammonia in great excess, stirring the mixture with a tube. Dilute with water, and by repose the ioduret is deposited, so that with care the liquid can be decanted off to the last portion. Wash the remainder well with water and the ioduret remains in the form of a fine powder. The washing by decantation is most convenient, but it is sometimes necessary to finish with the filter, because the ioduret being extremely divided, a portion of it is very slowly deposited.

This modification of the process is considered as stated by the author to be incomparably superior to the ordinary, especially as it may be stirred and washed thoroughly under water without fear of detonation. The pressure even of a tube, which in the common way so easily causes detonation, is in this case, safe.

Iodine precipitated from its alcoholic solution by water, placed in contact with liquid ammonia, gives an ioduret, which, like that made with iodine in powder detonates under water with the slightest friction.

It is said that no gas is disengaged in the preparation of the ioduret of azote; but the contrary will be evident by mixing, either the alcoholic solution, or iodine in powder with liquid ammonia, in a tube closed at one end and inverted in a capsule of water. Bubbles of gas extremely fine immediately arise and increase in the upper part of the tube.—*Idem.*

21. *Chloride of nitrogen.*—The method of M. Serullas of preparing this dangerous compound, does not differ from that usually prescribed. Nevertheless, he states, that notable differences have been observed in the products which it gives when in contact with water only, or, at the same time with bodies which have no action on that fluid. The substance having been prepared with chlorine and a solution of one part hydrochlorate of ammonia, in eighteen of water, was well washed with pure water, and being exposed under water it disappeared in twenty four hours.

Caustic potash disengaged azote and formed nitrate and hydroclorate of potash.

Sulphuret of carbon mingled with it, slowly disengages azote, forming hydrocloric and sulphuric acid and ammonia.

Selenium produces an explosion as violent as phosphorus.

Arsenic in powder detonates as violently with great light.

Oxide of arsenic produces a quiet decomposition.

Nitrate of silver acts promtly but quietly.

Oxide of silver—and the oxides of copper, cobalt and lead produce decomposition with disengagement of azote.—*Idem.*

22. *The fulminating silver* first obtained by Berthollet by bringing into contact oxide of silver and ammonia, has been regarded by some chemists as an *ammoniuret* of the oxide and by others as an *azoturet* of metallic silver.

The analogy between this compound and the chloride and iodide of nitrogen leaves but little doubt of its being a compound of nitrogen and silver. When the fulminating silver is placed under dilute sulphuric acid, nitrogen is disengaged, but the greater part is transformed into sulphate of silver and sulphate of ammonia. But the disengagement of nitrogen cannot proceed from the decomposition of ammonia, under the influence of this acid.—*Ibid.*

23. *Percussion powder.*—Gunpowder made of chlorate of potash, sulphur and charcoal is much stronger than that made of saltpetre. Welter filled small bombs with this powder, buried them in the ground, and then caused them to explode. They were constantly broken into pieces of the size of a horse chesnut, while those exploded with common gunpowder, under circumstances precisely similar, were broken into much larger pieces. As a material for priming to be fired by percussion or otherwise, this powder has serious inconveniences. It soils and corrodes the lock very rapidly, a defect which cannot be easily remedied, and the use of it is very much abandoned.

A preference is therefore given to a powder composed of ten parts of fulminating mercury and six of common priming powder. The fulminate is ground upon a marble slab with a wooden muller after having been moistened with thirty per cent of water; six parts of common powder are then added, and the grinding continued. A firm paste is thus attained, which being properly dried, is divided into grains, one of which is sufficient for a priming.—*Ann. de Chimie, Sept.* 1829.

MEDICAL CHEMISTRY.

1. *Decomposition of sulphates in waters, by organic substances.*—M. Vogel has made some direct experiments on this subject and has found that a very weak solution of sulphate of soda, and a saturated solution of sulphate of lime, mixed with sugar, with gum arabic, with liquorice, or with an infusion of woad, and kept a long time in pitchers, sheltered from the light, were decomposed; that sulphuretted hydrogen, carbonic acid, and acetic acid were formed; that the mixture acquired a strong smell, and when heated to ebullition, emitted sulphuretted hydrogen and carbonic acid.

This observation may explain the formation of a great number of hepatic waters. M. Dumenil had before observed acid in some mineral waters, and M. Vogel has confirmed this observation.—*Idem.*

2. *Poisonous confectionary.*—M. Bairreal, a chemical agent to the faculty of sciences, examined the nature of the fine green color of the surface of sugar plums manufactured at one of the best confectionaries in Paris, and ascertained that the coloring substance was arsenite of copper, or schwanfurth green. In consequence of this enquiry the authorities interposed, and it having appeared also that the yellow preparations were colored by chromate of lead, the sale of these *bonbons* was strictly forbidden.

On the first of January 1829, the wife and children of a gentleman in Paris were seized with illness after eating a few bonbons callc *pâte de pistache* of a pistachia green color. Dr. Hennel having demanded of the confectioner with what substance he colored these articles, was answered with blue and gamboge. On analysis however the coloring matter proved to be indigo and chromate of lead.

A quantity of the green sugar plums were after the prohibition in Paris, introduced there from Germany, and proved to have been colored with arsenite of copper.

It is obvious therefore that parents cannot be too much on their guard against suffering their children to buy and eat these colored sugars. The college of health in France has taken measures to prevent their preparation and sale.—*Annales d'Hygiène publique et de Medecine Legale, Juillet*, 1829.

3. *Memoir on hydro-cyanic acid, by M. Orfila.*—This valuable memoir commences by remarking that the medico-legal history of this very active poison, had not yet obtained the desired degree of perfection. Neither the manner of detecting its presence when mingled with the contents of the digestive canal, or with alimentary substances, syrups, &c. nor the various symptoms which ensue when it is taken into the system, nor the changes produced by it in the organs, have been well defined; the proper treatment or mode of cure has been much more successfully laid down. 1st. *Characters by which this acid may be recognized.*

Its most distinctive character is smell, which is at first fresh then sharp and irritating, very strong, insupportable, and analogous to bitter almonds. This odor may be distinctly perceived in a fluid so weak as not be detected by the most sensible reagent.

The most delicate test is nitrate of silver, which throws down a curdy white precipitate of cyanuret of silver, insoluble in nitric acid at common temperatures, but easily soluble at boiling, and in ammonia. If the acid be contained in syrups or other highly colored fluids, it is recommended to add two or three drops of a solution of potash to a small portion of the fluid and place in it a strip of unsized paper, which after a few minutes will acquire a reddish yellow color; dry it in the air, and then touch it with a solution of trito-sulphate of iron, when all the parts touched will become of a greeenish blue.

With respect to the hydro-cyanic syrup, it is enough to dilute it with distilled water, and to add nitrate of silver in excess; all the hydro-cyanic acid will be precipitated, without the addition of any foreign matter to the cyanuret of silver.

The hydro-cyanic syrup of the French Codex, composed of nine parts of syrup of sugar, and one of the medicinal acid of .9 is an excessively strong medicament, which should be administered only in drops; for a dose of two or three grs. occasions the death of the most robust man in from twenty to forty minutes.

The means hitherto employed to combat the effects of this poison are, principally, the following: ammonia, concentrated infusion of coffee, spirits of turpentine, bleeding, affusion of cold water, and chlorine. These several methods were carefully tested by direct and repeated experiments upon dogs, and the result is that not much confidence can be placed in any of them except chlorine. This remedy proved surprisingly efficacious. It was first tried as a prevention against the vapors of the an-hydrous acid in the hospital of St. Louis by M. Simeon, the apothecary of that establishment in the month of April last. Finding that gaseous chlorine counteracted the unpleasant effect of the hydro-cyanic vapors, he put two drops of the liquid acid prepared by Vauquelin's method, on the conjunctiva of a cat, which in a few seconds produced all the symptoms of a fatal poison. After a minute and a half, a weak solution of chlorine, was presented to the nose of the animal, which appeared at first to produce no effect, but, two minutes after, the cat, which seemed not to have breathed till then, made a deep respiration, the pulsations of the heart became stronger and more regular, he opened his mouth, and put out his tongue as if to seek the chlorine.

In three fourths of an hour his restoration was still doubtful, although the chlorine was constantly applied to his nostrils and the surrounding parts bathed with it. In half an hour more, he was able to stand upright and take a few steps. In the course of six hours from the commencement, his walk was easy and he appeared to be perfectly recovered, except a slight trembling which did not cease under twenty four hours.

Similar experiments were afterwards performed on dogs, some of them young and others old and robust. The application was decisive even after the animal had become insensible, and the remedy had been delayed four and five minutes after the invasion of the symptoms, and to such an extent as to render death otherwise inevitable. The chlorine was applied in solution, and the animal appeared to breathe it with avidity.

The affusion of cold water on the head and neck, appeared evidently in some cases to have a good effect, and where chlorine is not at hand, it should be faithfully tried.

M. Orfila recommends that in case of poisoning by this acid taken into the stomach, a strong emetic be immediately administered—or if there is reason to believe, from the length of time that the poison has passed the pylorus, a purgative enema; and without delay place under the patients nose a vessel containing one part of strong liquid chlorine, and four parts of water; or, in defect of chlorine, one part of aqua ammoniæ, and twelve of water. The breathing of these gases, and especially of the first, must be insisted on with slight intervals. At the same time, water as cold as possible should be poured on the head and neck and along the spine. A vessel filled with ice should be placed on the head, and kept there until the symptoms disappear. Bleeding in the jugular or in the arm, or leeches behind the ears will be indicated by symptoms of cerebral congestion, although it was found bleedings alone were insufficient to restore the patient. These remedies may be simultaneously applied, and if in due season, a cure may be almost certainly effected. It may not be amiss, also, to rub the temples with tincture of cantharides and ammonia, and to apply sinapisms to the feet. The patient should have also assuaging drinks.

It may not be useless to remark that the foregoing method of treatment, may probably be employed with advantage in cases of poisoning from other venomous substances. This the author proposes to investigate.—*Idem.*

4. *Efficacy of Chlorides.—Extract of a letter from M. D'Arcet, fils, member of the medical commission sent to Egypt.*—The chlorides tried upon forty seven persons affected with the plague, did neither good nor harm; but these preparations completely preserved the six members of the commission. The autopsies were by this means performed without accident. Clothes taken from persons who had died of the plague the preceding day, were purified by the

chloride of soda, dried in the sun and worn during nineteen consecutive hours by the six members of the commission in presence of the French consul, without any unfavorable result whatever. We were able to employ solutions of the chloride so weak, (half a degree by the chlorometre of Gay-Lussac,) that they had no sensible discoloring effect upon the garments subjected to their action. The chloride of lime was compared in effect with the chloride of soda. The Turks, seeing the commission visiting the sick, feeling their pulse and putting on their clothes without fear and without danger, did not hesitate to solicit chloride of lime for their own use. At the departure of the last letter, there were dying fifteen or twenty men of the plague daily at Tripoli. M. Pariset exceedingly well satisfied with the results he had obtained, addressed a report to the minister, and repaired to the Lazaretto at the foot of Libanus, there to study the leprosy. —*Ann. D'Hygiène, pub. Oct.* 1829.

5. *Deleterious effects of sulphuretted hydrogen.*—It would appear, from various experiments, that the deleterious tendency of this gas has been overrated. Dupuytren states that $\frac{1}{800}$ part of this air killed a bird, and that it was necessary to reduce the proportion to $\frac{1}{1000}$ to prevent death, and that even that quantity embarrassed respiration.

Dogs were killed by one part in 299 of atmospheric air; and according to Chaussier, $\frac{1}{250}$ will kill the strongest horse. At this rate, $\frac{1}{265}$ ought to be sufficient to take the life of a man; but in cleansing the sewers in Paris, it has been found by accurate observation, that the men could work without inconvenience in an atmosphere containing one part of sulphuretted hydrogen in 100 of common air, and that they constantly breathed from 25 to 90 thousandths of this gas.

A dog, of middle size, was thrown into the Amelot sewer, where he remained more than a week, accompanying the men when at work in cleaning it, and frequently scratching the mud; and it was proved that the air of the sewer, at this time, must have contained at least one per cent. of sulphuretted hydrogen. The analysis of able chemists has shewn that the quantity of this gas which is constantly found in sewers, exceeds the proportion which, in the experiments of Dupuytren, produced asphyxia in animals of a medium size. A case is cited in confirmation of this conclusion. A cat having been shut up in a laboratory several days without food, became so furious that it was found necessary to destroy her. For this purpose a vial containing sulphuret of antimony and muriatic acid was fastened to a stick, and the opening held to the cat's mouth. In this manner she breathed an enormous quantity of the gas, and though convulsed by it so as to occasion her to spring up and rebound violently, they were unable to kill the animal, until by scattering the antimonial powder around her and sprinkling it with the acid, she was surrounded with an atmosphere of the gas. This destroyed her in about twelve or fourteen minutes. It would therefore be rendering a service to science and humanity to examine anew the real action of sulphuretted hydrogen, breathed in variable proportions.—*Idem.*

6. *Cleansing of Sewers.*—In a valuable paper, containing an elaborate description of the method pursued under the direction of a commission of able chemists appointed by the police of Paris, it is stated that the most important advantages were derived from the use of chloride of lime as a counteracting agent. The most efficacious mode of employing it was found to be the scattering of hay through different parts of the sewer, and sprinkling the chloride of lime upon it. It was gradually dissolved in the moisture, and diffused its antiseptic qualities through the atmosphere of the sewer.—*Idem.*

7. *Chlorine.*—Several physicians in Paris have been engaged in the administration of chlorine as a remedy in phthisis. Dr. Cottereau has contrived an apparatus, by which, and a small lamp and thermometer which accompany it, the patient is enabled to separate the gas from an aqueous solution of chlorine, at a given temperature, so cautiously that the drops of the solution may be counted, and the tube through which the chlorine is breathed, shut so as not to lose an atom. A report on this subject by *Magendie* and *Dumeril,* was read to the Academy in August last, in which they notice the complete cure of a student of medicine, named Piau, twenty-six years of age. The report commends the apparatus of Dr. Cottereau, but admits that before the efficacy of the new remedy can be considered indubitable, many other analogous facts must be produced.—*Reports of the Institute for August.*

8. *Hydriodic Ether,* by M. Serullas.—Hydriodic ether, for the discovery of which we are indebted to Gay-Lussac, being, like all other combinations of iodine, susceptible of some useful applications in medicine, and perhaps (considering the particular state in which the iodine is found) preferably to any other, I have thought it would not be useless to make known a second modification which I have

introduced in the preparation of this ether. The process is similar to that which I pointed out to obtain hydrobromic ether; only I have since observed that the proportion of phosphorus was too great, and that it ought to be diminished one half.

Introduce into a small retort by its tubulure,

Iodine,	- - - - -	40 grammes,
Alcohol, at 38°	- - -	100 "

Project, in small fragments, agitating the mass,

Phosphorus,	- - -	2.5 grs.

which makes 1 part of phosphorus to 16 of iodine.

Distil by ebullition almost to dryness (jusque à la fin); stop the process, and add from 25 to 30 grammes of alcohol, and continue the distillation to the same point.

The ether separates from the water of the distilled product, sinking to the bottom. It must be washed as usual, and re-distilled from a few fragments of chloride of calcium.—*Ann. de Chim. Oct.* 1829.

10. *Analysis of Bile*, by Henry Braconnot.—From the uncertainty which still hangs over the composition of this fluid, so important in the animal economy, this able chemist has been induced to examine afresh, the matter which constitutes the essential portion of ox-bile, viz. the picromel. His memoir, which occupies twelve pages of the Annales, furnishes the following results.

1. That bile is a true soap, as the ancient physicians had determined.

2. That the picromel of the ox contains:

1. A peculiar acid resin, which forms the greater portion of it.
2. Margarique acid.
3. Oleic acid.
4. An animal matter.
5. A very bitter substance, of an alkaline nature.
6. A colorless saccharine principle, which becomes purple, violet and blue, by sulphuric acid.
7. A coloring substance.—Nancy, 17th Oct. 1829.—*Idem.*

NATURAL HISTORY.

1. *Analysis of the Russian Platina*, by J. J. Berzelius.—The platineferous sand contains, often, besides the little scales of metallic iron discovered by M. Osann, alloy of iron and platina, which is not only attracted by the magnet, but even possesses polarity. These

have a different composition from the non-magnetic grains. They are separable by the magnet.

Minerals from the Oural.

1. *Nischne Tagilsk.*—This ore of platina has an obscure grey color, and contains many magnetic grains, some of which possess polarity, and the largest of them, to such an extent as to raise small fragments of steel wire.

I have analyzed the magnetic grains separately from the non-magnetic. The results of some of these analyses do not entirely agree; yet the difference is so small as to prove that the two varieties possess a peculiar and constant composition. I shall cite but one of these analyses, selecting that which I deem most accurate.

	Grains non-magnetic.	Grains magnetic.
Platina,	78.94	73.58
Iridium,	4.97	2.35
Rhodium,	0.86	1.15
Palladium,	.28	0.30
Iron,	11.04	12.98
Copper,	0.70	5.20
Osmiuret of iridium in grains,	1.00	
" " in scales,	.96	
Insoluble matters,		2.30
	98.75	97.86

2. *Goroblagodat.*—This ore is entirely non-magnetic, and is remarkable for containing no iridium. I ought to remark, however, that I found a trace of it in one specimen; and there may be found here and there, though rarely, grains containing iridium.

Platina,	86.50
Rhodium,	1.15
Palladium,	1.10
Copper,	.45
Iron,	8.32
Osmiuret of iridium,	1.40
	98.92

In these three analyses a part of the loss consists in osmium, which distils during the acid solution. I have however thought best to give only an approximated estimate of its quantity, as the experiments with respect to osmium constituted the last portion of my work.

Analysis of an ore of platina from Barbacoas in the province of Antioquia de la Columbia.

This ore consists of grains which often weigh more than a drachm, intermingled with those which are smaller. The largest grains I found to be composed as follows:—

Platina,	84.30
Rhodium,	3.46
Iridium,	1.46
Palladium,	1.06
Osmium,	1.03
Copper,	.74
Iron,	5.31
Quartz,	.60
Lime,	.12
	98.08

Ann. de Chim. Avr. 1829.

2. *On the Silicate of Iron, of Badenmais*, by Prof. Kobell, of Munich. (Annalen de Physik.)—This mineral, reduced to very fine powder, is attacked by hydro-chloric acid.

20 parts gave the following results:—

Silica,	6.12
Protoxide of iron,	10.32
Sulphur,	.18
Water,	3.74
	20.36

As it is found with pyrites, the sulphur doubtless arises from a slight mixture of these latter. In making the needful deduction and attending to the increase of weight, we have—

Silica,	31.18—containing oxygen,	16.25
Peroxide of iron,	50.86	15.59
Water,	19.12	16.99
	101.26	

This mineral may therefore be regarded as a silicate of hydrate of iron.—*Idem.*

3. *On a new mineral, Hydro-carbon.*—A combustible substance has been found by Colonel Scherer in the interstices of lignite or

fossil wood, discovered near Urnach, in the canton of St. Gall; and being given to M. Macaire Prinsep, he has examined and published an account of it. It occurs in small white, or yellowish white acicular crystals, between the fibres of the fossil wood, or else in translucent layers, having a nacreous lustre, no taste or smell, and a specific gravity of about 0.65.*

Heated, it fuses, and remains liquid when cooled, until touched, when it suddenly crystallizes. It melts at 112° F., distils at 194° F. and condenses unaltered. It sinks in alcohol at 40°, (s. g. .867?) dissolving only slowly, unless heat be applied. It dissolves in ether and oil of turpentine, not in water or alkaline solutions. It differs from naphthaline in being more fusible, more volatile; in the form of its distilled product, which, with naphthaline, is frequently that of rhomboidal plates; in its inferior solubility in alcohol, and also as it appears in composition.

M. Macaire Prinsep analyzed both naphthaline and the substance, by the use of peroxide of copper; but appears to have doubts, not of the principle of the process, but of his results. However, he makes out naphthaline to consist nearly of 86 carbon, and 13.8 hydrogen; this is almost equal to single proportionals of each, or 6, and 1 by weight, which is the composition of olefiant gas; but both Ure and Thomson make out far less of hydrogen.

The new fossil is, according to M. Macaire Prinsep, composed of 73 carbon, and 24 hydrogen, or nearly of one proportional of carbon to two of hydrogen; 6 : 2 by weight. This is the same composition as the light hydro-carbon. (Bull. Univ. xl. 68.)

If the latter estimate be at all near the truth, then it would be exceedingly interesting to know the specific gravity of its vapor, for comparison with light hydro-carbon; and also the kind of flame which is produced when the vapor of the substance is burnt from a jet. No indication of the appearance of the flame, whether pale, bright, or smoky, is given.—*Ed. Quar. Journal*, No. x. 431.

4. *Means employed by the spider in weaving its web.*—We find, in the introduction to Entomology by Kirby and Spence, a very curious description of the means employed by spiders in warping their webs. The author, after having described the four little spiders, as

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* There must be some mistake here, for afterwards it is said to sink in alcohol.

they call them, which produce a visible silk, explains the procedure of this little insect, whose work he compares to the spinning wheel of the rope maker. Each spider is pierced with an infinite number of holes, like the drawing plate of a gold wire drawer, and these holes are so small and tight, that the space which a pin would occupy would contain more than a thousand such. From each of these issues a thread of inconceivable fineness, which instantly unites with the others to form but one. The four spiders each making their thread in the same manner and in the same time, the result is that there are four threads alike, which, at the distance of about a tenth of an inch, reunite also to form the silk that we are accustomed to see, and which the spider makes use of to spin her web. Thus the thread of a spider drawn by the smallest species, and so delicate that the eye can scarcely perceive it, is not, as is generally thought, a single thread, but in reality a cord which contains not less than four thousand of them.

But to understand perfectly this wonder of nature, it is necessary to follow the calculations made by the learned Leuwenhoeck, agreeably to his microscopic observations. He has found that the thread of the smallest spider, of which some are not as large as a grain of sand, were of such a fineness that it would be necessary to unite more than four millions to form the thickness of a hair. Now we know that each one of this series is already composed of four thousand threads; it follows then that sixteen million of these threads, drawn by the little spider, have not together the thickness of a hair.—*Jour. de Con. Usuel. VIII*, 9.

5. *Phosphorescence of sea water.* (Jahrbuch der Chemie.)—M. Pfaff, in a work on the coloring principle of the water of the Baltic Sea, makes incidentally some remarks on the phosphorescence which it presents, principally at the close of summer and in the autumn until the month of November. He confirms, by a series of observations, the opinion that this phenomenon is owing to the presence of microscopic animals, and chiefly of the *infusoria*. He remarks that if an electric current be passed through a tube filled with sea water recently drawn, there is immediately perceptible in it a multitude of brilliant points, continually in motion, and which are visible only for a few moments. In general, all the experiments prove that these microscopic animals produce the light which is peculiar to them, when they are agitated in contact with stimulants, such as ammonia, acids,

ether and alcohol. It is observed also that a mechanical pressure upon the water produces the same effect, and that this phosphorescence is rarely perceived in calm water.—*Bib. Univ. Juin*, 1828.

6. *Analysis of a new mineral, from Hoboken*, by M. Wachmeister. (An. de Pog. 1828, p. 521.)—There has been found in the serpentine of Hoboken, state of New York, [New Jersey,] in the United States, with the carbonate of magnesia, a white powder, which has been taken for hydrate of magnesia. This mineral is composed of

Magnesia, - - - -	.4241
Carbonic acid, - - - -	.3682
Water, - - - - -	.1853
Silica, oxide of iron, &c. - - -	.0223

Its formula is $MqAq^3 + 3MqC^2$.—*Jour. des Mines, T.* V. *p.* 309.

7. *Temperature of the atmosphere and of plants, &c.*—Dr. J. Guèrin, of Avignon, in France, has ascertained, by a great number of observations, made at various seasons on Mount Ventoux, a conical and isolated mountain, whose summit is one thousand toises above the sea, that in the latitude of 44° and at an elevation of one thousand toises, the temperature of the atmosphere decreases one degree (centigrade) in summer for every eighty toises in elevation, and one degree in winter for every one hundred toises, and in the intermediate seasons one degree in ninety toises.

As a proof of the cold produced in solid substances by radiation, in a clear atmosphere, Dr. Guèrin has ascertained by nice observation, that the temperature of trees and plants is very often much inferior to that of the air. On the 24th of January, 1827, at 7 A. M. the air being -11.3 (C.) the snow adhering to the branches of a cypress and other plants and shrubs, was -14.5 and 15, that is to say, 3.5 lower than the air. On the 1st of April, 1828, the trees and flowers were -2.5 and the air $+1.5$ (C.)

The mean temperature of Avignon, obtained by twenty seven years observation, is 14.38 (C) = 57.88 Far. The height of the barometer, from a mean of twenty years is seven hundred and sixty two millimetres. The annual quantity of rain, from a mean of twenty years, is 20 in. French, 3.8 litres.

The friends of meteorology must wish to obtain, from the different countries of the globe, data as complete as those furnished by Dr. Guèrin relative to the country which he inhabits.—*Bib. Univ. Juillet*, 1829.

8. *Helvetic Society of Natural Sciences.*—The fifteenth session of this patriotic and useful society was held in the month of July last, at the Hospital of the Great St. Bernard. An account of this interesting session has been given by Professor A. De La Rive, from which we extract the following. The monks of St. Bernard having offered their convents, at the last meeting of the society, as the place of the annual meeting in 1829, the offer was gratefully accepted, and letters were in consequence addressed to the different members, inviting them to meet at Martigny on the 19th of July. This call was answered from all parts of Switzerland, and on the 19th, Martigny witnessed the assemblage of compatriots all bending their course to one point,—friends happy in meeting each other, and strangers, ambitious to be present at this society, particularly interesting in the present year, both on account of its objects and of the place of its meeting. Every thing which could facilitate the ascent of the mountain, had been timely and carefully provided by the Valaisans;—mules, guides, stations, prepared, &c. in a word, the society was transported *en masse*, without accident and with the greatest facility to a height of near 1300 toises; and held its session in the midst of eternal snows, and surrounded by rocks rising from the surrounding Alps which bordered the horizon on all sides.

We shall not attempt to describe the reception which awaited the travellers at the summit of the Great St. Bernard: the cares of the most attentive hospitality had been taken in the preparations, and we could not say too much relative to the various precautions and the kind and cordial reception, by which the monks endeavored to make us forget the austerity of the climate into which we found ourselves so suddenly transported. It had snowed a little on the nights of the 19th and 20th, but the weather had somewhat relaxed; nevertheless it was cold, and the thermometer descended below 0 on the night of the 20th and 21st. It was at 3° above on the day of the 21st, and on the 22d it ascended to 7°. Add to this low temperature a violent and uninterrupted north wind, an atmosphere so rarefied that the barometer hardly stood at twenty one inches, and an idea may be formed of the sojourn at Saint Bernard in the middle of summer, and of what must be the rigor of other seasons with their ice, snows and avalanches. What religious devotion, what profound humanity must be necessary to induce men to live in such a climate, especially when another so different exists a few leagues from them. And yet with what simplicity and cheerfulness do they appear to devote themselves to such a duty.

The remarkable situation of the place in which we found ourselves was eminently favorable to the lovers of the natural sciences; and the intervals of the sessions, and of the meals which were taken in common, were employed in numerous excursions, sometimes scientific, sometimes simply picturesque; and the meeting, this year, will probably not be one to which the society will be the least indebted, as it will certainly be that which will leave the deepest impression on those who attended it.

The sittings were on the 21st, 22d and 23d of July. About one hundred persons, including the candidates and a few strangers, were present; among the latter of whom we remarked M M. Leopold de Buch, Bouvard, of the Academy of Sciences, Paris, and Michaud, of the Royal Society of Agriculture of the same city.

The Chanoine Biselx, curate of Vauvry, Vice president, presided, and in an excellent discourse, expressed to the members, the cordiality and pleasure which the monks of Saint Bernard experienced in receiving and entertaining the society. He gave a brief history of this celebrated hospital which has existed ever since the 11th century, has been built three times, burnt twice, and having lost all its estates, it is only within the last century that it has been indebted for its restoration to the generosity of its neighbors, and especially of the Swiss Cantons. In the fire of 1555, it lost all its titles and ancient records. The president gave an account of the late ameliorations in the hospital, both by the construction of calorifères, (heaters,) which have succeeded very well, and by the erection of another story just finished, and by which it was enabled to entertain the Helvetic Society. It was M. Parrot de Dorpat who first suggested the idea of a European subscription for the benefit of the Hospital, which was warmly seconded by the late Professor Pictet, whose absence is so deeply deplored by the Helvetic Society at all its meetings, and more particularly on this day. The government of Le Vallais has given six hundred francs to the Helvetic Society, and a society of natural history has been formed in that Canton, making the eleventh society of this kind in the Swiss Cantons. In 1815, only three of these societies were in existence, and those in a languishing condition.

Such have been the happy influences of the Helvetic Society. The *proces-verbal* of the Cantonial institutions is read at the annual meeting of the Helvetic Society, and from that they are all occupied in the active cultivation of the natural sciences.

Among the brief notices of the transactions of the Helvetic Society at this meeting, are the following :—Mr. Baup of Vevey announces that a great number of experiments have proved to him that the weights of the atoms of simple bodies are exact multiples of each other; a law which has been announced hitherto only in a hypothetical manner and without being verified by facts. He promises on this subject a detailed memoir.

Prof. Gautier gave the society some details of a new observatory about to be constructed at Geneva, the plans of which he presented.

Prof. A. De La Rive of Geneva, stated the result of some researches he had made with Prof. Gautier on the inclination of the magnetic needle at Geneva and at St. Bernard by means of a dipping needle of Gambey. Allowing for the difference of latitude the inclination is proved to be less at the Convent than at Geneva.

The radiation of terrestrial heat is much more intense at St. Bernard than at Geneva, but the atmospheric electricity is there almost nothing.—*Idem.*

9. *Determination of the time which a drowned person has been under water.*—As the means of ascertaining, very nearly, the time which a dead body has been under water may prove in some cases to be important in a judicial investigation, M. Alph. Devergie was authorized by the prefect of Paris to observe and open the subjects deposited at the Morgue, a place to which all bodies are brought that have died by unknown means, or which are found in the public places of that city or in its neighborhood. The number annually brought there is about three hundred.

After much investigation M. A. Devergie assigns the following characters as the means of deciding the length of time the body has been submerged, supposing the weather to have been cold.

1. From three to five days.—Rigidity of the corps, coldness: no contraction of the muscles by electrical stimulus; the epidermis of the hands beginning to whiten.

2. From four to eight days.—Suppleness of all the parts; no contraction from electricity; color of the skin natural; epidermis of the palms of the hands very white.

3. From eight to twelve days.—Flaccidity of all the parts; epidermis of the backs of the hands beginning to whiten; face softened and presenting a wan appearance, different from that of the skin of the other parts of the body.

4. About fifteen days.—Face slightly swelled, red spots; greenish tint of the middle of the sternum; epidermis of the hands and feet totally white and beginning to fold.

5. About one month.—Face red, brownish, eyelids and lips green; breast reddish brown, and greenish in front, epidermis of the hands and feet white, loosened and folded as if by poultices.

6. About two months.—Face generally brownish and swelled; hair rather loose, epidermis of the hands and feet in a great degree detached; nails still adherent.

7. Two months and a half.—Epidermis and nails of the hands detached; epidermis of the feet detached, nails still adherent; in females, redness of the subcutaneous cellular tissue of the neck, of that which surrounds the trachea and organs in the cavity of the breast; partial saponification of the cheeks of the chin; superficies of the breasts, groin, and anterior part of the thighs.

8. Three months and a half.—Destruction of part of the scalp, eyelids, nose; partial saponification of the face, superior part of the neck and groins; corrosion and destruction of the skin on various parts of the body, epidermis of the hands and feet completely removed; nails gone.

9. Four months and a half.—Almost total saponification of the fat of the face, neck, groins, front of the thighs; commencement of a calcareous incrustation upon the thighs, and a saponification of the anterior part of the brain; most of the skin opaline; loosening and destruction of almost the whole of the scalp; scull bare, beginning to be very friable.—*Annales d'Hygiene publique, Oct.* 1829.

MECHANICAL PHILOSOPHY.

1. *Magnetic influence of the Violet Ray.*—The power of the violet portion of the solar spectrum to convert a steel needle into a permanent magnet seemed to have been well established by Prof. Morichini in 1812, and confirmed by Mrs. Somerville in 1826. But other philosophers having failed to obtain results which they deemed satisfactory, some doubts appear to have prevailed with respect to the certainty of such an influence in the violet ray. Prof. Zantedeschi, of Pavia, in an article communicated to the Bib. Univ. of Geneva, states, that having placed the extremity of a well polished soft iron wire four inches long, and one fourth of a line in diameter, to the violet spectrum, kept in its place in a dark chamber by a Heliostat,

he found that in the course of five minutes, the wire when presented to a magnetic needle, manifested very decidedly the existence of poles.

The violet ray changed or reversed a well marked pole in a soft iron needle.

The red, yellow, orange and green ray produced no alteration whatever in a magnetic needle, nor in one which had no sensible magnetism.

A soft iron wire, covered with a coat of oxide, and strongly magnetized, exposed to the violet light, in three minutes, had its south pole transformed to a north pole.

A soft wire, magnetized, being bent, and both ends exposed to the violet ray, in ten minutes, both ends became north.

If the wire was oxidized, this change was effected in five minutes.

These experiments were so often repeated as to leave no doubt of the magnetizing property of the violet ray.

In the course of his investigations, Prof. Z. ascertained that iron obtained from a sulphurous mine, could not be thus magnetized, nor was it easy to produce much effect upon iron highly tempered.

At low temperatures, also, such as 6° R. 0, + 10°, the results are very equivocal. But at + 20°, Centig. the temperature of Mrs. Somerville, or at 25° or 26°, R. that of Prof. Z. the results are very striking.

If the middle of the needle be placed in the violet ray, the effects are weak or uncertain.

Perceiving that the carburets* could acquire magnetism and not the sulphurets*—that needles artificially oxidized, presented the phenomenon in question more promptly than those which are not so, and that the effect increases or diminishes with the temperature, Prof. Z. is confirmed in the opinion that the action of the violet ray is chemical. The light of a candle gave him, in three fourths of an hour, a slight degree of magnetism, but the violet light of the moon had no effect. The latter was tried, however, at a temperature not exceeding 5°, R.

Prof. Z. finds his needles retaining their magnetism, at the end of eight months.—*Bib. Univ. Mai*, 1829.

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* Of iron.—*Ed.*

2. *Iron Works of Sweden.*—The account of exportation of iron from Sweden during the year 1828, in tons of 1000 kilo-grammes each, (2200 lbs.) was as follows :—

United States, - - -	9.409 tons.
Germany, - - - -	6.676
Great Britain, - - -	5.753
France, - - - -	5.096
Portugal, - - - -	3.200
Denmark, - - - -	1.771
Low Countries, - - -	1.436
Indies, - - - -	893
Russia, - - - -	350
Brazil, - - - -	289
Malta, - - - -	142
Spain, - - - -	64
Antilles, - - - -	58
Italy, - - - - -	40
Norway, - - - -	35
Total,	35.212 tons.

The value of which, in the Swedish ports, is from ten to eleven millions of francs, (two to 2 1-5 millions of dollars.)

This is about one fifth of the total production of France. In Sweden, the only fuel with which the forges are supplied is wood; of course the fabrication is limited to the annual production of this combustible, and cannot be increased as in forges supplied with pit coal. Hence, if the demand for Swedish iron should rise much above what it is at present, it is probable that the price would augment rather than the production increase. We have not much satisfactory information on the metallurgic resources of Sweden, and it appears that in relation both to art and economy, we have much yet to learn from them. This knowledge would come very seasonably at a time when our forges are calling for important ameliorations, and capital is waiting only to be secure in its results.—*Rev. Encyc. Mai*, 1829.

3. *Calorific effects of the Voltaic pile.*—Prof. De La Rive, in a memoir read to Soc. de Phys. et d' Hist. Nat. of Geneva, on the 4th of Sept. 1828, considers these effects as owing to the difficulty which the electric current finds in passing from one body to another, or from one molecule to the following, and to the resistance which it meets in these successive transits.

When a jointed wire, composed of alternate pieces of different metals, having different conducting powers, is made the medium of communication between opposite poles, that which is the slowest conductor becomes most intensely heated. Thus, if the alternate pieces consist of platina and copper, the former may become fully ignited, while the latter exhibit no signs of incandescence.

In fluids, if their conducting power be diminished by the interposition of solid particles, the evolution of heat is much greater. This is manifest in causing the current to pass through moistened cotton, or through the fresh stem of a succulent plant. In the latter case, the heat becomes so great as to cause the sap to boil at the points where the platina wires are inserted. It is found also, as might be foreseen, that fluids which evolve the least gas become the most heated. In water, the calorific effect is greater at the positive pole where oxygen is disengaged, than at the negative, where double the volume of hydrogen is set free.

It is well known that the greatest heating power is obtained when a given surface of metal is employed in the smallest number of plates. A single pair of one foot square each may ignite and melt metallic wires which a pile of eighteen pairs of sixteen square inches each cannot even warm, although the sum of the surfaces is exactly the same, and they are charged with the same quantity of water and acid. It is necessary however in these cases to distinguish between this igniting and melting power and certain other calorific effects, for to produce the combustion of metallic leaves, to evolve light and heat from charcoal points, or to effect an elevation of temperature in liquids traversed by the voltaic current, number is also requisite. Thus a pile of sixty pairs, capable of producing the three last classes of phenomena, cannot redden the finest wire of platina or iron; while ten pairs of the same pile produce the latter effect, but cannot determine the former.

The different calorific effects of the pile must not therefore be confounded with each other, but should be classed, simply, according to the conductors necessary to their production. If the conductor be perfect, continuous and homogeneous, as a metallic wire, the effect, whether calorific or magnetic, will be the more intense, the smaller the number of elements under a given surface. If the conductor be imperfect, or discontinuous, as in charcoal points or metallic leaves, or if it be heterogeneous as in the case of metallic plates immersed in a liquid interposed between them, then the given surface must be contained under a great number of pairs, to increase the intensity of the phenomena which these different conductors are capable of developing. The chemical, calorific or luminous effects, all those in a word which are produced by imperfect conductors, will, thereby, be equal gainers. The two electric principles which are accumulated at the two extremities of the pile and which are continually tending to neutralize each other, have, in fact, two routes offered them for this purpose, the one, the conductor which establishes the communication between the poles; the other, the pile itself, which is a heterogeneous and imperfect conductor, and the greater or less portion of the electric current, which takes the one or the other of these routes, will depend on their relative conductibility. If there be a metallic wire, the pile may be reduced, even to a single pair, because the current prefers the more perfect conductor; but if the conductor be jointed or heterogeneous, the conducting power of the pile itself offers an approximate facility, and hence the difference must be increased by an increase of number. But the necessity of reducing the number of the elements of the pile in order to produce a great effect in the case of a perfect conductor, can be accounted for, only by distinguishing between *intensity* and *swiftness.* The first depends on surface and number conjointly, the second principally on number, because the current is the less retarded in passing through the pile, the less the number of alternations of liquid and solid conductors. The calorific effects of the pile, therefore in the case of a perfect conductor, can be sensible only when the swiftness is very great, and when, from the construction of the pile this becomes reduced to a degree inferior to that to which the resistance of the wire would reduce it, there will be no development of heat, since this development proceeds from the effect of this resistance over the swiftness.

It is true that by an augmentation of intensity the diminution of swiftness may be partially compensated: thus a pile of sixty pairs strongly charged may easily redden a wire; but the ignition will not be so strong as with ten pairs only of the same pile.—*Bib. Univ. Jan.* 1829.

4. *Electro-magnetic property of carbon.*—It appears from the experiments of Mr. Kemp, (*Edin. Phil. Journal, April,* 1829.) that coke and charcoal raised to the temperature of active combustion and placed in the galvanic circuit, causes a wide deviation of the magnetic needle. Very little effect is produced until the strips of

coke or coal become thoroughly ignited, and even then the conducting power depends less on the heat than on the act of combustion, for when the charcoal was placed in a tube of glass and connected by wires with the opposite piles, it produced no change in the needle though red hot, until the heat of the furnace melted the glass around the charcoal, and then the effect was much less than when the charcoal was exposed to active combustion.

When three troughs of sixty plates, each, four inches square, were charged with muriatic acid and water connected laterally so that the poles of the same name were together in connection, a cylinder of charcoal one-eighth of an inch in diameter, being placed in the circuit, the magnetic needle situated over the charcoal did not deviate. But when the troughs were connected so as to form a single battery of one hundred and eighty plates, then the needle placed under the charcoal, was strongly divergent, especially when the circuit was, from time to time, interrupted.

It is well known, however, that charcoal conducts electricity at common temperatures. The fine experiment of the electric current between charcoal points in a vacuum, shews that combustion is not necessary. But why does not the current commence until the points are in contact, and begin to redden, and why does it continue when they are gradually separated to a considerable distance, an event which does not take place between metallic points? What is the luminous arc between the points, which appeared to conduct electricity? Is the flame, which is only carbon in the state of vapor, a conductor of the galvanic fluid? The experiments of Erman have thrown light on these phenomena, or rather they have shewn that there are in the conducting power of flame singular anomalies.

It is desirable that the subject should claim the further attention of able experimenters. G. D.—*Bib. Univ. Juin*, 1829.

5. *On the Deflection of Light*, by M. Haldat.—The phenomena of deflection, the examination of which has lately furnished so many arguments against the hypothesis of Newton, and in favor of the opinion of Descartes, appear to the author not to have been sufficiently examined. He accordingly performed a great number of experiments, which proved that the deflection of light is not modified either by the density or chemical nature of the substance; and having ascertained this, he turned his attention to the great powers of nature, and having prepared wires and plates of iron, copper and sil-

ver, adapted to the deflection of light, he caused them, during their action upon the ray of light, to be successively heated to whiteness, and cooled to —10° ; but no change whatever was thereby produced upon the colored bands of deflected light. The metal was then made to serve as conductors to currents of common electricity from powerful batteries, strong enough to ignite and to melt them, passed in either direction ; and a powerful magnet was also in one case attached to the deflecting plate ; but in no case was there any appreciable alteration in the light, nor was there any change when the rays of light, prior to their arrival at the metallic edge, were made to pass through vivid flame.

The author infers from these facts, that the explanation of deflection, founded on the influence of the attractive force, or the existence of certain atmospheres heretofore attributed to the body, cannot be admitted, since such a force or such atmospheres, subjected to agents so fit to control them, produced no change in the phenomena. These facts certainly do not establish the system of undulations, but they may perhaps be considered as favoring it by ruining the only explanation which stands opposed to it. But the author does not deny the difficulties which arise from these experiments relative to the theory of undulations ; and he asks why the motions of luminous waves, which ought to be so regular, are not disturbed by the motion of subtle fluids which dash against them in their march. He refers the solution of these questions to that future point in science when the nature of these agents shall be more intimately known.—*Ann. de Chimie*, *Aout*, 1829.

6. *Preservation of firemen against fire and flame.*—Chevalier Aldini, of Milan, a gentleman well known to science, has recently brought into notice an equipment which appears to offer a remarkable protection to persons exposed, as firemen are, to excessive heat, and which enables them to encounter with impunity dangers which it would be very imprudent to hazard, without such a safeguard.

This protection consists, 1st, of a covering composed of a tissue of asbestus, a substance somewhat in use among the ancients as the material of an incombustible cloth. Chevalier Aldini has succeeded, it appears, in preparing this substance in such a manner that it may be spun and woven without an intermixture of cotton or other fibre : 2d, of one or more additional coverings of metallic or wire gauze—of these materials, coverings are made adapted to the head, hands, feet, and all parts of the body—openings being left for the eyes, nostrils and mouth, but defended probably by metallic gauze.

The municipal authorities of several of the Italian cities having approved of these useful contrivances, the council of Geneva applied to Aldini for a complete assortment of his apparel; he stopped at that city on his way to Paris, and having given suitable instructions to the firemen selected for the experiments, the following trials were made in presence of the magistrate, professors, and a large concourse of citizens, on the 20th of August last.

1st. A fireman, having his hand covered with a double glove of asbestus, and a piece of pasteboard of the same substance over the palm, seized a red-hot piece of iron, carried it with a moderate step one hundred and fifty feet, set fire with it to a heap of straw, and brought it immediately back. His hand sustained no injury.

2d. A fire of shavings was maintained on a vast chafing-dish, supported about breast high. A fireman, with his head covered with the asbestus cap (covering also a mask on his face) and metallic cuirass, and a buckler in front, plunged his head into the midst of the flames, holding his face next the grate, and repeated the operation during more than a minute. The experiment was repeated more than once, and those who submitted to it affirmed that they felt no oppression or pain in the act of breathing, a thing well worthy of remark.

3d. Two ranges of faggots supported on bars of iron, and mingled with straw, with a passage between them thirty feet long and six wide, were set on fire. A fireman with the whole dress on, passed backwards and forwards between this double column, the flames rising ten feet high and meeting over his head. He walked with a measured step six or eight times, each passage occupying from fifteen to twenty seconds, being thus exposed to the constant action of the flame from one and a half to two minutes or longer.

The fireman then carried on his back a fire-proof basket, in which was a child with its head covered with an asbestus cap and protected by metallic gauze. These trials were made by four firemen, and in neither case was there any difficulty in breathing. An abundant perspiration ensued, but the skin was not injured. They received the reiterated plaudits of the numerous spectators, from whom they were sometimes entirely concealed by the double hedge of flame. That a man can breathe in the midst of flame with this covering is very remarkable. The triple metallic tissue must of course so reduce the heat as not to affect the organs. Many persons have perished in conflagrations, altogether from having their organs of respiration destroyed, as has been proved by the autopsy. It is possible that those interior lesions may have been occasioned by heated aqueous vapor, which retains its caloric better than air.

The grand duke of Tuscany has had six of these dresses prepared for the city of Florence.

M. Aldini shewed before the Philosophical Society of Geneva, that a loose tissue of asbestus intercepts the flame of a candle or spirit of wine lamp, as well as a metallic gauze of the same contexture. This gives new force to the objections to Davy's theory of the effect of wire gauze, for in this case the metal, which is a substance of the highest conducting power, is replaced by one which is a slow conductor.—*Bib. Univ. Aout*, 1829.

7. *Plumbago instead of oil in watches and chronometers.*—M. Hebert appears to have well ascertained that plumbago, well prepared by rubbing and repeated washings, to remove all the particles of gravel which are more or less found in the best specimens, is preferable to oil in watch movements. It is applied with a hair pencil, either in powder or mixed with one or two drops of pure alcohol. It adheres promptly to a pivot of steel, as well as to the surface of the hole in which it turns, so that the rubbing surfaces, no longer present a metal to a metal, but plumbago to plumbago; they acquired a polish which yields only to that of the diamond; the retardation from friction and the wearing becomes almost nothing. An astronomical clock made by M. Hebert, the pivots and holes of which, and the teeth of the escapement had been covered on their surfaces with fine plumbago, fourteen years before, was taken apart and examined by a committee of the London Society of Arts. The surfaces of plumbago were found, for the most part, entire and perfectly polished, and a strong magnifying glass discovered not the slightest wear, either in the pivots or the holes. (Trans. Soc. of Arts, 46, p. 48.)—*Idem.*

8. *Optical Surgery.*—M. Maunoir, professor of surgery at Geneva, having performed the operation for cataract by extraction upon a man eighty two years of age, weakened by an operation for hernia which he had endured six weeks before, perceived to his regret, that although the pupil remained of a beautiful black and perfectly intact,

the anterior and posterior chambers of the eye were not replenished, the cornea became sunk and wrinkled, a few bubbles of air penetrated the anterior chamber, and the patient had no vision.

Without yielding to the first melancholy impression, the operator, by a happy presence of mind, conceived the hopes of filling the cavity; he sent immediately for some distilled water, warmed it, placed the patient on his back, and filled the external orbit of the eye with the water, opened the eye lid and raised the flap of the cornea. The water then penetrated into all the accessible cavities, the folds of the cornea disappeared, and its convexity was restored. Having kept the eye shut for some minutes, he then directed the patient to open it, and found it in the most satisfactory condition, the patient distinguished all the objects presented to him as well as after the most completely successful operation. A slight pain was felt after the introduction of the water, which went off in a short time. From that time the eye healed without difficulty, and when opened a week after the operation, it was free from swelling and inflammation; the cornea was perfectly united, but the pupil was a little obscure, the sight feeble, and the patient complained that he did not see so well as immediately after the operation. But six days after the bandage was removed, the shade of the pupil was much diminished, the sight grew stronger from day to day, and no doubt was entertained that the patient would soon be able to read common print.—*Bib. Univ. Oct.* 1829.

9. *A remarkable Watch.*—M. Rebiller has made a watch, all the wheels of which, and every portion of the works are visible from the outside. The case, the bridges, and many of the wheels are of rock crystal, a substance perfectly transparent, and little inferior in hardness to the gems.

The screws are tapped in the crystal itself, all the holes are sunk in rubies, the piece which forms the escapement is of sapphire; the balance wheel is of crystal.

When the difficulty of working in such a substance, on a scale requiring so much delicacy as a watch which may be suspended from a lady's neck is duly considered, one can scarcely conceive how the maker could succeed in a work of this nature. It is a *bijou* of remarkable elegance, and the only one hitherto executed. M. Rebiller assures us that it keeps time almost as well as a chronometer, and he attributes this effect to the balance wheel being of crystal, and the hair spring of gold, substances but little affected by temperature. —*Rapport fait par Francœur. Bull. d'encour. Nov.* 1829.

10. *Magnetic influence of the solar beam;* by P. Riess and L. Moser.—Although some doubt had been entertained relative to the accuracy of the conclusions of Morichini, which ascribed a magnetizing influence to the violet ray, yet the subsequent experiments of Mrs. Sommerville appeared to settle the question, and to confirm the fact of such an influence. Resolved to subject this question to new trials, MM. Riess and Moser procured needles of soft steel, of very small magnitude, but having considerable surface, and they judged of the acquired magnetism by the relative number of oscillations before and after the experiment. The spectrum which they found was always at a minimum of deviation, which corresponds with its greatest intensity. The needles were upon a card, three or four feet from the prism, the chamber was darkened as slightly as possible, and the lens had an aperture of 1.2 inches, and a focus of 2.3 inches. The violet ray, concentrated by the lens, was passed in the several experiments, from 100 to more than 500 times along one half of the needle. In three instances the spectrum was kept stationary by means of a heliostat, and the needle was exposed seventeen and a half hours to the action of the ray. The experiments were also varied agreeably to the method of Baumgartner, by using steel wire, three inches in length, polished in different parts, and fixed vertically before and after each experiment. At the suggestion of M. Poggeadorff, they tried also the effect of polarized lights.

It is sufficient to say, that the most careful attention to the results, is altogether unfavorable to the opinion that the violet ray possesses any magnetic influence, and they conclude with observing, that there is good reason for rejecting an opinion which, during seventeen years, has from time to time troubled science.—*Annales de Chimie, Nov.* 1829.

STATISTICS.

1. Number of pupils which attended the universities of the Netherlands in the year 1827, and who were inscribed on the lists of the different faculties.

Universties.	Theol.	Law.	Med.	Science.	Philos.	Total.
Leyden, - -	158	191	62	10	167	588
Utrecht, - -	169	95	21	45	168	498
Groningen, - -	92	68	29	14	84	287
Louvain, - -		168	70	83	373	678
Leige, - -		185	89	78	154	506
Ghent, - - -		207	165	11	21	404
Total, - - - - -						2,961
In 1826, - - - -						2,774
Increase, - - - - -						187

Report of Minister of the Interior, 1829.—*Rev. Encyc. Aout*, 1829.

2. *Peruvian geography and geognosy.*—Extract from a statement of the labors of M. Pentland in Peru, by Alex. de Humboldt.

The great chain of Peruvian Andes is divided, between the 14th and 20th degrees of south latitude, into two longitudinal branches, which are separated from each other by a wide valley, or rather by a *Plateau*, the surface of which is elevated two thousand and thirty three toises above the sea. The northern extremity of this table includes the Lake Titicaca. The shores and islands of this lake are remarkable for having been the seat of ancient Peruvian civilization, and the center of the empire of the Incas. The western chain separates the bed of the Lake Titicaca and the valley of the Desaquarado from the shores of the South Sea, and it presents a great number of volcanos still in activity. Its geognostic constitution is essentially volcanic, while the eastern chain consists entirely of mountains of secondary and transition formation, of micaceous schist, syenite, porphyry, red sandstone, marl containing fossil salt, gypsum, and a little calcareous oolite.

From this eastern chain, issue a great number of torrents, which empty into the Rio-Beni, and which bear down with them portions of auriferous sand. One of these streams deposits so great a quantity of this gangue, that it has given to the little valley of Tipiani, in the district of Larecaja, the name, now so celebrated, of *Dorado* or

El Dorado. From the 14th to the 17th degree of latitude, this chain rises almost uninterruptedly above the region of perpetual snow. Several of its peaks surpass twenty thousand English feet, and some of them are the most elevated of all the points of the Cordilleras which have been measured, towering above the gigantic summits of Columbia, Chimborazo, Antisana and Cayambé.

A remarkable geognostic fact, noticed by M. Pentland, is, that in no part of the volcanic region of the Andesian chain which he traversed, either in Peru or Chili, did he find any traces of basalt or pyroxene. Trachytic agglomerations, and trachytes mingled with grains of quartz, are the forms under which are presented the most common masses of volcanic origin. Trachytic pechsteins, obsidians, and other vitrified volcanic products, are very rare.

The ancient inhabitants were exceedingly prone to ascend the highest elevations, in pursuit of their mining operations, a long time before the conquest of the Spaniards. Many of these artificial excavations are found at the height of sixteen thousand and six hundred English feet. The whole ridge of Potosi has an elevation of sixteen thousand and eighty feet, and yet this mountain is riddled to its summit with pits and galleries.

The highest habitations of man, between the 14th and 18th degrees south latitude, are above fifteen thousand and five hundred feet. Small villages and post houses are found as high as fourteen thousand and four hundred feet.

The following table contains the principal measures, obtained by M. Pentland, of the highest elevations of the Andes. The first two, and probably the third, were ascertained trigonometrically, and the others by means of the barometer.

Names of places, in Peru and Bolivia.	Heights above the sea, in English feet.	South latitude.
Sorata,* (eastern chain,) -	25,200	15° 30′
Illimani, do. - - -	24,200	16 35
Ridge of Cherquibana, (western chain,)	22,000	
Arequipa, (volcano,) - -	17,780	16 19
Potosi, - - - -	16,080	19 36 35″
Ancomarca, (post house,) -	14,410	17 31 50

* Chimborazo is twenty one thousand five hundred and twenty seven feet; Mont Blanc fifteen thousand eight hundred and fifty four. The two highest summits of the Himalaya are twenty eight thousand two hundred and one, and twenty five thousand eight hundred and sixty three feet.—(Note by Humboldt.)

Names of places, in Peru and Bolivia.	Heights above the sea, in English feet.	South latitude.
Tacora, (village,) - - -	14,275	17° 51′
Cherciuto, (town on Lake Titicaca,)	13,030	
Puno, do. do. -	12,832	15 30 20″
Lake of Titicaca, - - -	12,760	
Paria, (village, eastern chain,) -	12,750	
La Paz, (town,) - - -	12,194	16 29 30
Cochabamba, do. - -	8,440	16 23 58
Arequipa, do. - - -	7,795	16 23 58
Tacua, do. - -	1,795	18 1 50
Lima, do. - - -	512	

Bib. Univ. Sept. 1829.

3. ***Revue Encyclopedique.***—At the monthly supper given in commemoration of the establishment of this journal, the company which assembled on the second Tuesday of November, were the representatives of seventeen nations, five of which were Americans, one Asiatic, and eleven Europeans.

Prior to the repast, Aldini of ***Bologna*** executed in presence of a select company of eighty persons, his fine experiment for preserving the body from the action of flame.—A young Swedish savant, Professor Ritzius, pupil and friend of ***Berzelius***, seized and held for some minutes in his hand, covered with a thick glove of amianthus, a bar of red hot iron, and a fireman furnished with a double mask of the same substance, covered with a double cap of metallic gauze, braved with impunity, torrents of flame and smoke from a vast chafing dish.—The generous philanthropist Eynard of ***Geneva***, gave an interesting detail of the actual situation of Greece, and the advantages which civilization and commerce will derive from the political reorganization of that nation.—The distinguished French engineer Brunel of *de **Rouen***, now of London, who is equally an honor to his native and adopted country, explained the plan of his tunnel under the Thames, and stated his hopes that this bold enterprize would soon be resumed with renewed activity, and brought eventually to a successful termination.—Admiral Sir Sidney Smith deeply interested the company in an account of experiments which he had made in several ports of France and Holland, with a life boat of his invention, in cases of shipwreck.—Roccafuerti, minister plenipotentiary of Mexico at London, and Salazar and Torres senators of Colombia, explained the sentiments of their respective compatriots, in relation to the means of extending the physical and moral improvements of the American people.—The United States of America were worthily represented by their consul general, J. C. Barnet.—M. Labarraque gave an account of the new and happy applications made in Syria and Egypt of the chloride of lime, as a preservative against pestilence, and paid a just tribute to the medical deputation conducted by Dr. Pariset. Other communications of interest were made by gentlemen present, and the evening entertainment appears to have closed highly to the satisfaction of the party assembled, and honorably to the president of the banquet, M. A. Jullien, founder of the Journal, whose establishment furnished the primary occasion of the meeting.—*Rev. En. Nov.* 1829.

4. *Comparative number of books which appear in France and Germany.*—The comparison of the catalogues of the fairs of Leipsig with the Bibliographical Journal of France, proves, that in the lapse of thirteen years, from 1814 to 1826, many more books have appeared in Germany than in France. The total number for France is thirty three thousand seven hundred and seventy five, and in Germany fifty thousand three hundred and three. The progression however, is much more rapid in France. The number of new works which appeared in 1826, is more than quadruple that of 1814, while in Germany, the number of 1826, is not even double that of 1814.

The number of authors may be estimated at half the number of works, which would give in round numbers thirty five thousand authors. But as thirteen years are not the half of a generation, (fixed at thirty years,) we must at least doubt the number for the remaining seventeen, and say that Germany has now seventy thousand authors who write, have written, or will write. In allowing to that country forty millions, it makes one author for every five hundred and eleven inhabitants.—*Rev. Ency. Dec.* 1829.

5. *Vauquelin.*—To fill the place made vacant by the death of this distinguished member of the French Academy, M. Serullas was elected on the 28th of December, by a ballot of thirty two votes out of fifty six. M. Clement had twenty four votes.

To fill the chair of chemistry in the garden of plants, M. Chevreul united fifty three votes out of fifty four.—*Idem.*

MISCELLANIES.

(FOREIGN AND DOMESTIC.)

1. *Vegetable coloring materials in Canada.*—Mr. William Green of Quebec, whose success in the investigation of the various coloring matters of Canada, obtained for him the gold Isis medal of the Society of Arts, Manufactures, and Commerce of London, describes a brilliant and durable red dye in the root of a procumbent species of Galium. This plant has a quadrangular stem with reflexed prickles, surrounded at intervals by small oval leaves; and a thread-like root which runs horizontally through the low soil formed in the woods from the decay of leaves. On extraction from the soil, the root is frequently colorless and transparent, resembling undyed silk; but in a few minutes after, acquires a dark hue and the property of yielding brown and red colors. On washing it in cold water the brown coloring matter is dissolved out; after which it is boiled in a saturated solution of alum in water, and on the addition of ammonia a beautiful lake is precipitated. Its hue is said to be equal in beauty, though inferior in intensity, to that of the finest carmine, over which, it has the advantage of much greater durability. Patches of various specimens of carmine, and red lake from cochineal, were painted in oil on a window pane; which all faded, more or less, and some nearly disappeared on being exposed to a strong light for two weeks: whereas patches of red lake from the Galium remained unchanged after a similar exposure for two years. The Indians have been in the habit of extracting a dye from this plant with which they tinge their porcupine quills, elk hair and other substances. The Hurons derive their supply from Caughnawaugha, where it is thought to be found of a superior quality, although the woods at Lorette produce it.*

A very rich and durable brown for dyeing, and a lake of the same color for painting are afforded by the outer husk of the butternut (*Juglans cinerea.*) The color is copiously extracted by infusion in warm water, and may be precipitated either by alum or muriate of tin; if by the latter, it will dry the quicker in oil. It is of a tint intermediate between those of asphaltum and prussiate of copper.—*Trans. Lit. and Hist. Society of Quebec. Vol. 1.*

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* It is very much to be desired, that this species of Galium may be identified, as there can be little doubt, that it is found also in some parts of the United States.—C. U. S.

2. *Phosphorescence of the sea in the Gulf of St. Lawrence.*—Captain Bonnycastle, R. E. whilst coming up the gulf on the 7th September, 1826, observed this phenomenon under the following interesting circumstances. At two o'clock, A. M. the mate, whose watch it was on deck, suddenly aroused the captain in great alarm, from an unusual appearance on the lee bow. The night was star light, but suddenly the sky became overcast in the direction of the high land of Cornwallis county, and a rapid, instantaneous and immensely brilliant light, resembling the Aurora Borealis, shot out of the hitherto gloomy and dark sea on the lee bow, and was so vivid that it lighted every thing distinctly, even to the mast head. The mate, having alarmed the master, put the helm down, took in sail and called all hands up. The light now spread over the whole sea between the two shores; and the waves, which before had been tranquil, now began to be agitated. Capt. B. describes the scene, as that of a blazing sheet of awful and most brilliant light. A long and vivid line of light, superior in brightness to the parts of the sea not immediately near the vessel, showed us the base of the high, frowning and dark land abreast of us; the sky became lowering and intensely obscure. The oldest sailors on board had never seen any thing of the kind to compare with it, except the captain, who said that he had observed something of the kind in the Trades. Long tortuous lines of light in a contrary direction to the sea, shewed us immense numbers of very large fish darting about as if in consternation at the scene. The sprit-sail yard and mizen-boom were lighted by the reflection as though gas lights had been burning immediately under them; and until just before day break, at four o'clock, the most minute objects in a watch were distinctly visible. Day broke very slowly, and the sun rose of a fiery and threatening aspect. Rain followed.

Capt. B. caused a bucket of this fiery water to be drawn up; it was one mass of light when stirred by the hand, and not in sparkles, as usual, but in actual corruscations. A portion of this water kept in an open jug preserved its luminosity for seven nights. On the third night the scintillations in the sea re-appeared, and were rendered beautifully visible by throwing a line over board and towing it along astern of the vessel. On this evening the sun went down very singularly, exhibiting in its descent a double sun; and when, only a few degrees above the horizon, its spherical figure changed into that of a long cylinder which reached the horizon. In the night the sea became nearly as luminous as before. On the fifth night the luminous appearance nearly ceased.

Capt. B. is unwilling to attribute the above effect to living animalculæ; but suggests the idea that it depends upon some compound of phosphorus suddenly evolved and dispersed over the surface of the sea. In such a compound he conceives the phosphorus or phosphoric acid to be afforded by exuviæ or secretions of fish, and the other constituents to be in some way connected with those abundant oceanic salts, the muriate of soda and sulphate of magnesia.—*Idem.*

3. *Antarctic Expedition.*—A letter from an officer of the Chanticleer, dated at Table Bay, Cape of Good Hope, July, 1829, to J. Barrow, Esq. F. R. S. has been published in the January number of the Edinburgh Journal of Science. The Chanticleer has been on an expedition in the southern oceans, for scientific purposes, since 1826. The writer, Capt. Webster of the Royal Navy, says he "is happy to state that the ship has not lost a man since she was commissioned." This, when compared with the sufferings of many early navigators, is a striking evidence of improvements in nautical skill, and in the methods for provisioning ships, and for the preservation of health on ship-board. He does not mention any newly discovered lands, but makes several interesting notices of the animal and vegetable productions of Cape Horn and Staten Land, which is an island near Terra del Fuego on the east.

The vegetation of Cape Horn and Staten Land is composed principally of evergreens, of which a species of beech ranks first for size and frequency, and clothes the country with forests of perpetual verdure. The wood is of small value, but the bark possesses the tannin principle, and is employed to convert seal skins into leather, to which it imparts an agreeable odor. This beech is incumbered with a parasitical shrub, but of what species the writer is ignorant. It is also beset, on the trunk and large branches, with smooth globular orange colored fungi, of the size of a small apple. Wherever these fungous substances adhere to the tree it becomes knotted and tuberculated, but the most singular property of this evergreen beech is the change produced in the wood by decay. It becomes throughout of a bright beautiful verdigris green color, which it retains against the action of all acid and alkaline agents; and in an equal degree resists the effects of weather. It affords an excellent pigment, having been pulverized and tried as a paint in various kinds of work, where it proved both elegant and durable. This substance is not luminous in the dark, and every tree is not alike converted into this material; though it is found in large quantities, and considerable blocks have already been sent to England. Another species of beech which is deciduous is rare on Staten Land, but very common at Cape Horn, where by the changing colors of its leaves, it imparts the usual charm of autumnal scenery.

The Fuegian rush is another product of those almost antarctic regions, possessing uncommon beauty for baskets, mats and hats. It grows in wet grounds and bogs, and when cut and dry, like the rush of our own country, resembles coarse hay.

Capt. Webster has forwarded to the English Admiralty, specimens of the plants and seeds found on Cape Horn, Staten Land and Del Fuego.

The *berberis mycrophylla* is described as "a pretty bush," bearing plentifully a fruit between a grape and a goosebery, fit for tarts or for the table.

The balsam plant grows in Staten Land, from the leaves of which exude a resinous juice, that concretes into a solid resin, having the properties of copaiva.

A good coloring matter is extracted from the scarlet berries of the Hamadryas, similar to arnatto, particularly valuable for not being altered by alkalies or acids. It thrives on bogs, moors, and waste places. The sea weeds about Staten Land are very large and contain iodine.

Some flowers of peculiar beauty were found, such as the *Chelone ruelloides*, and *Androsace spathulata*, or fuegian auricula, but they were of rare occurrence, and few seeds could be obtained. An elegant myrtle leafed evergreen (*Arbutus arculeata*) bearing berries, is a beautiful ornamental shrub, retaining its berries through the winter.

Celerery grows spontaneously in great luxuriance and perfection.

Shetland south east from Cape Horn and near the antarctic circle, probably the most southern tract ever visited by civilized man, is described as "naked, and destitute of a vestige" of vegetation, "a shrub or two of a most diminutive moss, requiring a microscopic eye to discover it, is very scarce, being found only in a few spots, and a lichen identical with the one on the hills of Cape Horn, comprise the botany of Shetland." Even the sea weeds are extremly meagre in amount and variety.

The Geology of these regions of desolation, and also of Cape Horn, has been examined by the gentlemen of the expedition, and numerous and ample specimens have been forwarded to England. From the further communications which may be expected on this subject, a complete account may be looked for, of the geological formations, and of the minerals and rocks. Extensive beds of graphite were found in Staten Land.

The objects of the voyage being mathematical and philosophical, the necessary facilities for investigations in natural history were not at hand, and the success in that department did not correspond with the diligence and industry with which they were prosecuted. Many prepared specimens of birds were lost, for want of convenient room to dry them. The peculiar structure of the penguin, and the strange anatomy of the sea leopard, or leopardine seal, attracted particular notice. The surprising peculiarity of the penguin is its jugular veins, which are stated to be two inches in diameter; and a venous sinus extending from the right to the left hypochondrium of the sea leopard, of seventeen inches in diameter, although without parallel, and seemingly incredible, is asserted by Capt. Webster as an unquestionable fact.

4. *Gold and Platina.*—An account is quoted in the Annals of Philosophy, from a Prussian Journal from which it appears that rich beds of Platiniferous sands have been recently discovered "throughout the western branch of the Uralian mountains. Banks of greenish gray argillaceous sand, varying from two and a half to five feet in thickness, lie near the surface under a covering of turf and contain from one to three pounds of metal in three thousand and seven hundred pounds of sand.

The asiatic side of the mountains is rich in gold. Documents supplied by Professor Fuchs, show that from the beginning of summer to the month of August in the same year, seven thousand seven hundred and ninety two workmen were employed in the gold washing, and that they procured fourteen hundred and sixty pounds of pure gold. From the first of May to the first of October, two thousand eight hundred and twenty four pounds and some ounces of gold were obtained from about two hundred and seventy thousand times its weight of sand; masses of gold occurs frequently but a few inches under the grass.

5. *Rock crystals substituted for crown glass in making telescopes.*—The celebrated artist Cauchoix, has imformed Dr. B. Lynde Oliver, that by employing rock crystals instead of crown glass he can make a reduction of one third in the length of his telescopes, with the farther abvantage of an increase in the amplifying power and light of one eighth; but this improvement he states, is limited to telescopes whose aperture does not exceed five inches.—*Letter of Dr. Oliver to the editor, dated Dec.* 27, 1829.

6. *On the Temperature of the Sea.* (Communicated to the Editor.)

I. By Paul Swift, M. D.

Nantucket, February 16th, 1830.

Professor Silliman—In the last No. of the American Journal of Science and Arts, there is an account of several interesting experiments, made by different navigators, showing the temperature of the ocean at great depths.*

Thy correspondent says, "It seems to me that the facts detailed by M. Péron are inconsistent with the theory of M. Cordier, as to central heat, if they do not prove conclusively its entire fallacy."

Now it seems to me, that neither the experiments of Péron, nor those of any other navigator adduced, justify, or in any degree countenance this conclusion.

All the experiments reported agree in establishing the facts, that the temperature of the surface of the water varies with that of the superincumbent air, and differs but little from it, and that at greater depths, the water preserves much more nearly a uniform temperature.

From these facts it will necessarily follow, that the comparative heat of water at the surface, and at great depths below it, will depend on the temperature of the air at the time and place of making the experiment; thus, if the experiment be made, as by Péron, within the tropics and near the equator, the surface never being less than 86° of Fahrenheit, the mercury will fall in proportion to the descent of the instrument in the water; if, on the contrary, the experiment be made in a high latitude, when the temperature of the air or surface is low, as twice occurred in those made by Forster,

* Communicated by B. Tappan, Esq. of Steubenville, Ohio.

and once only in those by Irving, the mercury will rise in some proportion to the depth to which the instrument is sunk.

This I suppose to be true within certain limits only, for we are justified in concluding from the experiments published, that at any given time and place the temperature at one hundred fathoms' depth does not differ materially from that of seven hundred fathoms, with the exception, perhaps, of the equatorial and polar regions, where the influence of a vertical sun or long continued cold may be felt at a greater depth.

At first view, the doctrine advanced in the article under notice, may appear to be supported by the experiments given, for *generally* the water was found colder at great depths than at the surface; but when it is remembered that the experiments were made during the hot or temperate months of high southern as well as northern latitudes, the cause of this general result will be obvious.

General inferences from a few and (in this case from their nature) imperfect experiments are always dangerous to the progress of truth.*

If the truth or fallacy of the theory of central heat be ever established, it must be by experiments on a medium, less subject than the ocean to variations of temperature, from the agency of tides, winds and currents.

II. By Dr. E. Emmons.

Williams College, March 7th, 1830.

It is familiarly known, that the upper surface of heating water is hotter than the bottom, and that even *ice* may remain at the bottom, while the water near the surface would be quite uncomfortable to the hand. Now the experiments of Péron prove the water of the ocean to be in the same condition as water heating in a furnace, viz. with the bottom the coldest and the upper surface the warmest, which circumstances are known to depend on the ascent of heated particles of water to the surface, and the sinking of the colder to the bottom. Now, until it is shown that a different effect would follow from heating the ocean at the bottom, from what takes place in our culinary operations, I shall consider the experiments of Péron as misapplied

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* The caution suggested by Dr. Swift is equally applicable to both sides of this question. It is certainly proper to observe and report all well ascertained facts on the subject, although it may be long before any theory can be firmly established.—*Editor.*

in the article I have noticed. Fearing that I may be mistaken in my views, I will respectfully request Mr. T. to consider the subject farther, and to give his opinion on the heating of water at vast depths and under great pressure; and to show, if possible, that the heated particles of water would not tend to the surface, but would be confined to the bottom, forming there a stratum of hot water more dense than marble. If however the heating of the ocean at the bottom would be attended with the same circumstances as the heating of a kettle in a furnace, then the experiments of Péron, instead of going to disprove the theory of Cordier, would, in the view of some, furnish arguments in favor of it, for it is known that the ocean continually gives off caloric to the surrounding medium, and what source for a continual supply of it can be found nearer at hand, than the interior heat of the earth?

7. *Proceedings of the Lyceum of Natural History, of New York.*

(Continued from Vol. XVI, p. 357.

June, 1829.—Mr. Halsey offered for inspection branches of the Tilia Americana and Gleditschia triacanthos which had been destroyed by the bark and membrane beneath being taken off by some insect, in a circular manner, as completely as if effected by a sharp cutting instrument, and so effectually as to destroy all that part of the twig above the spot thus girdled. This insect appears to be allied in its habits to the Lamia destructor. Mr. Cooper presented specimens of one hundred species of plants collected by himself in Kentucky, Tennessee and Virginia, in August and September, 1828, with a critical catalogue prepared by Prof. Torrey. Among them were several of the rarer plants observed by Michaux and the earlier botanists, and some which are probably new. Dr. Holmes of Montreal presented a large and valuable collection of minerals from York, Grenville, &c. but chiefly from the Rideau Canal, all in Upper Canada. They comprised fine specimens of scapolite, tremolite, hornstone, white pyroxene, (petalite?) precious garnet, sahlite, apatite, dodecahedral carbonate of lime and several varieties of iron ore. Prof. Del Rio, late of the University of Mexico, read an account of a new mineral from the vicinity of that city. It is a carbonate of tellurium and bi-carbonate of nickel, occurring with oxide and molybdate of lead. Prof. Del Rio proposes to call it Herrenite. Messrs. H. H. Eaton of Troy, and Isaac Lea of Philadelphia, were elected corresponding members.

September.—Mr. A. Nash read a paper on the gold region of the southern states. A communication accompanied with books was received from Prof. Rafn of Copenhagen.

October.—Mr. Nash resumed the reading of his interesting memoir on the gold mines of Carolina. The paper was accompanied with maps illustrating the various localities of gold in that state with profiles of the auriferous veins in the numerous localities personally examined by Mr. Nash. At the request of several individuals concerned, Dr. James Eights of Albany, was appointed naturalist to the private expedition now about to explore the southern Atlantic and Pacific oceans. A committee was appointed to make such arrangements and render such aid as might be required. Dr. Boyd presented a large mass of iron ore containing crystals of zircon from Canterbury, Orange county, N. Y. Messrs. A. Nash and J. C. Hamilton were elected resident members. Captains Pendleton and Palmer of Connecticut, Mr. Reynolds of Maryland, Dr. Heron of Warwick, N. Y. and M. Schoneberg of Paris were chosen corresponding members.

November.—Prof. Torrey presented a specimen of Hydrocharis spongiosa from Ontario county, N. Y. supposed not to have been heretofore found north of Carolina. A valuable collection of mammalia was received from Dr. Pitcher, corresponding member. They were collected in the vicinity of Fort Gratiot. Among them were noticed the Melos *labradoria*, American badger, Sciurus (Pteromys) *sabrinus*, large flying squirrel now for the first time found within the limits of the United States, Mus (Pseudostuma) *bursarius*, male and female, Dipus *Canadensis* and several others. Stilbite in single perfect crystals was presented by Prof. Torrey, from Patterson, N. J.

December.—A paper was read by Maj. Le Conte on the American tortoises, (since published in the Annals of the Lyceum.) A large collection of fishes from Lake Huron was received from Dr. Pitcher. They were referred to a select committee for examination and report. Maj. Le Conte read a paper entitled "Description of a new genus (Psammomys) of the order Rodentia," since published in the Annals of the Lyceum.

January.—J. E. Dekay read a paper entitled, Description of a new genus of extinct crustacea formerly designated as Bilobites—and hitherto supposed to have been distorted shells. Maj. Le Conte read a paper on the United States species of the genus Pancratium, inserted in Vol. III. of the Annals. J. E. Dekay presented a communication on the American species of Mosasaurus and Geosaurus from New Jersey, since published in the Annals; also a notice of Coprolite from the same locality. Prof. Fowler of Middlebury College exhibited a specimen of colorless fluate of lime from Ackstead, N. H. a new locality.

February.—Dr. Mitchill read an essay upon various subjects of natural history which had presented themselves to his notice within the last month. Dr. Feuchtwanger read a paper on the pretended diamonds said to have been manufactured by M. Latour and others. The same gentleman presented several interesting minerals from Norway, and a fossil fish, *Esox islebensis*, from Germany. M. Boisduval of Paris, and W. Swainson, Esq. of St. Albans, (England,) were chosen corresponding members. The following gentlemen were elected officers for the ensuing year.

Joseph Delafield, President.
A. Halsey, *J. E. Dekay*, Vice Presidents.
J. Van Rensselaer, Corresponding Secretary.
Alfred Wagstaff, Recording Secretary.
William Cooper, Treasurer.
J. E. Dekay, Librarian.
I. Cozzens, *J. Delafield*, *L. D. Gale*, *J. E. Dekay*, *and O. Brooks*, Curators.

8. *Providence Franklin Society.*—Officers for 1830, elected at an annual meeting, Jan. 5th.

William T. Grinnell, President.
Stanford Newell, Vice President.
Samuel Boyd Tobey, Secretary.
George Baker, Treasurer.
Owen Mason, *Joseph Balch, Jr.* *Joseph Mauran*, } Standing Committee.
William S. Patten, Librarian.
Thomas H. Webb, Cabinet Keeper.

This Society, whose object is the pursuit and cultivation of the different branches of Science, was established in 1821, and it consists, at the present time, of between forty and fifty members. Its meetings are holden once a week, throughout the year, and during six months of this time, a lecture is given at each meeting, by some one of the members, on a subject connected with the objects of the Society.

A cabinet consisting of mineralogical and conchological specimens, with a variety of curiosities natural and artificial, has been formed and is progressively augmenting.

The members of this institution have avoided a public announcement in any of the Scientific Journals, until its permanency should be thoroughly ascertained; and our principal object in desiring a place in the Am. Journal is to propose a correspondence, and an exchange of minerals, &c. with other societies and individuals. Situated as we are in a region abounding with minerals, (some of which have not yet been discovered in other states) we can at any time furnish specimens from nearly all our localities.

Articles intended for the society may be directed to "the Cabnet Keeper of the Franklin Society, care of Peter Grinnell and Sons, South Main St., Providence R. I."

From a personal knowledge of some of the members of the Franklin Society and of their zeal and activity, we believe that this institution will prove efficient and useful, and that it has already been beneficial to the cause of useful knowledge.—*Ed.*

9. *Circular Scale of Equivalents, by J. Finch.*—I have recently received from a friend in England a circular Scale of equivalents, which, although it has been published some years, has not, I believe, been noticed in any Scientific Journal in the United States. It consists of two circles, of which the outer one is fixed, the inner one is moveable. The margin of the inner moveable circle is marked with a logometric scale, which passes twice round in a distinct line, and is numbered from one to a thousand. The inner margin of the outer circle is also marked in a similar manner, and the numbers extend from one to a thousand. When the circles are in their original place, the numbers on both correspond.

The exterior of the scale is marked with a list of chemical substances, which, instead of being placed opposite to the numbers which represent their combining proportion, are arranged alphabetically. An opportunity is thus afforded to give a list of near three hundred substances and their atomic weights, and the list is much enlarged in a pamphlet which accompanies the scale. What seems very superfluous is that two atomic numbers are given for each substance, the first line has reference to hydrogen, and the next to oxygen as the unit. These two are so easily approximated in the scale more commonly in use, that two sets of numbers are unnecessary. The author of the Circular Scale, Dr. Warwick, acknowledges a preference for the hydrogen unit, on account of its giving whole numbers for the equivalents. The atomic weights given, approximate very nearly to those of Dr. Thomson and Professor Brande.

"In the employment of this scale it will be advisable to consider the moveable circle as containing the weight of the object of enquiry. The fixed circle will contain the equivalent numbers. If you wish to ascertain how much of any alkali, earth, or metal, will saturate any given weight of acid, or vice versa, place the weight you know under its equivalent, fasten the circle in its place, and under the equivalent of the substance about which you are uncertain, you will learn the weight required. For example; if you wish to know how much carbonate of ammonia will saturate one hundred grains of crystallized oxalic acid, place one hundred in the moveable circle under seventy two, which is the equivalent of crystallized oxalic acid, and then under thirty nine, which is the equivalent of carbonate of ammonia, you will find fifty four and one fourth, which is the quantity of the salt able to saturate one hundred parts of oxalic acid." While the circle is thus placed, you may learn how much of any other alkali, earth, or metal, will possess the same power, by examining the numbers which are below the atomic weights of those different substances.

The author also proposes to ascertain by it how much of any simple substance is required to produce a given weight of any article, into whose composition it enters, but this would be much easier done by referring to the equivalent numbers, and calculating the result on paper. The advantage which the scale possesses in the extreme range of its numbers appears to be far more than counterbalanced by the defective arrangement of the chemical substances. How far it would compete with those which are straight, if the numbers were arranged opposite to their equivalent numbers, is a question not yet determined. I am however inclined to believe that the danger from warping, in the circular scales, which are near fourteen inches in diameter, would be much greater than in the Wollaston scale in common use. One which should give the equivalent numbers of Sir H. Davy and Berzelius is yet a desideratum.

10. *Notice of a locality of Arragonite, near New Brunswick, (N.J.) by* J. Finch.—This mineral occurs in a quarry on the south shore of Raritan River, one mile above New Brunswick.

Specific gravity, a mean of several trials, 2.88. Effervesces slightly with acids. Color, greyish white; with a faint tinge of blue. In plates, varying from one sixteenth to one inch in thickness. Structure, coarse fibrous; fibres parallel. Lustre silky, and exhibits a changeable play of color. Not so chatoyant as satin spar.

It forms seams, both horizontal and vertical, in secondary sandstone. The banks of the river vary in height from thirty to sixty feet. The water descending from the high ground towards the river has formed numerous ravines. One of these ravines has a pavement of arragonite. Its hardness, superior to that of the marle, has prevented the destruction of the lower strata.

It is associated with calcareous spar in nests, in sandstone and variegated marle.

11. *Thomson's Scientific Medals; by* J. Finch.—There have been recently published in England a beautiful series of scientific and philosophical medals. They are sixteen in number, three inches in diameter, and are struck either in tin or silver. The figures and impressions are executed in a very superior manner; they contain condensed tabular views of the sciences, very useful to the student, and figures of the steam engine, hydraulic press, mountains, &c.

Medal.	Obverse.	Reverse.
No. 1.	Mechanics, - - -	Mechanics.
2.	Optics, - - - -	Optics.
3.	Electricity, - - -	Galvanism.
4.	Hydrostatics, - - -	Hydraulics and Pneumatics.
5.	Metallurgy, - - -	Specific Gravities.
6.	Chemistry, - - -	Chemistry.
7.	Astronomy, - - -	Astronomy.
8.	Mineralogy, - - -	Mineralogy.
9.	Geology, - - -	Geology.
10.	Crystallography, - -	Crystallography.
11.	Mountains, - - -	Classification of minerals.
12.	Phrenology, - - -	Phrenology.
13.	Marquis of Worcester and Captain Savery on the Steam Engine,	Trevethick on the high pressure.
14.	Newcomen and Beighton on ditto.	Perkins on the high pressure.
15.	Watt's Single for raising water,	Watt's single.
16.	Watt's Double for driving Machinery,	Watt's double with every improvement.

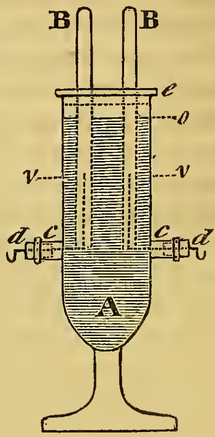
12. *Porcelain Clay.*—We have a specimen of clay from Granby, Conn. which very much resembles the porcelain clay of Limoges in France. Under the compound or oxy-hydrogen blowpipe, it vitrifies into a white enamel, and exhibits no tinge of color. We are informed that it exists in a thick bed a few feet below the surface, and that measures are about being taken to explore it, and to ascertain its properties more effectually.—*Ed.*

13. *Galvanic currents.*—In the decomposition of water by the galvanic power, two tubes being filled with water, (see the figure on the next page,) and inverted in a vessel filled with that fluid, their orifices being about one inch apart, and the connexion established through the fluid, by slips of platina, I had recently the satisfaction of observing, distinctly, the currents of gas as they took their departure to their respective poles. It has been a problem, whether the water is decomposed under one tube, or the other tube, or at some intermediate point; but, in the experiment referred to, ocular demonstration was exhibited, that the decomposition took place, simultaneously, under both tubes, and not at any intermediate point. This appeared from the fact, that under each tube, a current of gas rose, vertically, from the platina slip, and collected in the top of the tube, while another current shot off, laterally, and took up its march, towards the opposite pole beneath the contiguous tube; as this process was going on at the same time, under both tubes, it follows that there were opposite currents of gas, but they occasioned less mutual disturbance than might have been supposed; because the levity of the hydrogen and the gravity of the oxygen determined them to pass each other at different levels, and although many bubbles were buoyed up in the passage and made their escape, and were lost, by passing through the water intermediate between the two tubes, a large part of the gases was collected in the respective tubes. The process was continued for several hours with a large battery,* and the currents were palpable to all the bystanders. With a magnifying glass the appearance was beautiful, and nothing can exhibit more decisively the all dominant power of the galvanic influence in causing even gaseous elements to separate at different points, and to pass horizontally, in opposition, through at least two inches of water, until they arrived at the poles by which they were respectively attracted. But on examining the gases in the two tubes, so far from finding the oxygen gas in the one and hydrogen in the

* 720 pairs of 6 and 4 inch plates.

other, there was found in both a highly explosive mixture, which gave a very sharp report when a flame was applied; and in fact, the result was precisely the same as when the two tubes, standing in different vessels, and furnished with metallic caps and depending platina wires, to connect them with the slips of the same metal below, are joined by a good conductor touching the caps.

Did the strong mechanical conflict of the two opposite currents cause the gases to be intermingled, and thus to be in part carried back against the stream, or did a portion of each gas fail to be expelled from the tube by the attractions and repulsions, and thus rise by mere levity, to mingle with the gas appropriate to each particular pole?



A, a foot glass of the capacity of nearly one pint, filled with distilled water to *o;* through the wooden top, *e*, are inserted the receiving tubes, B, B, which descend and rest upon strips of platina, *d*, *d*, inserted through corks at *c*, *c;* the platina strips being bent at right angles, and rising as high as *v*, *v*, in the tubes, which are filled with distilled water.—*Ed.*

14. *Tennessee Meteorite.*—This meteoric stone* which we have recieved, presents a decidedly felspathic appearance; and is quite homogeneous, except its black crust and the small metallic particles consisting of the protosulphuret of iron and native iron, every where disseminated through its mass. Its specific gravity, as ascertained by Mr. Seybert, is 3.48. Of all the stones of this sort, which have fallen in the United States, it resembles the most nearly those of Maryland; from which it differs only in being of a color more nearly approaching to white.

15. *Rensselaer School Flotilla.*—The acting officers of the Rensselaer School, have issued notice, of a Summer Term of Travelling Instruction, in this Institution. It commences on the 23d of June, 1830, and continues ten weeks. All persons who have previously belonged to this school, or who shall enter at Troy or Albany three days before the term commences, will be conveyed by a flotilla of towed canal boats to Lake Erie and returned at the end of the term

* Analyzed by Mr. Seybert, see Vol. XVII, p. 326, of this Journal.

in the same manner. The instruction will be conducted by the professors and assistants of the school, and will consist of lectures and examinations on the following subjects; viz. Mineralogy, Geology,* Botany, Zoology, Chemistry, Experimental Philosophy and Practical Mathematics, particularly Land Surveying, Harbor Surveying and Engineering. Applications will be made, by direct inspection of rocks and minerals in place, plants and minute animals in their native localities, the works of the engineer in actual operation, the labors of the agriculturist, &c. One of the largest boats belonging to the flotilla is to be furnished with a suitable chemical and philosophical apparatus, and cabinets in mineralogy and geology; a reading room, also, is intended to contain such scientific books as are deemed requisite for the course. Students of the course will be taught the method of procuring specimens in natural history, and required to make collections of whatever is interesting upon the route.

16. *Production of Hydro-cyanic (Prussic) acid, under uncommon circumstances.*—A. A. Hayes.—Wishing to decompose some nitric acid containing about one third its weight of dry acid, it was subjected to distillation, with one third of its weight of raw sugar; the distillation was attended by the production of vapors of nitrous and hyponitrous acids, as is usual in the decomposition of nitric acid. The fluid in the receiver was slightly acid; it was therefore returned to the retort, still containing the residue of the first operation, and gentle heat applied; the strong and peculiar odor of hydro-cyanic acid was developed, in such a quantity, as to render the atmosphere of a small room irrespirable. After cooling the apparatus and decanting the distilled fluid, a few drops of ammonia were added, and the alkaline fluid, mixed with a solution of proto-sulphate of iron, and a few drops of acid, deposited a bulky precipitate, which, on exposure, became of a fine blue color.

Roxbury Laboratory, March 16, 1830.

17. *Dr. Morton's paper.*—The conclusion of Dr. Morton's Synopsis of the Organic Remains of the sand formation, would have appeared in this number, had not the arrival of the MS and drawings, which were finished in season, been accidentally delayed: they will appear in the July number.

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* Prof. Eaton has recently published improved editions of his chemical and geological text books.

NOTICES OF RECENT AND FORTH-COMING SCIENTIFIC WORKS.

Foreign.

1. *Arcana of Science and Art: or one thousand popular inventions and improvements, abridged from the transactions of public societies, and from the scientific journals, British and foreign, of the past year,* (1829): London: 12mo. Vol. II. The first volume of this neat little work appeared in 1828, and has passed through a second edition. The object is to embody in each the discoveries and inventions in the popular arts and sciences, during each year, and present them to the public in an interesting form. Though designed for the general reader, it has still a dignified and manly character, with which we are greatly pleased.

Domestic.

1. *American Ornithology, or the Natural History of the Birds of the United States, illustrated with Plates, engraved and colored from original drawings, taken from nature:* by Alexander Wilson: with a sketch of the Author's life, by George Ord, F. L. S. &c.: New York: 3 vols. royal octavo—pp. 430, 456, 396; the plates to be in folio. The last volume of this valuable work has just been published. In the preface the editor says, that he "has adhered to the original text, correcting only some erroneous references and a few verbal inaccuracies, most of which were probably typographical errors.

"Wilson in his introduction, mentions its being desirable that the birds should be arranged scientifically; and takes notice of the causes that rendered it, at that time, impracticable. In fact, he was obliged to figure and describe his birds, nearly in the order in which he obtained them; and was therefore often compelled to place together those of the most dissimilar habits and characters, and to separate the male and female of the same species. In arranging them in proper order, the editor believes that he is merely accomplishing that which the author himself would have done, had he lived to prepare another edition. The original plates, engraved under the eye of Wilson, are employed in this edition, after having been carefully examined and retouched by Mr. Alexander Lawson, by whom most of them were executed."

2. *Encyclopaedia Americana,* Vol. II. pp. 600, has been published, since the notice of this work in our last Number. The execu-

tion is in the same superior style as that of the first volume: the third volume of this very valuable work may be shortly expected.

3. *The North American Medical and Surgical Journal*, No. XVII. January, 1830. Philadelphia: pp. 240. A circular accompanying this number says, "This work, instituted for the purpose of diffusing enlarged and instructive views of Theoretical and Practical Medicine, and its auxiliary branches, has been assiduously continued in the same spirit. Its pages are filled with whatever is calculated to promote sound ethics and improve the practice of the profession. Ancient and modern Medical literature, in *Reviews* and *Biographical Notices*—salutary reforms, and useful suggestions, in *Original Communications;* a carefully prepared digest of all the current events, so as to constitute the chronicles of the science, in a *Quarterly Summary*, have composed the materials for each successive number of this Journal, from its first appearance in January, 1826, down to the present time." The number before us contains six original communications, among the authors of which we recognize some of our most distinguished practitioners: the editors are gentlemen of the highest respectability in their department, and the work is a fair sample of the progress of "the sciences of observation," for which our country is beginning to attract attention.

4. *Conversations on the Animal Economy: designed for the instruction of youth and the perusal of general readers;* by Isaac Ray, M. D.: Portland, 12mo. pp. 242. An interesting work.

5. *The Southern Agriculturist, and Register of Rural Affairs; adapted to the southern section of the United States:* published monthly: Editor, J. D. Legare, Esq. We are gratified with every thing which tends to bring out the resources of our country. Those of an agricultural kind, in the southern portions, are yet but little known: the writings of Flint have placed the south western states before us in a light of which we had scarcely any conception before: the periodical under notice exhibits the south eastern parts in an interesting view. It has reached the commencement of its third year, and appears to be an important auxiliary to the agriculture of that section of the country.

6. Messrs. Carey & Lea, Philadelphia, have in press, *Elements of Myology, by John D. Godman, M. D. illustrated by a series of beautiful engravings of the muscles of the human body, on a plan heretofore unknown in this country.*

7. *Conversations on Vegetable Physiology, comprehending the Elements of Botany, with their application to Agriculture.* By THE AUTHOR OF CONVERSATIONS ON CHEMISTRY, "NATURAL PHILOSOPHY," &c. &c.; with copperplate engravings: 8vo.—New York, G. & C. & H. Carvill. 1830; with remarks on vegetable Physiology, &c. (Communicated.)

Whatever may be the fact with regard to elementary treatises and *vade-mecums* in other branches of Natural History, Botany, (at least since the publication of Nuttall's Introduction, the Lectures of Mrs. Lincoln and the present unpretending work,*) is so well supplied with these, as to leave little if any thing farther to wish for: and no obstacle whatever, can any longer be said to be in the way of those who may desire an easy acquisition of the essential principles of this science.

The author of this familiar treatise, who was before distinguished for her skill in presenting chemistry and natural philosophy, in a form so familiar as to be intelligible to all classes of readers, and so accurate as to be employed for text books in schools and academies, has lost nothing of her tact in the illlustration of botany. The little flippancies which sometimes occur in the dialogue, are scarcely entitled to a harsh remark, although they are not in good taste, and mar the dignity of a grave "Conversation."

Classification, formerly almost the sole object of the science, in her hands takes a subordinate place, while she unfolds the natural philosophy of vegetation. With considerate deference, she assigns the Linnean classes and orders their proper rank, as an important feature, and not the essence of botany. The natural method as suggested by Jussieu, and developed by De Candolle, is that adopted by the author. She remarks, that "De Candolle, so far from confining himself to the classification of plants, examines the vegetable kingdom in its most comprehensive and philosophic point of view. In describing the structure, he investigates the habits and properties of plants, and shows not only how wonderfully they have been formed to answer the purpose of their own multiplication and preservation, but how admirably they answer the higher purposes of ministering to the welfare of a superior order of beings—the animal creation; and more especially to that of man." This method discloses

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* Which deserves additional recommendation, from the fact, that it professes to have drawn its facts and opinions "almost exclusively from the lectures of a *distinguished professor at Geneva.*"

extensive benefits to the arts. It develops "colors for the dyer, and materials for the weaver, and extracts healing juices, and salutary poisons for the physician." But these points of utility are not all. The subject rises to the higher contemplations of sublime philosophy, displaying the wisdom and beneficence of the Creator, in the disposition of elements and agencies regulated by unerring laws—in a silent and unvarying process, sustaining and perfecting the vegetable world. A beautiful example of this occurs in the organization of plants, and in the mode by which they receive their aliment. The action of air, water, heat, and light, in sustaining and promoting their growth, is portrayed by this writer in the most lucid manner; after which an outline of their application to agriculture is given, as being one of the great ends of their creation.

Water containing silex, soda, lime, carbonic acid, magnesia, and potash, absorbed by the roots, forms the *ascending* sap; and after circulating through every ramification of the plant, a portion of the water is evaporated by the pores of the leaves, and the remaining part being chemically converted into a liquid suited to its nourishment, returns as *descending* sap, traversing every organ, and depositing in each the materials requisite for its sustenance and growth. The evaporation by the leaves is estimated at two thirds the quantity of water absorbed by the roots.

As carbon is the base of the vegetable skeleton, so it is a principal material of vegetable food; and there is no law of nature more beautiful than that which supplies it to the growing plant. The demand of plants for carbon, is an obvious reason why manure is necessary for the support of vegetation. It is essential that a thorough decomposition should take place, resolving the materials into their primitive elements; for when not thus separated, the ingredients are too gross to re-enter the vegetable system. Carbonic acid gas, being an abundant product of animal and vegetable decomposition, carbon is in this highly attenuated form conveyed by the water to the roots of the plant, and by the atmosphere to its leaves. In its passage among the leaves, the action of light decomposes the acid, occasioning the oxygen to part from the carbon, which is then distributed by the descending sap, and appropriately deposited in the various organs of the plant. Without the agency of the leaves in throwing off the oxygen, the carbon would not be incorporated and assimilated in its solid form, nor be deposited in sufficient quantity to perform so important a part. The disintegration of rocks, however finely pulverized could not furnish the material of vegetable substance, although minute portions are occasionally conveyed into the vegetable system, by the all pervading agency of water, yet the co-operation of the earth is indispensable; it supports the plant in its place, shelters the roots, and adapts their position to receive the necessary aliment, mingles with, and tempers the viscous quality of manure, and finally, keeping back the rigid matters while the water passes through the necessary ingredients, yields it to the roots filtered and refined, and laden with the elements of vegetable life.

Hydrogen, one of the constituents of water, enters into a chemical combination with parts of the plants, and becomes identified with the solid tissue. It enters largely into resins and gums. The remaining portion of water not evaporated, retains its liquid form, and appears in the sap, and in the juices of leaves and fruit. Nitrogen, another gaseous material, obtained chiefly from animal decompositions, enters in small portions into the composition of some vegetables occasioning, during their spontaneous decomposition, a strong disagreeable odor, of which cabbage and mushrooms are examples.

The alkalies, acids, and earths, have their appropriate use in modifying the consistency, flavors, odors and colors of vegetables, as they are variously elaborated and combined.

The fibrous tissue of leaves is of a yellowish white. M. Sennebier considers the native color of carbon to be not black, but blue. This, when deposited in the yellow substance of the leaf, and subjected to the action of light, causes the beautiful hues of green which overspread the earth. The more carbon and the stronger the light, the harder the leaf and the deeper the tinge; less carbon allows more water, hence a softer leaf and lighter color, rendered still paler by shade. The color of carbon is doubtless changed by chemical agencies, in the wood, bark and flowers. But although this, and the influence of electricity, with many other interesting facts in the physiology of vegetables, have engaged the attention of naturalists, sufficient insight has not been obtained to establish conclusive opinions. Perhaps they are beyond the limit of human inquiry, and are referable to those operations, where "the mysterious principle of life" acts its important part.

8. *The Natural, Statistical, and Civil History of the State of New York, in three Volumes*, 8vo. by James MacAuley. New York, Gould & Banks, and Wm. Gould & Co. (Communicated.)—

It is peculiar to the history of this country, that it commences with precise data. The names, character, and complexion of the settlers; their motives for emigration, and their success in subduing the wilderness and its savage inhabitants; the origin and progress of arts and letters; of society and government—are all matters of record. Nor are the capacities of the country omitted. The climates, seas, rivers, soils, metals, minerals, and animal and vegetable products, are extensively described from actual observation and survey. This advantage appears peculiarly striking, when we observe the labors of the curious or philosophical inquirer, in the old world, who bores the solid earth, navigates unknown oceans, uncovers buried cities, or reveals the secrets of the catacombs to find some clue to the origin of nations, to discover the founders of cities, and to ascertain the progress of science, of mechanical skill, and of mental improvement in earlier ages.

Among the numerous works teeming with information relative to this country, is MacAuley's History of New York. This is in many respects a valuable, though not a very agreeable book. It comprises a vast amount of facts, which give stronger evidence of the author's patience and industry in collecting materials, than of his skill and taste in arranging them. The details are very minute, and sometimes extended with repetitious prolixity; but whoever will persevere in the labor of reading them, will obtain a thorough knowledge of the origin and settlement of the State—of its progress in population and government—and of its aspects and resources. The first volume describes its physiological features; the other two contain some interesting accounts of the Indians, with extensive statistical details, and the history of the State from its first settlement in 1614 to the adoption of the federal constitution after the close of the revolutionary war.

9. *Practical Instructions for the culture of Silk and the Mulberry Tree;* by Felix Pascalis, M. D. 2 vols. 8vo. pp. 112 and 105. New York; and *Essays on American Silk and the best means of rendering it a source of individual and national wealth, with directions to farmers for raising silk worms;* by John D'Homergue and Peter Stephen Duponceau. 12mo. pp. 120, Philadelphia. The first part of the interesting and valuable work of Dr. Felix Pascalis on silk, was mentioned in Vol. XVII, p. 202 of this Journal. Both this and the recent treatise from the Philadelphia press are valuable

and well executed works, on a subject of great interest to our country. We shall hope still to receive a more extended notice of them and of the subject, which was promised for the present number of this Journal.

OBITUARY.

Died in New Haven, his native town, Feb. 3, 1830, Col. JARED MANSFIELD, LL. D. aged 71, formerly surveyor general of the United States, and recently and for many years, both before and after his holding the office of surveyor general, Prof. Nat. Phil. in Mil. Acad. West Point. He was graduated at Yale College in 1777—visited England in his youth, was early employed as an instructor of the Hopkins Grammar School in New Haven, and afterwards of that sustained by the friends at Philadelphia; when a little boy he discovered a strong taste for mathematics, and great ability in that subject. He was accustomed to examine the students in Yale College at the public examinations and although he did it with great kindness and candor, the students feared his questions because they had no connexion with their text books, but grew out of a comprehensive and familiar knowledge of the whole science. About thirty years since, he published a volume of essays, mathematical and physical, which were highly appreciated by those who were masters of the subjects. He introduced great improvements in surveying the public lands, and was distinguished for zeal and success in the important duties of an instructor at West Point. He was familiar, from early life, with Newton's Principia and with the other works of the great masters of that school and age of philosophy, as well as of more ancient and modern times. His admiration of Newton was almost a passion, as appears from the retrospective reviews written by him and inserted in Vols. XI. XII. and XIII. of this Journal.

Col. Mansfield was much beloved by his numerous friends and pupils, and among the latter are some of our most eminent engineers and mathematicians.

He was a warm friend to the cause of science, and to this Journal and its editor, as humble agents in promoting it; and his active services in the common cause were rendered in a manner so cordial and disinterested, as at once to increase the sense and lighten the pressure of obligation. Col. Mansfield was one of those men whose life and labors have added to the knowledge, the honor and the happiness of their country.

Miss C. S. del.ʳ on stone *From a drawing by D. Wadsworth in India Ink* *Pendleton's Lithy. Boston*

VIEW NEAR THE UPPER FALLS, ON THE GENESEE RIVER.

THE

AMERICAN

JOURNAL OF SCIENCE, &c.

Art. I.—*Illustrations of a View taken from the Upper Falls of the Genessee River; in a letter to the Editor, from* Daniel Wadsworth, Esq.

TO PROFESSOR SILLIMAN.

My Dear Sir—The view I send you, is taken from the vicinity of the upper Falls of the Genessee River, a quarter of a mile below the last cascade,—twenty-three miles above Moscow, and about sixty south of Lake Ontario. The river, in its windings, traverses a much greater distance, before it reaches the lake. The rock which, in the drawing, is facing the spectator, rises probably to the height of four hundred and fifty feet.* The scenery in this neighborhood is very little known,—but when all the points worth visiting, both at the top and foot of the rocks, are rendered more accessible, and there are good accommodations for lodging, it must become a place of great resort; and not improbably this may have taken place, since† my visit to the spot, so rapidly does every thing advance in this country.

There are three distinct falls, included in a distance of three miles. They differ as much as possible from each other; having their own peculiar beauties, and each a different and laborious approach; they are respectively sixty, ninety, and one hundred and ten feet high. To see them all, is now, no light undertaking, but will soon, I think, be rendered a very easy one.

The cascades themselves, would, any where else, be objects of great admiration, and are fully deserving of a particular, and separate description. But they are almost forgotten, in the feelings of

* As we were gazing, in some trepidation, from the brink of the less elevated, but nearer precipice on the left, a hardy young man of the party, exclaimed with an almost inarticulate voice, "I wonder these trees are not afraid to grow here."

† Now two and a half years.

Miss C. S. del^t on stone *From a drawing by D. Wadsworth in India Ink* *Pendleton's Lithog^y*

VIEW NEAR THE UPPER FALLS, ON THE GENESEE RIVER.

wonder, and even of fear, with which the sublime perpendicular walls of the river, inspire you. They may truly be called walls,—for they do not, like the beautiful rocks at Trenton, recede as they approach the top; but are for a great distance, perfectly upright, or impending, and almost as regular, for a great part of three miles, as a work of art, and rising, as the inhabitants around tell you, from two to five hundred feet; and so they appear, but probably four hundred is not beyond the truth. To this depth, the river seems to have worn its circuitous passage, in the solid rock,—in turns almost as short, and bends nearly as graceful, as if winding through the softest meadows. I have never witnessed in nature, a scene of more savage grandeur and loneliness, than the view from these fearful walls, when looking into the gulf from one of their highest points, to the very edge of which, by trusting to the boughs of the thick shrubbery, you can approach, without apparent danger. Gigantic evergreens stand upon the extreme verge, lifting their tops to the clouds, and *looking* unconsciously over the awful precipice which man cannot approach *without alarm*, and they seem from their vast height, to have held their places on this brink, for ages.

The spectator, in the drawing, is supposed to stand about one hundred and fifty feet above the river—and the wall of rock, in the bend facing him, to be four hundred and fifty feet high.

Remarks by the Editor.

The view given in the frontispiece was sketched by Mr. Wadsworth, during a journey in the autumn of 1827; and he has, at my request, permitted it to appear in the present place, because, as I conceive, it illustrates, in a very striking manner, not only the picturesque scenery of that interesting region, but also the peculiar geological structure upon which it depends. Happily, these two subjects, the one so interesting to science, and the other to taste and moral feeling, are capable of being blended, in a manner both highly instructive and delightful. If the painter were always a geologist, his sketches of rock scenery, and of the ever varying outline of landscape, as it is seen in hills, plains, valleys, waters and mountains, would assume a verisimilitude, depending on physical laws, since none of these features are matters of chance; were the geologist a painter, he would breathe into his faithful graphic outlines, the living spirit of the sublime and beautiful; the beholder would be arrested, through his imagination, as well as his understanding; and were the powers of poetry added, or at least the ability to conceive, with correctness, the exactness of fact; to feel, vividly, the imagery impressed on the face of the landscape; and the power to paint it, as graphically in language, as in sketches and colors, the subject would then assume its highest interest, and attract attention from a large class of admirers. There are many scenes, in this country, which are interesting, in all the particulars alluded to, and sketches of them would be perfectly appropriate to a Journal of Science. We have the example of the Geological Society of London, whose instructive volumes are adorned by many views, distinguished equally by their picturesque and scientific character. The region of the Genessee and Niagara rivers, which I had an opportunity of observing, on the same tour, in which the frontispiece was sketched,* are remarkable for their very distinct and almost horizontal stratification.† The rocks, consisting principally of limestone, sandstone and slate, although greatly indented on the surface; scooped into deep basins and valleys, swollen into high hills, and presenting great variety of outline in the sweeps of bold and beautiful curves, are, generally, laid down, with the regularity of a work of of art, and remain, evidently, in the horizontal position into which they first subsided. Wherever a distinct section is exposed, as at the high banks of the Genessee river, near Geneseo, there are similar precipices, and of a height probably not inferior to that of the cliffs, described and depicted by Mr. Wadsworth; the observer is impressed by the grandeur of the piles; by the different colors of the alternating strata of rocks reposing upon each other in perfect order, as if reared by the mason's art and power; by the mild beauty of the trees, shrubs and verdure, on their summits and edges, and by the enormous masses, which time has thrown down in ruins, to be washed by the ceaseless wear of a river, always powerful, and at times, swollen to an overwhelming torrent.

The mighty Niagara, it is well known, has worn its passage through rocks, similar to those on the Genessee, and the tourist, trusting in the skill of the boatmen who, in open skiffs, at the very foot of the cataract, tempt that raging flood of billows, breakers, and whirlpools, contemplates in safety, the stupendous stratification of a canal, obviously deepened, if not formed by the river; which has been receding, in time, from Lake Ontario; is still travelling towards the upper inland seas, and which may be destined, in still remoter time, to drain their beds, and to surrender them to agriculture and the arts of life.

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* I was not at that exact spot, but saw similar scenes on the same river.

† At least, as old as the ancient secondary.

Art. II.—*Architecture in the United States.*

It is proposed in this article to consider,

1. The most appropriate use of the Grecian orders;
2. The application of the Grecian temple form to modern purposes;
3. The Gothic style;
4. Public monuments and other ornamental architecture; and
5. Domestic architecture and ornamental grounds.

We will commence with the Grecian and the Roman Doric. Of these the Roman is the one more frequently employed in our country. It differs from the Grecian in having a base; in the height of its shaft, which is eight diameters instead of six; in the capital, which is richer but less natural than the Grecian; in the disposition of the triglyphs; in the admission of a variety of decorations; in the metopes, and in a more richly moulded frieze. Its characteristic is a cheerful dignity, which is often very agreeable, and for which we could perhaps find no substitute in the other orders. I should be far from desiring its exclusion; but wish to have its proper character, and the danger to which we are exposed in using it, clearly understood. The latter arises from the inherent richness of the order, seen in the numerous mouldings, and in the variety of ornament which it admits. A flower, an ox-head, a fillet or something of this kind is almost universally employed in the metopes, and seems indeed to be requisite in order to have the frieze in just keeping with the column and with the remaining parts of the entablature. But there is danger in all this. The powers of the architect are frittered away on these minute parts; he forgets that the building must take its merit from its powers *as a whole;* his mind is distracted amid this variety; his taste is vitiated, and the taste of the public is lowered in the same degree. I venture to say that no architect who employs himself entirely or even mainly with the Roman orders, can rise to great eminence in his art. His edifice will fail in the most essential part, *in expression.* By *expression,* is meant its power of acting as a whole on the imagination and feelings of the beholder. Here is the most difficult part of an architect's labors, and the most important, the part indeed in which his character is chiefly shewn. I intended to commence this article with an analysis of expression in building, and its difficulties, with an enquiry into an architect's education in regard to it; but the subject was found to be too extensive for my present limits and was relinquished. I must be allowed however a quotation from the writings of a man, whose comprehensive and practical knowledge of the arts entitles every thing from him to our highest confidence—I mean Sir Joshua Reynolds.

"I observe as a fundamental ground, common to all the arts with which we have any concern in this discourse,* that they address themselves only to two faculties of the mind, its imagination and sensibility. All theories which attempt to direct or to control the art, when any principles falsely called rational, which we form to ourselves upon a supposition of what ought in reason to be the end or means of art, independent of the known first effects produced by objects on the imagination, must be false and delusive. For although it may appear bold to say it, the imagination is here the residence of truth. If the imagination be affected, the conclusion is fairly shewn; if it be not affected, the reasoning is erroneous, because the end is not obtained; the effect itself being the test and the only test of the truth and efficacy of the means." * * * "It remains only to speak a few words of architecture, which does not come under the denomination of an imitative art. It applies itself, like music, (and I believe we may add poetry,) directly to the imagination, without the intervention of any kind of imitation. There is in architecture, as in painting, an inferior branch of art, in which the imagination appears to have no concern. It [architecture] does not however, acquire the name of a polite and liberal art from its usefulness or administering to our wants or necessities, but from some higher principle: we are sure that in the hands of a man of genius it is capable of inspiring sentiment and of filling the mind with great and sublime ideas.

"It may be worth the attention of artists to consider what materials are in their hands that may contribute to this end; and whether this art has it not in its power to address itself to the imagination with effect, by more ways than are generally employed by architects. To pass over the effect produced by that general symmetry and proportion by which the eye is delighted, as the ear is with music, architecture certainly possesses many principles in common with poetry and painting."

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* Thirteenth discourse before the Royal Academy; the subjects of which are painting, poetry, acting, gardening and architecture. The whole of these discourses are well worthy of an architect's attention.

In the eleventh discourse (which, though on painting, contains many principles applicable to architecture) he says—

"If my expression can convey my idea, I wish to distinguish excellence of this kind by calling it the genius of mechanical performance. This genius consists, I conceive, in the power of expressing that which employs your pencil, whatever it may be, *as a whole;* so that the general effect and power of the whole may take possession of the mind; and for a while suspend the consideration of the subordinate and particular beauties or defects.

"The advantage of this method of considering objects is what I wish now more particularly to enforce. At the same time I do not forget that a painter must have the power of contracting as well as dilating his sight; because, he that does not at all express particulars, expresses nothing; yet it is certain that a nice discrimination of minute circumstances and a punctilious delineation of them, whatever excellence it may have, (and I do not mean to detract from it,) never did confer on the artist the character of genius.

"Besides those minute differences in things which are frequently not observed at all, and when they are make little impression, there are in all considerable objects great characteristic distinctions, which press strongly on the senses, and therefore fix the imagination. These are by no means, as some persons think, an aggregate of all the small discriminating particulars; nor will such an accumulation of particulars ever express them. These answer to what I have heard great lawyers call the leading points in a case, or the leading cases relative to these points.

"The detail of particulars, which does not assist the expression of the main character is worse than useless, it is mischievous, as it dissipates the attention, and draws it from the principal point. It may be remarked, that the impression which is left on our mind, even of things which are familiar to us, is seldom more than their general effect; beyond which we do not look in recognising such objects. To express this in painting, is to express what is congenial and natural to the mind of man, and what gives him by reflection his own mode of conceiving. The other presupposes *nicety* and *research*, which are only the business of the curious and attentive, and therefore does not speak to the general sense of the whole species; in which common, and, as I may so call it, mother tongue every thing grand and comprehensive must be uttered.

"I do not mean to prescribe what degree of attention ought to be paid to the minute parts; this is hard to settle. We are sure that it is expressing the general effect of the whole, which alone can give to objects their true and touching character; and wherever this is observed, whatever else may be neglected, we acknowledge the hand of a master."

Besides the danger into which the Roman Doric is apt to lead us of neglecting this expression *as a whole*, in attention to minute parts, there are many purposes to which its powers are unequal, and for which we must resort to something else. In most large edifices we wish to express grandeur, or majesty or solemnity, or perhaps all of these united. All these we shall find in the *Grecian Doric.* I congratulate the country on the prospects of this order among us. It has hitherto been little used, but the reception it has met with augurs most favorably of its success. The Bank of the United States, at Philadelphia, is an example of this; indeed I know of no instance where it has been employed, in which its pure, chaste and noble character has not been at once appreciated. There is in it so much of true grandeur united with great simplicity; such boldness joined with delicacy in the outlines; such apparent recklessness of effect; such disregard of every thing extraneous, and seeming confidence in its own inherent merits; in short such consonance in all its parts, with the principles of beauty with which we have been familiar in nature, that every one feels immediately a charm to which he has not been accustomed in architectural objects. Every visiter at Philadelphia speaks of its bank, and every citizen is proud of it. I hope the use of this order will become the characteristic of architecture in our country. In churches, in large banks, in houses for legislation or for the administration of laws, and for all edifices where grave and simple majesty is requisite in the expression, the Grecian Doric should be employed. It is an order however that will admit of no dallying, and he who uses it will have a difficult part to do, if he wishes to use it with its proper effect. For edifices in which we desire a pleasing and cheerful dignity, the Roman Doric seems to be well adapted: it is sometimes employed with advantage in private buildings; but for these a much more appropriate order may be found in the *Ionic.*

In the *Ionic*, we must also distinguish between the Grecian and the Roman order. They differ in the height of the shaft, the Grecian requiring eight, the Roman nine diameters; and in the capital. The Grecian capital was characterized by two large volutes, supposed by some to be copied from the curling of hair, or of the bark of trees, or of the leaves of tender plants; but it is more probably only an improvement on capitals to be seen among the ruins of Persepolis, in which a strong resemblance of parts may be traced. The curving of the Grecian volute is extremely graceful and the whole order has taken a corresponding character. The Romans diminished the size of the volute, and also formed a new order by changing the two parallel volutes into four diagonal ones, and uniting these with the lower part of the Corinthian capital. This forms the *composite order;* the latter addition is more frequently rejected, the four diagonal volutes alone being used, under the name of the *modern Ionic.* In all these changes the beautiful and striking sweep of the volute is entirely lost, and the characteristic of the order is turned into mere driblets, through fondness for a variety of parts. The composite and the modern Ionic have no *whole;* nothing to fasten on the mind and to which we may readily and naturally bring all the rest to bear. The *whole* of the Grecian Ionic is gracefulness, extreme neatness with extreme beauty; the expression of the entire edifice is made to correspond, and the sensations it communicates are of the most pleasing kind. We should not employ then, either the Composite or the modern Ionic, in the main part of a building, or in any part where *expression* is desired.

We should be far, however, from excluding them entirely from our buildings: they are certainly not devoid of beauty, and may often be used with advantage as subsidiaries to the Grecian order: while we reserve the latter for the façade and those parts which are chiefly to give character to the edifice, these may be assigned to the more retired situations, where they will serve to give variety, without destroying the unity of design. They will thus also save our respect for the principal order, by keeping it from being employed in the inferior parts: their character, rich and pleasing, without being very expressive, seems to adapt them in every respect, to such an use.

We come now to the Corinthian. This order has made an effort among us for the preference which it has received in most other countries, and with considerable success. The ease with which it may be employed has probably contributed to this. It transfers the labor of an architect from his mind to his hands, and almost any one who has mechanical skill enough to shape its several parts, may use it with success. It is also the richest of the orders, and the glare of its ornament is well calculated to dazzle the minds of those who look not beyond the mere parade of the arts. Here is its greatest danger—the *great* danger; and I venture to say, that if the Corinthian becomes our favorite order, we shall never rise to any eminence in architecture. We can take no such certain method of corrupting our taste, and of preserving it corrupted, as to encourage this order. But I believe there need be no great fear of its success. It can never be used for churches with any propriety, and I do not now recollect an instance of its being so used in the country: it must there give way to the other orders; and where these are fairly introduced, the Corinthian will sink to its proper rank. It is well suited to edifices of gay character, and there let it remain. A word or two about the fanciful story of its origin, which has sometimes gained it admirers. A basket, it is said, covered with a square tile, was left on the grave of a Corinthian young lady: it chanced to have been placed on an acanthus, and this growing up and curving around the basket, furnished the idea of the capital, called, from this circumstance, Corinthian. This is pretty enough when we think of the acanthus in its proper place, on the ground, and curving from beneath a basket of trinkets; but when we transfer it to the top of a pillar, with a heavy entablature above, it is too much at variance with nature and propriety for the refined age of Pericles, when the invention is said to have taken place. It is doubtless originally from Egypt, where columns still exist to which it has a strong resemblance. They resemble bundles of the stalks of the lotus, the leaves of which curving from the upper part, are formed into a capital.

Let us delay a few minutes now to take a hasty review.

Grecian Doric—the highest effort of the art: characterized by grandeur and majesty: to be employed in all buildings where such an expression is desired; in churches, in edifices for making or administering laws; in the larger banks; occasionally in colleges and similar institutions; never in private houses.

Roman Doric.—Its character a pleasing and cheerful dignity: to be used wherever this expression may be desired; but to be used with caution.

Grecian Ionic.—Gracefulness its characteristic: suited to the smaller kinds of banks; to edifices for the exhibition of the arts; sometimes for college buildings; and for the larger kind of private dwellings.

Roman and Modern Ionic.—To be used in subservience to the preceding, in order to keep it from being made common, and for the sake of variety: suited to rear porticos and the like.

Corinthian.—Gay and showy : to be employed in edifices adapted to such purposes as these.

The Grecian Temple Form.

Can the Grecian temple form be applied to modern uses? This question is pressed upon us by the inherent beauty of the form itself, and by the fact that there is scarcely an oblong building in the country, with pillars, that does not claim to be modelled after the Parthenon or some other Grecian or Roman temple. In the last article I endeavored to give the reader an idea of the Grecian temple of the *Peripteral* form, that is, with pillars all around : in addition to this was the *Prostyle*, having a row of pillars only at one end ; the *Amphiprostyle*, with a row at each end ; the *Dipteral*, with a double row all around ; and the *Pseudo-Dipteral*, with a single row all around, but this placed as far from the cell, as if another one had intervened. The Peripteral was the one usually employed. In the choice of the ground itself, the Greeks seem not to have been very particular. The Parthenon was on a steep eminence : the temple of Minerva at Cape Sunium was also on an eminence, of steep ascent : but the temples of Theseus, of Ceres at Eleusis, of Venus at Egina, and the massive temple at Corinth, were on ground nearly or quite on a level with that around, though eminences in all these cases might have been easily procured. I should myself prefer an elevated spot for a Grecian building, but this seems by no means to have been considered essential. The *side* of a hill however should never be chosen, when it can be avoided. The Greeks seem to have been particularly careful to have the peribolus or area, from which the temple was to rise, horizontal ; and in the case of the temples at Cape Sunium, and of Jupiter Olympus at Athens, high walls are built up in several spots to support the filling up of ground necessary for this. Indeed, few large buildings can appear to advantage when the ground is higher on one side than on the other. The pavement or floor of their temples was never elevated more than about three feet (the ascent was by three steps) above the peribolus, and the whole elevation of the temple was formed to this. A basement story therefore, or any thing resembling it, is certainly out of character : when there may chance to be an absolute necessity for one, we should avoid giving it the appearance of any connexion with the remainder of the building ; which may easily be done by making it of coarse rubble work, or by a large offset, and by having its color different from that of the parts above. So far there is no difficulty in employing the Grecian form ; but one of a serious character yet remains to be mentioned :—the cell has no opening in its side for the admission of light. Should it be said that windows may easily be made, since our necessities demand them, I answer that the experiment is a dangerous one. When an object is complete and perfect, we cannot change any one of its parts, without great risk of spoiling the whole. It is so in the present case. The Greek temple grew up without occasion for more light than could be admitted through the door or openings in the roof, and every part of it was accommodated to this circumstance. With this, the solid and heavy entablatures are in perfect keeping, and we shall always find a difficulty in reconciling them to any other. The Grecian Doric entablature is one third of the height of its column: the upper line of the windows must be at least several feet below the entablature ; and thus, while the lower part of the building is pierced with numerous openings, nearly five twelfths of it remain above this in its original solid and heavy form. The inferior part, thus honey-combed, seems ill suited to the superincumbent weight. I speak however on this point with diffidence, and perhaps should not speak at all, if my observation of the minds of others did not correspond with the effect on my own. I believe I have never yet seen a person taken, for the first time, to a building of this kind, who did not immediately ask if the entablature was not entirely out of proportion with the other parts. The fault was not in the entablature, but in the windows below. Should it be objected to this that the columns, though placed at considerable intervals, support the same weight without any incongruity, I answer that the upright posture of the pillars offers a full preparation for this weight; but in the other case the pressure is on horizontal objects, for such is the posture of the materials which compose the cells. The difficulty may perhaps be obviated by panelling the sides and placing the windows in the sunken parts of the wall, where they would be less observed, and would scarcely be felt, indeed, to interfere with the general appearance of the building. Parts of the cell would then also assume a vertical character, and the entablature would have an adequate support. This, it is true, would destroy the simplicity of the cell in a great degree : but this simplicity must at all events be destroyed by the windows ; and the question is, whether they shall be a prominent and striking object, weakening the substructure, or whether the strength of this part shall be preserved, and the windows withdrawn in a great measure from our notice. We have, I believe, no purpose that will allow the pure Grecian form. Banks would do it, as far as light is concerned; for sufficient light might be admitted from above, and for them this is the best kind of light; but the heat of such an edifice in summer would be intolerable.

The Gothic Style.

We pass now to a consideration of the Gothic style. The strong resemblance borne by the arches and rich tracery of this style, to the appearance presented by groups of certain species of trees, has made the impression general, that this was its origin. The idea was strongly advocated by Sir James Hall, in a memoir before the Royal Society of Edinburgh in 1797. It is a pretty theory, but unfortunately it has no support in history; and the transition from the Roman to the Gothic, which can be clearly traced in the ancient Italian and English buildings, is too gradual to warrant such an idea. The Romans, as was said in the last article, introduced the semicircular arch, causing it often to spring immediately from the pillars: the meeting of such arches, and still more their interlacing, when they were used, as was sometimes the case, in a kind of relief against the façade of an edifice, suggested the idea of the *pointed* arch: it came slowly into use: the arches had a lighter character than those of the semicircular form, and the columns were made by degrees to correspond: it had now become a distinct style, and had begun to attract attention: the singular yet beautiful ornamenting of the Saracenic style was added by the Crusaders; some tincture of the Moorish was also perhaps given by travellers from the South of Spain: architecture, with the other arts, was reviving; and, as artists could now be no longer mere copyists, but were thrown on the resources of their own minds, the Gothic grew up into a style of exquisite beauty. Its characters become more strongly marked as we recede from Italy, probably from the fact that in these nations its advances were less checked by a regard for the more ancient styles. England is supposed to present the best examples of the Gothic. In the edifices of that country, we can trace the whole progress of this style. The oldest remains exhibit the semicircular arch, supported by short heavy columns, evidently copies from the Roman. These belong to the period of the Saxon government. The Normans introduced higher pillars and more lofty vaultings, with more lightness and greater delicacy of ornament. The pointed arch seems to have been employed, for the first time, soon after the conquest, a well authenticated example, belonging to the year 1092, being still to be seen in Winchester cathedral. It seems to have come slowly into use, until about the year 1240, when it drew attention, and its progress became more rapid. Up to the year 1272, however, when the first Edward ascended the throne, the style had not acquired much beauty : the pillars, it is true, had become tall and clustering, but the windows were narrow and plain, and the arch was suffered to retain an extreme degree of sharpness. All this constitutes what is called by architects the *first order* of the Gothic, its chief feature being the arch first spoken of, termed, from its shape, the Lancet arch. The *second order* embraces all between the year 1272 and the end of the following century. During this period the style made rapid improvements. The arch was depressed, though still kept considerably above a semicircle; the pillars received additional lightness, were more gracefully clustered, and were united under one capital; numerous tasteful ornaments were added ; the windows were enlarged, and were enriched with tracery; stained glass was employed, sometimes forming beautiful devices, sometimes historical pictures ;—the whole style became bold, rich and imposing. Here artists should have stopped ; for there is a point in all species of architecture, beyond which every attempt at improvement must fail ; and this point had now been reached in the Gothic. Changes however followed, during the fifteenth century, in quick succession. The arch, though still kept pointed, was depressed below a semicircle ; the walls of the churches were reduced to an extreme of thinness, and by the great extension and multiplication of windows, became little more than a case or frame for glass ; the windows were endlessly divided by mullions ; tracery and other ornaments were crowded into them and on the ceiling ; pendants were introduced, and the striking majesty of this style was lost in the multiplication of minute parts. This is the *third order* of the Gothic. Some of its ornaments are of great delicacy and beauty, and in forming our taste for this style of architecture, should by no means be neglected ; but the period from 1272 to 1400, is to be considered the golden age of the Gothic, and to it we should go for the more characteristic parts.

The main feature in all the three orders is the arch. The lancet-shaped arch has little beauty, and as there is little danger that it will be much used in our country, we will pass it by : the other two are both employed and deserve a more attentive consideration. Let us prepare ourselves for it by some notice of the object of the Gothic style.

We adverted to these in a brief comparison, in the last article, between this and the Grecian architecture. The latter aims only at gratifying the taste: to this point it concentrates all its powers, and while success is rendered difficult by the singleness of its aim, the pleasure is of the most thrilling kind, when it does succeed. The Gothic operates on all our sensations. With the pleasures of taste are mingled astonishment, fear, wonder, awe; we are delighted, but it is solemn delight; we would criticise, but our faculties become overpowered and subdued; we feel weak and humbled, and then loose all recollection of ourselves amid the majesty and the exalted grandeur of the scene. These are the most prominent effects of a Gothic edifice, and should be the object of its various parts. The arch of the second order is well adapted to such a result. It is in perfect keeping with the tall clustering pillars, one of the greatest ornaments of the art, and by the height to which it rises, adds to the vastness of the dimensions, another striking trait in the Gothic style. At the same time it has in itself much grandeur and nobleness of expression. The uniform sweep of the semicircle is not devoid of gracefulness, but when used in the larger kind of arches, it has an air of heaviness, which requires strong supports to correspond. When it springs from pillars, they are accordingly made short and of large diameter. The same remark as to heaviness, will apply to the Gothic arch of the third order, which, as has been said, is depressed below a semicircle, and which, as it approaches the horizontal line of the Grecian entablature, requires its column to approach in the same degree to those of the Grecian style. This heaviness is relieved somewhat, it is true, by the pointed character which it still in some degree retains, but still there remains the incongruity between a tall, light pillar, and a low flat arch above. There is another consideration arising partly from taste, partly from mechanical considerations. I refer to lateral pressure. This in the depressed arch is very great. The Gothic style, as has been said, delights in creating mechanical difficulties, and in the exhibitions of skill which they occasion, but the beholder must be made to see that they are overcome: otherwise the sensation we receive from them is a painful one. Mine have never failed to be of that character, where a wide sweep of low arch has been presented without any thing to counterbalance its lateral pressure. Such counterbalance is formed sometimes in buttresses, which are to be considered as a part of this style, but when the pressure of a large arch is resisted on each side only by the pressure of one not half its size, as must be the case in the nave and aisles of our churches, the inequality is at once seen, and the impression does not fail to be a disagreeable one. The lateral pressure, indeed, is not equal in the arches of the second order: but in these it is comparatively trifling, and not being pressed on our attention, the difference is not often observed, or if observed, produces no striking effect on the mind. Such impressions must be carefully regarded. The arch is the most important feature in the Gothic style: it draws our attention first: it gives a character to the whole edifice, and our feelings are pleasant or painful as they are affected by it. The depressed arch is, however, not without its uses. It can be used in door-ways, and often in other subordinate parts with great advantage; but in the main portions of an edifice, those which are to determine its character, the arch of the second order should be employed. Its noble and imposing form, its lightness, its keeping with the graceful clustered columns of this style, its complete adaptedness to all the purposes of Gothic architecture, entitle it to this.

But after determining on the arch, much still remains to be done, if we wish to form a Gothic edifice. And first, as to the form of the building. In the Grecian style, simplicity, we have remarked, is the most striking quality: a *simple Gothic* building is a contradiction of term. Simplicity has no part in the whole matter. When therefore we build up smooth walls, with plain pointed windows, and call this Gothic we most egregiously mistake. The aim of the Grecian, let me say again, is to bring all the parts within the compass of the mind, and subject them to its keenest perceptions: that of the Gothic is to confound the attention, and while the powers of the mind are thus weakened, to bring it completely under its control. To do this, it multiplies its parts, and studies a certain degree of irregularity and apparent disorder. Hence arises the difficulty of reducing it to any kind of rule: the European edifices have been measured, and attempts have been made to discover from them some system for the government of architects, but one object of the style, and one on which its success greatly depended, was to baffle all efforts at systematizing, and we can rarely discover any thing like rule, or system. Whenever we can, the mind gains so far the mastery over the style, and the architect is soon perceived to have so far failed. There arises here a singular difference between a Grecian and a Gothic edifice. The former at first sight always appears smaller than it really is, but the longer and oftener we look at it the more its parts enlarge, till what was at first seemingly diminutive, becomes vast and grand; the latter on the contrary when first observed, always appears larger than the reality, and is apt to shrink in its dimensions as we inspect it more closely. In the case of the Gothic, our first emotion is astonishment and admiration; but the mind soon begins to generalize its parts, and as it succeeds, the strong power of the building declines: but the architect who understands his business, anticipates us here; he foils us in every effort at generalizing; the powers of our mind are kept divided and weakened, and the edifice still retains its control. While we avoid simplicity, however, we must not run into the other extreme, either of confusion or finesse: the one will weary, the other will disgust, the beholder.

Our country labors under many disadvantages, as regards the Gothic style. Its expensive character is in most cases far beyond our means. It flourished in Europe at a time when the revenues of the church were princely, and no style demands such large pecuniary resources as this. Still, enough has already been done among us, to shew that this is not an insurmountable obstacle. There is another important difficulty in the nature of Protestant worship. The interior of our edifices for worship must not be broken up into parts. The best form for a Protestant church is a rectangular parallelogram, though I have seen the circle and other simple forms employed, seemingly, without any inconvenient results. But any thing like a cross, the favorite form of the Gothic, is entirely inadmissible. There is at Washington a church in form of a Greek cross, in good taste as to its general architecture, but in consequence of its shape, a part of the congregation cannot see the minister, and the want of *fitness* in the interior, is exceedingly unpleasant. But still, I do not despair. The smoothness of the walls, on the exterior, may be broken by buttresses and other projections, and the simplicity of the interior is kept from being strongly felt by galleries, which, on this account, I do not consider a great evil, notwithstanding the outcry frequently made against them by writers on this style. The reader will bear in mind that we speak of churches, as they must exist, among us. Could we have them, with the same multiplicity of parts as those in Catholic countries, a gallery would be an evil; it adds nothing to the grandeur of an edifice, and in them it would not be needed. But the case is different with us. The form of our churches, as I have said, must be simple, a quality entirely at variance with this style, and without something to conceal and draw attention from this plainness, their interior will appear meagre and bare. Galleries assist in doing this, but the edifice should be accommodated to them, and they to it, more than is now usually done. The windows should be so constructed, that we may feel that the gallery is not concealing their beauty from our view: and on the other hand, the gallery should not be carried in a straight horizontal line from pillar to pillar, in the manner of a Grecian entablature, but should be supported by low arches of the third order, and should be made to preserve the Gothic character throughout. The great variety of arches and of ornaments admitted by the style, will easily allow the architect to do this.

Stained glass may be considered as belonging to the Gothic style, and should by all means be employed when this is possible. The secret of staining glass is said to be known once more; at all events, glass of the most brilliant colors can now be obtained in Boston and will probably soon be manufactured elsewhere: it is now expensive, but we may expect it to follow the course of other things and to become more reasonable, if the demand for it should increase. As to the employment of it. Our means will very seldom allow the formation of historical figures, and I will not stop to discuss the advisableness of them, taken in connexion with modern taste in painting; but devices and objects of this kind we may readily have. In forming these latter, we must never lose sight of the design of this style. There must not be disorder, but the mind must still be baffled in the attempts which it will invariably make to systematize. While we avoid confusion then, we must avoid system. The same device, for instance, to each window, would be felt at once by a good judge, to be out of character with the style. How far this want of regularity may be carried it is perhaps difficult to determine; at all events, no rule can be given for it, any more than for the other parts; in which, as has been already remarked, lies the chief difficulty of the style.

A word or two on spires and I dismiss this fascinating subject. The spire had its origin with the Gothic style and may be considered as belonging to it, though with us it is applied to all species of churches. Among the Italians it is unknown, the tower alone being employed: some of their towers are crowned with low pyramids; but there is nothing which can claim the title of spire, in its proper sense. The towers there are, with great propriety, made either entirely distinct from the church or attached to one side; they are never suffered, as with us, to break upon the majesty of the façade, or rather to destroy it, but leave it to its full effect. They are felt to be an appendage, the church itself being the main object presented to our sight; and this is as it should be: with us the church generally seems to be an appendage to the steeple, and the steeple is little more than a thing for bells and for a *vane* to shew us how the wind blows. As we go northward from Italy the spire comes into use, and is often a most striking and beautiful object. That of the cathedral of Vienna is four hundred and sixty five feet in height, and that of Strasbourg four hundred and fifty six: the diminution in both these however commences at the base, as is frequently the case in that part of the continent, and the effect is less imposing than where the tower and spire are combined. England is remarkable for happy combinations of the two, though in that nation also the tower without the spire is frequently to be seen. I return to our own country. There are few parts of architecture in which our taste is so bad as in this. The steeple is almost uniformly thrust forward and made the first and main object of our attention, no matter what the cost may be to the body of the edifice. It stands out either wholly or in part from the façade, which is thus broken up and is incapable of receiving either majesty or beauty of expression. I need not say that the façade is every thing to the exterior of a building. On it the architect labors most; to it the other parts are made to conform, and from it the edifice receives the unity and singleness of character which constitutes what artists call a *whole*. The English architects do better. They make the steeple rise from the front of the edifice, but its lower part is not seen; the façade is left to take its full power; the church becomes the main subject of our thoughts, and the steeple is felt to be only a necessary appendage: often it is in good taste and adds greatly to the character of the edifice. This however will do only when the steeple is of moderate height. When the elevation is very great we wish to see the base or support of an object so vast, and beside this, the upper part will be out of proportion unless the whole of the tower is laid open to our eye. But where shall it be put? The question is a perplexing one. There is one place however where it plainly should *not* be put—in the centre of the façade:

place it any where rather than in a spot where it will not fail to break up and destroy all expression in the building. These remarks apply chiefly to churches after the Grecian style. The steeple of a Gothic church is more easily managed. Even here however it should not be placed in the centre of the façade, unless the other parts can be brought out to a line even with it. This is often done in the English churches, and while the buttresses keep the tower distinct, the majesty of the façade is still preserved. A tower at each angle of the front is to be preferred. In this situation they will be found to be powerful helpers to the façade; they give it breadth and richness, and it acquires the importance it deserves.

As to the shape of the steeple, we have room for only a few remarks. Where we employ the spire, I think we generally err in giving it too little height in proportion to the tower. The spire in England most admired for its proportions, is one hundred and fourteen feet in height, the diameter of its base being nineteen; the tower on which it rests is seventy feet high and twenty two feet square. One word more—let us banish all fishes, arrows, and every thing of the kind, every thing resembling a vane, from the top of our spires. They are no ornament; what can they mean? A stranger would think us wonderfully anxious about the wind: if we must have them let them be put in some other place.

I must be allowed here to pass a little out of my way, and make some remarks on the hurry and the parsimony which seldom fail to accompany the erection of our public buildings. Our architecture has hitherto exerted itself among frail and perishable materials. The awkward wooden buildings it has erected are fast passing away, and we should be glad that it is so. But the case is hereafter going to be a different one. We are beginning to build entirely with bricks and stone, and what is hereafter to be erected, will go down to other ages to tell of our taste, and to exert its influence on theirs. Let us bear constantly in mind, then, that not one of these edifices is built for ourselves alone; let us extend our views through other generations, down to the far distant boundaries of time, and as we contemplate our works binding these ages to us, and us to them, let us indulge the feeling as our characters swell out and form themselves to this long series of years, and to this constantly thickening population. Let us remember too, that it will be an intelligent and a keen-sighted population. We wish them to respect our memory; let us show that we have respect for them: we wish them to reverence our laws and institutions, for we believe them good; let the objects we associate strongly with these laws and institutions, objects to be seen every day by them, and to influence their opinion of us, let these objects be such as to heighten reverence, at least let them be such as not to provoke their ridicule. How would our feelings for our Declaration of Independence be affected, if the Congress which voted it, had voted also the erection of a capitol, by a silly architect, and if this now stood among us the object of our contempt: again, suppose the same vote had passed, the architect capable, and that the result was an edifice, our pride and glory at home, and our boast abroad—how strongly should we be influenced by the association? And let our architects also beware. Painters are cautious how they dally with their fame, and yet painters, whose names are worth inquiring about, must generally expect to have their productions confined to the galleries of the wealthy, to be seen but by few. The architect's work, on the other hand, stands out in the broad light of day, where all see, where all judge, where all may applaud—*and where all may sneer*. We should then form our plans with careful deliberation. A moment's rashness now, may produce regret through many ages. I have at this time in sight, an edifice holding a conspicuous place in one of our handsomest cities—an edifice of substantial materials, and built for posterity, as well as for the present generation. It was erected but a few years since, and people are already sorry that its architecture was not more carefully planned. Had one year, or even two years been spent in procuring and examining plans for that building, what would they have been in the long series through which it is to pass? The same expense, with only a little more deliberation, might have made it a very beautiful edifice. I have lately examined also another public building, in which the fault of avarice is very strikingly displayed. It is a state capitol. The legislature appropriated for it, at first, thirty thousand dollars, together with an old edifice worth about one thousand more. This was found insufficient, and at the end of two years application was made for ten thousand more: nine thousand were granted, and from the want of this paltry one thousand,—paltry I say, for it is so in a state treasury—the commissioners, though economical and judicious, have found themselves straitened in all their subsequent operations. I went into the representatives' hall: it has four columns which were intended to be Ionic, and the proportions were made accordingly, but when they came to the capitals, it was found that the funds were not sufficient, and capitals were necessarily contrived which belong to no order whatever and which go far towards destroying the whole character of the room. For the same reason, as they informed me, the vault of the rotundo would have to be plain, instead of being panelled as was originally designed. No comment need be added to this.

Public Monuments.

Our remarks on other subjects of public architecture must be brief. We will begin with public monuments. A monument, when designed to be of small elevation, can take too great a variety of forms to be minutely examined here. It should always, however, be made solid and substantial. A monument, as has been already said, implies in its very name something that will last, and it must be a structure that has the principles of permanency in itself, for posterity will seldom take pleasure in the repair of such things: when therefore of perishable form or materials, its character is incongruous with its professed design, and the effect is inevitably bad. For this reason, I could never take much pleasure in the monument in the navy yard at Washington: the battle monument, at Baltimore, is in better taste. There is another monument near the latter city, belonging to a different and more imposing order; I mean those which are designed to be seen at a distance, and in which height is therefore a principal object. These are always either in the pillar or the obelisk form. The pillars are numerous, and as they have great names among their architects, we must speak of them with diffidence; the reader must judge whether my reasons for disliking them are valid or not. A column, whether Grecian or Roman, was designed originally to support a heavy weight; and it was formed accordingly. All its parts, the base, the shaft with the swell in its outline, the capital, even the mouldings are formed to this, and when, after all this seeming preparation for weight, nothing at all, or, at best, only an equestrian statue, is supported by it, the want of fitness produces a sensation by no means agreeable. We take the idea of such monuments from the columns of Trajan and Antoninus Pius at Rome, but there is one circumstance about these columns which we omit in ours, and must almost from necessity omit, but which entirely changes their character. They are both covered with bas-reliefs. The shaft is no longer then a simple support for a statue above; it has lost its character of a shaft in the true sense of that word, and has become only a firm body to which historical sculpture might be attached. The bas-reliefs which are executed with much spirit, represent the military achievements of the respective emperors, and pass in a spiral line around the pillar, till they arrive at the summit, where stood originally on each, a colossal statue of the hero himself, the grand leader to all these glorious deeds. I have never looked at these two monuments without pleasure, but to my eye, there is something meagre and unmeaning in the nakedness and shape of a monumental column without such additions. It will be long before our country will be able to afford such sculpture: perhaps it will never be able to do it; but this is little to be regretted, while we have the cheap and beautiful form of the *obelisk* left. Every vertical object, which is high in proportion to its breadth, and which is not to support a heavy weight, should taper as it ascends, until it comes nearly to a point. This is a law in natural objects, which are ever conformed to the principles of good taste. And as to the statue itself, whether equestrian or not, why put it so high, that we can see only that it is there, and that in general it has the proper shape? Why not bring it within distinct vision where all the magic power of sculpture can be felt? Let us rear high our monuments, to tell far and wide our admiration and gratitude for noble deeds, but unless circumstances require it, let us not place the object of this gratitude where it can be at best but dimly seen. With the plan of the Bunker Hill monument, I am greatly pleased. We must be allowed, however, to offer one word of advice, unless, as is probable, the subject has already suggested itself. The blocks should be carefully joined, or else the jointing should be made to appear very delicate. There is a high obelisk of white granite at Marseilles, whose effect is very greatly injured by the distinctness of its joints.

Fountains.

A traveller from our country to the south of Europe, is struck every where with the number and variety of fountains. Some exhibit splendid jets, in which large columns of water are thrown high in the air, to descend in every variety of form; some shoot up a few silvery streaks; some pour forth large volumes of water amid rocks and crags; while in others it passes through unseen channels into simple basins, and is as quietly withdrawn. Sea-horses, sea-gods, shells, and other marine emblems, are their usual ornaments. The variety of taste is endless. In Rome alone there are more than thirty, of various but costly forms: but of all these, none attracts so much attention as the fountain of Trevi. The reader, who has not seen it, will perhaps represent to himself now, a magnificent jet, sending up its waters to dance and sparkle in the sun; but it is not so. There are magnificent jets at Rome: those before St. Peter's are the most splendid that can be imagined. But the fountain of Trevi simply pours forth its waters amid moss and rocks, and they are apparently left to gush or trickle down the descents as they can best find channels. It is beautiful because it is natural. There is seemingly no art about it, except in some sculpture among the rocks, which few people look at, and which, when noticed, are felt to detract from the beauty of the scene. The whole of it seems to have cost little labor to the architect; and yet there is probably no fountain at Rome that has cost more: any one can form a jet, if he can but have the mechanical power; he can form a splendid one if the power is great, and money can make it so: but money could not have formed the fountain of Trevi, and there are few architects whose minds are equal to such an effort. But let us turn to our own country. We shall soon have public fountains; we should have them now, for while they contribute to the health and cleanliness of a city, they are also a tribute of humanity which the wealthy owe to the poor. When we have them, I hope, in the first place, that we shall not have jets from the mouths of turtles, or sea monsters, or elephants, or swans, or any thing of the kind. The idea is almost vulgar and disgusting; it is at least unnatural, and what is unnatural can never be in good taste. A jet need not throw up a large body of water; some of the most beautiful I have seen consist of but a small streak; but the height should always be considerable: a jet of a few feet will always be regarded as *an attempt* at the wonderful, when we have not the means of attaining it. Generally, whatever may be the mechanical power in our possession, it will be preferable to let the water take the course it always takes in nature: mossy rocks, grottoes, if they can be employed, green waving grass, and overshadowing trees, will make for us a more beautiful and a far cheaper fountain than is any jet which the world has ever seen. Tritons, mermaids, sea-horses, and such like, should be carefully excluded. Why have sea-horses or tritons, appearing to flounder in a shallow basin a few yards in diameter, and this in fresh water too? Why place a portly Neptune, provided with trident and other paraphernalia, to preside over what is only a good sized punch bowl? The thing is ridiculous, and can be tolerated only where good taste is left behind and where people are doing violence to their nature in attempts at what is pretty or wonderful. Even the simple Turkish fountain is in far better taste.

Domestic Architecture.

We pass to the last division of our subject; a part yielding to no other in importance, but upon which we shall be extremely brief. Dwelling houses are capable of such endless modifications, and depend so much on circumstances for their character, that it is extremely difficult to reduce them to rule, or, at all events, to bring the subject within moderate bounds. In cities, houses must be crowded and generally of considerable height; in towns they are of less elevation and at greater intervals; while in the country they take a still different character. We will endeavor however to give the subject a brief consideration. The architecture of dwelling houses should be marked by two qualities, first and mainly by convenience, and secondly by cheerfulness. The former we must leave to take care of itself. As regards the latter, a choice of one of the three ancient orders will in most cases be necessary, and on this the character of the edifice will chiefly depend. The Doric, it has been already remarked, is grave and majestic; the Ionic cheerful and graceful; the Corinthian gay. If this is true, the Ionic is the proper order for a dwelling. If the façade is large and imposing, the Roman Doric may sometimes be used for the sake of variety; but where the taste is left free to its exercise, we should always prefer the Grecian Ionic, and we may trust to it without a fear. It has a good mixture of simplicity and richness; it is pure and extremely graceful; it is in short just that to which we would desire all the internal arrangements and even the manners of a family to correspond. The idea may excite a smile, but I assert without hesitation, that the character of a family will generally be found to have some resemblance to the house in which they live. The Grecian Ionic however does not appear well in small objects; and where the dwelling is broken into a multitude of diminutive parts, or where none can be large, the Composite or the Modern Ionic may be more advantageously employed. These are frequently used in small porticos and the like; and to them they are very well suited. The Grecian Doric *may* perhaps be made to appear well in a dwelling house, but I have never yet seen it succeed, and consider the attempt as an extremely hazardous one. Its character of bold and manly grandeur, coupled with simple majesty, is not at all suited to such a building; the Corinthian errs as greatly on the other side.

We are fond of variety in cities or towns. In the former it is more difficult than in the latter, but we often make the case even worse than our necessities require. It is so when we erect a larger block of buildings, each one corresponding exactly with the rest. Why is this? Is there not uniformity enough in the constant recurrence of streets, of the same breadth, and perhaps meeting at the same angle, in an unbroken range of houses each advanced to the same line and finished with the same proportionate number of windows and doors? But there is another consideration. In a block of this kind, the whole mass takes an unity which requires vastness in the other parts to correspond. We look for this and find, with disappointment, the doors, windows and porches, the same as those of any other houses: the details become more minute from a comparison with the vastness of the whole, and the discrepancy becomes more strongly forced on us and more painful.

Smaller cities and towns have a great advantage in the intervals which occur between the houses, and in New England this advantage is turned to good account. The houses there are frequently built at a distance of twenty or thirty feet from each other, a space of several yards being also left between them and the street. The whole of this is planted with delicate shade trees and shrubs, and as the houses themselves are usually painted white and have small tasteful porticos in front, the effect is the most agreeable that can be imagined. Gentlemen who have travelled extensively in Europe, frequently inform us that they have never seen any thing that, as a whole, would compare in neatness and real beauty with some of the New England villages. It is a beauty in the power of every one of our towns, for the houses in New England, though as comfortable and durable as in other places, cost I believe even less than is usual for edifices of their size. Nearly the whole is effected by the neat little yard, with its verdure, in contrast with the pure white of the façade, and by the little portico over the door. There is another characteristic in these towns, which I should like to see more common in the country; I mean the habit of planting trees along the streets. We should not have all the streets in a town treated in this manner; those for business should be kept clear, but in all others trees should be planted more or less thickly, as taste or convenience will admit. They give a town the appearance of richness and comfort, which cannot be so cheaply procured in any other manner. The elm is our most graceful shade tree, and will be found most suitable when the streets are wide; when narrow, the maple, I believe, is found to answer best.

As to country houses and their premises, so much depends on the character of the ground, and of all objects, even to a distance of miles, that the subject swells entirely beyond our limits. I must be allowed however, to remonstrate against the warfare which is every where carried on against our noble forest trees, trees which should be estimated by us as far above all price. The first thing done in the new parts of our country, when a spot is determined on for a house, is to cut down all the trees within many rods of it; and then, year by year, the work of destruction goes on, as if the very sight of a forest tree were odious. The house stands alone in the clearing, its inmates, and particularly the children, roasted and browned under the hot summer's sun; but by and by, the nakedness and dreariness of the situation is felt, and then are planted some Lombardy poplars "all in a row." Now, the trees which we cut down with such an unsparing hand, are the very kind which English gardeners cultivate with the most persevering diligence, and are planted here just as they labor most to plant. And we too shall cultivate them before long, and shall then think, with the most bitter regret, of the sad destruction which we and our ancestors have made. But in vain; for all the art of man will not be able to restore in any length of time, such glades, and thickets, and lawns, as we now possess. When about to build in a new country, we should save, near our house, an acre or two of the forest, and should guard it with the most watchful care. Morning, noon, and evening, it would be an agreeable retreat; its shade would be refreshing in our scorching heats; it would connect us in some measure, with ages long since gone, and would bring before us the wild, but high-souled Indian, his council, his battle song, the war, the chase, the feast and dance; its noble and manly forms would gratify our taste; it would raise our thoughts to Him who is "a shadow from the heat, a strength to the needy in his distress." I say again, let us spare our noble forest trees. Many political considerations might be adduced to show the imprudence of our rude havoc among them, but for these we have not room.

A few words more and we have done. They will be designed for cities chiefly, but will be found applicable also to towns. There is one practice among us most destructive to property, and yet strangely suffered to exist almost without comment. I refer to roofing with pine and oak shingles. The frequency and extent of fires in our cities are proverbial: their extension is caused in nine cases out of ten, by our wooden roofs. We feel their dangerous character, for in case of fire, our first attention is always directed to the roofs of the neighboring houses; here our apprehensions fix themselves most keenly, and on them the engines most unremittingly play. "If the roof can be saved" is the universal cry, "all is safe." Is it not most strange then, that people will still continue the practice of roofing with such combustible materials, or that if they will do so, that state authorities do not interfere and put a stop at once to the evil? The practice, so dangerous, often so widely destructive, cannot even plead economy in its support. I have received from an eminent architect in New York, some very valuable memoranda, shewing the comparative expense of various kinds of roofing in that city, which will furnish us with some useful data: I regret that our limits will not allow me to lay the whole before the reader.

The following will shew the present prices of roofing in that city, and the time each kind will last.

	Prices.	Time which they will last on a roof inclined 26° 30′
20 In. white pine shingles, in three thicknesses, laid on white pine boards, with square edges, per 100 superficial feet,	from $7 to 9*	from 20 to 25 years.
30 In. white cedar shingles, in three thicknesses laid on oak laths, the laths 1 inch by 2 1-4 inches,	" $10 to 12	" 35 to 40 "
16 In. Welsh slate, laid on 1 1-4 inch plank, with square edges, close and leaded at the ridge,	" $12 to 14	" 35 to 40 "
16. In. Welsh slate, laid on oak laths, and plastered between the laths with lime and sand mortar, and leaded,	" $14 to 16	" 40 to 45 "
Tile laid on oak laths 1 1-4 inch square, and pointed on the underside between the laths, with lime and sand mortar,	" $12 to 15	" 60 to 70 "
Common bright tin, with grooved edges, laid on 1 1-2 inch white pine plank, ploughed and grooved, the groves of the tin first put together with white lead and well beat down.	" $18 to 20	" 25 to 30 "
16 Oz. sheet copper, (or one pound to the square foot,) with grooved edges laid on 1 1-2 inch pine plank, grooved as above,	" $35 to 40	" 55 to 60 "

* These prices include the expense of boarding, lathing and plastering.

From this it appears that Welsh slate, even when imported, is in the end, exactly as cheap as pine shingles, while the expense of tiling is only about half as great. Slate has been found in our own country, and extensively wrought, but its quality I believe is not equal to our severe winters, and the Welsh slate is still preferred. But we know not yet half the resources of our country, and if encouragement were given, slate of as good a quality as any from abroad, would probably be found. A correspondent in Baltimore informs me that a company has been formed in that city, which has undertaken to supply the inhabitants with slate, at as cheap a price as that of shingles. Doubtless the price of slate may be greatly reduced, should its use be encouraged, and the subject is one, worthy of immediate attention among our civil authorities. In Boston, I understand a law exists, that no house above a certain height shall be covered with shingles: there may be such laws in other of our cities, but I have not heard of them. There is none in Baltimore, nor any ordinance encouraging the use of slate. In that city about 30 per cent. of the houses are covered with slate or tiles, and about a dozen with copper or tin. In New York the number of slate roofs is about one half of the whole. Tiles were much used in the latter city, about forty or fifty years since, but are now seldom employed, chiefly on account of their weight and clumsy appearance. They might be made a very cheap article. In the south of Europe, and in Turkey, they are universally employed, and in one of these cities where I gave the subject some attention, a sufficient number may be procured to cover one hundred square feet, for one dollar and thirteen cents. Their appearance will probably prevent their use to any great extent in our cities: any thing however is better than pine shingles. The destruction of property which they cause among us is immense. It is impossible to estimate the whole amount, but some idea may perhaps be formed of it, from the fact, that the aggregate amount of loss paid by the Insurance companies of New York for the last four years, as reported to the legislature in February, was 2,085,000 dollars.

We must now dismiss this interesting subject. The situation of our country, our resources, the prospect of largely diffused knowledge and taste, the character of our government and of our population, our institutions liberal but not profuse, the influence of external and familiar objects on mind, and morals and happiness—all these shew it to be an important subject, and invite us to give it attention. The object of these articles has been, to make this importance felt, and, without entering into minute detail of principles or rules, to give the community materials for judging for itself on objects every day pressed on its notice, and affecting its destinies. If I have in any degree succeeded, I shall consider my time as well spent: if I have not, I hope others will make the effort, and with better success.

Art. III.—*On the Manufacturing of Indigo in this Country;* by William Partridge.

The value of the indigo consumed in this country, for the year 1829, cannot be estimated at less than two millions of dollars.

Of the quantity consumed, there was made in the United States about two hundred thousand pounds, or one tenth part of the consumption.

As the consumption is rapidly increasing, from the increase of population, from the extension of manufactures already established, and from the introduction of new articles of manufacture, I consider it an object of national importance, that it should be better made, and more extensively cultivated in this country.

I have been acquainted with the indigo market for more than thirty years, and never remember it in so depressed a state as it has been for the last twelve months. The average price of the sales for the last year cannot have been much over one dollar per pound. The average price of the imported has been about one dollar and fifteen cents, and of that made in this country about fifty cents. To endeavor to give such instruction to the planters, as will enable them to make an article fully equal to the imported, is the object of this communication.

The quantity of indigo made from an acre of the plant has been differently estimated by almost every maker from whom I have obtained information. Gen. Wade Hampton, who many years since made the article in South Carolina, informed me that he obtained sixteen pounds of fine indigo from the plant taken from a half acre, or thirty two pounds per acre. Other estimates make the quantity much larger, some nearly two hundred pounds to the acre. Taking the average of the different estimates, it would be at least fifty pounds. It will appear by this estimate, that it would require forty thousand acres of land to raise a supply for the present consumption; and as the demand is rapidly increasing, it is more than probable, that in ten years, it will require the product of eighty thousand acres to raise a supply for home consumption.

There are four points to be attended to in the making of indigo, which require much judgment, aided by practical skill. These are, the time of cutting the plant, the degree of fermentation to be given in the steeper, the degree of oxidisement of the coloring feculæ, and the extrication of foreign matter from the pulp after the indigo is made. Three of these processes being purely chemical, it is not therefore, surprising, that ordinary workmen should frequently fail in producing a good article. There is probably more loss sustained by our planters, from the ignorance of the operators, than the whole value of the article now sold.

The plant should be cut when at maturity, as it will then afford a fine color; but if cut too late, a portion of the color is then lost, and an indigo of worse quality is obtained. Mr. Dalrymple informed me, that the plant should be cut when in full flower, after the weather for some days has been dry.

Another celebrated maker of indigo, asserts, "that if the plants are suffered to stand till they run into flower, the leaves become too dry and hard, and the indigo obtained from them proves less in quantity and less beautiful—the due point of maturity is known by the leaves beginning to grow less supple, or more brittle.

It appears, that the makers of indigo differ as to the time of gathering the plant. It is greatly to the interest of our planters that they should ascertain, by direct experiment, the proper time of gathering the plant.

When the plant is gathered, it has to undergo a process by immersion in water, for the purpose of extracting its coloring matter. This operation is performed in two ways—by fermenting the green plant in a steeper, or by first drying the leaves and then simmering them in a boiler. The latter process is now pursued by some of the best makers in Bengàl, and has apparently an advantage over the old process.

When the green plant is fermented in a steeper, and the process is carried a little too far, the coloring matter will become dark, and is said to be burnt—if carried a slight degree farther it will be black, and of course the indigo will be very much injured. Nine tenths of the indigo made in the United States partakes more or less of this character, and has evidently been injured by an excessive fermentation. To observe a due degree of fermentation in the steeper is the most difficult point in the whole process of making indigo; for should not the fermentation be carried far enough, a considerable loss of coloring matter will be the result. It is necessary, therefore, to carry it on to a certain point, and to draw it off the instant it arrives at that point; and this can be known only by a skilful observer who has obtained his knowledge by practice.

There is no chemical operation so difficult to describe as that of fermentation, and I almost despair of making myself clearly understood by practical workmen in the following description of the steeping process.

Fermentation has been divided by chemists into four kinds, the panary, vinous, acetic and putrefactive. The kind of fermentation given in the indigo steeper is evidently of that kind called panary, or the first stage of fermentation. It is known to be the panary by the large quantity of carbonic gas given out, which rising to the surface, floats on the top, covered with a thin pellicle of the liquid. The difficult point for the operator to distinguish is when it arrives at that degree of fermentation, and begins to assume the acetic. The same difficulty occurs with the woollen blue dyer, and the losses so frequently complained of, by the vats being out of order, and often irrevocably lost, arise from the fermentation being permitted to proceed too far.

The following directions are given as a guide for those who may be engaged in the making of indigo. Whilst the plant is in steep, draw off a little of the water, and with a pen dipped in it make a few strokes on white paper. The first will probably be high colored, in which case the indigo is not sufficiently fermented. This operation is to be repeated every quarter of an hour, until it loses its color, when it will have arrived at its true point of fermentation.

Let a small hole be made in the stopper, six or eight inches from the bottom, exclusive of the opening or aperture, for drawing off the impregnated water. Let this hole be stopped with a plug, yet not so firmly but that a small stream may be permitted to ooze through it. After the plants have been steeped some hours, the fluid oozing out, will appear beautifully green, and at the lower edge of the cistern, from whence it drops into the battery, it will turn of a copperish color. This copperish hue as the fermentation continues, will gradually ascend upwards to the plug, and when that circumstance is perceived, it is proper to stop the fermentation.

During the progress of this part of the business, particular attention should be paid to the smell of the liquor which weeps from the aperture, for should it discover any sourness, it will be necessary to let the fermenting liquor run immediately into the battery, and lime water of sufficient strength must be added, until it has lost its sourness. As it is running off it will appear green, mixed with a bright yellow or straw color, but in the battery it will be of a beautiful green.

Another maker has given the following description of the fermenting process:

When the plant is gathered, a large quantity is put into a vat, and some wood laid above to prevent its rising above the water. The mass begins to ferment sooner or later, according to the warmth of the weather, and the maturity of the plant—sometimes in six or eight hours, and sometimes in not less than twenty. The liquor grows hot, throws up a plentiful froth, thickens by degrees, and acquires a blue color inclining to a violet—at this time, without touching the herb, the liquor impregnated with the tincture is let out, by cocks in the bottom, into another vat placed for that purpose, so as to be commanded by the first.

The boiling process, for extracting the color from the dry plant, was obtained from Mr. Dalrymple, who had for many years been an extensive indigo maker in Bengal. He says: "take an iron, brass, or copper boiler, fill it within three inches of the top with the plants, press down with stones, and cover the plants with water. The liquor must be heated, not until it boils, but until it begins to blubber, or simmer. The water, by this time, will look greenish, then draw it off into a shallow vessel or vat, and beat for one or two hours to incorporate oxygen with it. On taking some of the liquor in a white saucer, little particles will appear in it as big as a pin's head and smaller, then stop beating and throw in a little lime water, upon which the indigo will precipitate to the bottom, and the supernatant water will look like brandy. The water has now to be drained off to a level with the top of the sediment, lay the sediment on a cloth to drain, and when stiff enough put it into moulds to dry."

The directions given by Mr. Dalrymple are evidently imperfect, for none are given for the fermentative process, and those who are in the least acquainted with the manufacture of indigo, must know, that the coloring matter cannot be developed unless the liquor has previously undergone a due degree of fermentation.

I have been recently informed, that many first rate makers of indigo in Bengal condemn the process of obtaining it from the dried leaves, on the plea that the article obtained is no better, and is much less in quantity. If any of our planters should be disposed to try the dry process, it will be necessary to inform them, that should the leaves, between gathering and drying, be subject to fermentation, only a small portion of coloring matter will be obtained, and that the loss sustained will be as the degree of fermentation.

During the precipitation of the coloring feculæ the coarsest particles, possessing the greatest specific gravity, subside first, constituting the lower strata of the pulp, and the lighter and finer particles subsiding the last, form the upper part. It is necessary that indigo makers should take advantage of this circumstance, by first taking off the upper layer, and moulding it by itself, and the lower part by itself. By this means they may obtain several qualities of indigo from one mass of pulp.

It appears from analysis made by Bergman, Quatremere, and other chemists, that indigo of good quality does not contain more than from 46 to 47 per cent of coloring matter, and that the very best samples do not contain more than 48 per cent.

The following table will exhibit an analysis of indigo of a good quality, and of the menstruua in which the impurities are soluble.

Mucilaginous parts separable by water, - - -	12
Resinous parts soluble in alcohol, - - - -	6
Earthy parts soluble in acetic acid, - - - -	22
Oxide of iron soluble in muriatic acid, - - - -	13
Coloring parts almost pure, - - - - - -	47
	100

There cannot be a doubt, that manufacturers of indigo might produce, by attending to the analysis made by chemists, an article far superior to any hitherto offered to the public. It will also appear certain, when experience shall have confirmed the value of a superior indigo, that a more than remunerating price could be obtained for a purer article. For certain purposes a pure indigo would command double, and even treble prices, provided the supply were not too great for the consumption. This being the case, it would be well for our manufacturers to pay some attention to the subject, and endeavor, by some easy unexpensive process, to bring it to as great perfection as possible. To promote this object, I offer the following extracts and observations.

Bergman dissolved, by means of ebullition in water, a ninth part of the weight of indigo.

Quartremere also separated, by means of water, the parts which are soluble. He states their quantity to be more considerable, the worse the quality of the indigo; and that, after this operation, the residuum has acquired the qualities of the finest indigo. He therefore proposes to purify what is of inferior quality, by boiling it in a bag, and renewing the water till it ceases to acquire color.

If sulphuric acid be diluted with water, it attacks only the earthy matter that is blended with the indigo, and some mucilaginous ingredients.

Muriatic acid digested or even boiled with indigo, takes up the earthy part, the iron, and a little extractive matter, which colors it yellowish brown, but without attacking in any manner the blue color.

It is evident from the analysis, that to make indigo far superior to any now brought to market, requires only an application of known facts to the art of making it. It is a well ascertained fact, that if indigo be boiled in water containing muriatic acid, twenty five per cent of the impurities contained in the best samples would be extracted, and that the coloring matter remaining would form an indigo far superior to the best now offered for sale.

The best Bengal indigo, and I never remember it in a more depressed state, is worth, wholesale, one dollar eighty cents per pound. The average value of all the indigo imported from foreign countries is about one dollar and fifteen cents per pound, whilst the average value of that made in the United States is not more than fifty cents, and this great difference in the value is owing almost entirely to the great impurity of the article. The first object with our manufacturers, therefore, should be to make their indigo equal in quality to the best Bengal, and the second to go as far beyond them as is practicable.

In the best samples of the indigo of this country there is evidently too much extractive matter, and there is no doubt that this defect arises, in a great measure, from their taking the pulp from the beater, instead of their running it into a vat of clear water, and after well agitating it there, letting it settle in the third vat. This third receiver should undoubtedly be added where it has not been already done. Those manufacturers who would wish to avoid the expense of a third receiver, may fill up the beater with fresh water, after drawing off the first liquor, and perform the operation in the same vat.

The greatest improvement I can at present suggest, would be to boil the pulp taken from the vat by steam heat, for fifteen or twenty minutes, in water containing as much muriatic acid as would give to the liquor a strong acid taste. This operation can also be performed by placing a pipe in the beater from any steam vessel.

Muriatic acid, beside the oxide of iron, dissolves the carbonate of lime, red resin, and alumina, contained in the indigo, and by being mixed with water, the greater portion of the extractive matter would be taken up at the same time. By boiling the pulp in water strongly impregnated with muriatic acid the indigo remaining would be twenty five per cent better than any hitherto made, and a price, more than equivalent to the difference in the loss of weight and expense of working, would be obtained from the consumer.

I have been informed by some South Carolina planters, that owing to their inability to proceed with the fermentative operation as rapidly as the crops require, a portion is often left on the fields for two or three weeks after the plants have arrived at maturity. This circumstance alone is sufficient to blast the interest of the planters. Their interest would be much better consulted, by gathering in the crop, drying it, and extracting the coloring matter by the simmering process. This difficulty is obviated in Bengal by their planting the seed in successive periods, so that one crop shall ripen, a week or more after the other, each crop being sufficient to supply one set of tanks during the period of maturity.

Dyers as well as indigo planters, would be highly benefited by attending to the analysis of indigo. Were they, when a superior color is wanted, to boil the ground indigo in a bag as described by Quatremere, there would be no difficulty of obtaining the desired result from indigo of any quality.

Art. IV.—*Synopsis of the Organic Remains of the Ferruginous Sand Formation of the United States, with Geological Remarks; by* Samuel G. Morton, M. D. &c. &c.

(Continued from Vol. XVII, p. 295.)

Since the former part of this memoir was printed, but few additional facts have come under my observation, and the principal of these relate to the calcareous deposits embraced in the marl district of New Jersey.

These calcareous beds were first noticed, during the past year, in Gloucester county; more recently they have been found to have a much wider range, and are now traced for several miles in Burlington county, not far from Vincentown, where they possess precisely the same mineralogical and organic characters as the beds of Gloucester. Some specimens I have examined from the southern part of the peninsula, in the vicinity of Salem, lead me to the conclusion that the same formation exists there. It seems probable, therefore, that the calcareous strata extend, with occasional interruptions, nearly fifty miles, in a direction parallel to the course of the Delaware river, and from seven to ten miles east of it.

A gentleman who has recently examined some of these localities, informs me that he found the beds in question resting on the common green and blue marls; an important fact, inasmuch as it proves that our calcareous and arenaceous strata have the same relative position as the chalk and green sand of Europe; a circumstance much enhanced by the collateral fact that similar genera of fossils characterize the deposits on both sides of the Atlantic, as will be seen by reference to the former part of this synopsis.

The following list embraces the remaining marl fossils, and completes the list of those hitherto identified.

CHAMBERED UNIVALVES.

AMMONITES.

Two species have already been noticed, and three remain to be added.

3. *A. delawarensis.* (S. G. M.) Found in the lower beds of the Chesapeake and Delaware Canal; fragments only have been obtained, the most perfect of which is figured on the annexed plate.

4. *A. Vanuxemi.* (S. G. M.) Occurs with the preceding, but is as yet a rare species.

5. Fragments of a fifth species are contained in the collections of the Academy, but are too imperfect for description.

SIMPLE UNIVALVES.

PATELLA. *Lam.*

A small species, half an inch in diameter, and delicately ribbed.

BIVALVES.

PLAGIOSTOMA. *Sowerby.*

1. From one to three inches long, with numerous delicate longitudinal ribs, and elevated concentric squamous plates. Is found attached to other shells in the same way that some British species are attached to flints.

2? Casts are found in the marl of the Chesapeake and Delaware Canal resembling those figured by Sowerby as *P. rusticum*, pl. 381. I am not certain, however, that the two fossils belong to the same genus.

OSTREA.

5. About an inch long, compressed, with numerous diverging, spinous costæ. A remarkably perfect fossil, from near Arneytown, N. J.

PECTEN.

3. Compressed, thin, longitudinally striated; and bearing considerable general resemblance to the chalk fossil *P. nitidus* of Sowerby, tab. 394.

4. A large species, found hitherto only in fragments. Costæ large and convex, with a smaller one intermediate.

CLAVIGELLA. *Sowerby.*

A single specimen, apparently referrible to this singular genus, has been found in New Jersey.

ECHINIDEÆ.

SPATANGUS.

3. *S. stella.* (S. G. M.) Small, globose, with pentapetalous sulci; the longitudinal groove does not reach to the base, in which respect it differs from species 1st of this synopsis. Common in the calcareous marls. It was first pointed out to me by Mr. Titian R. Peale.

ANANCHYTES.

2. *A. cruciferus.* (S. G. M.) Oval; less than an inch in length: apex subcentral: the two lines composing each of the five pair of ambulacra are parallel throughout; there is no sulcus. I refer this fossil to ananchytes, although it does not in every respect agree with that genus. Communicated by Mr. T. R. Peale.

3. *A. fimbriatus.* (S. G. M.) Four pair of dotted ambulacra, with eight or nine lines passing from the apex to the mouth, and a poste-

rior sulcus. Found with the preceding species in the calcareous beds of New Jersey. Communicated by Mr. T. R. Peale.

The species of ananchytes embraced in the former part of this paper is very different from either of these: I have since given it the name of *A. cinctus.*

ZOOPHYTES.

ALVEOLITES. *Lam.*

A species occurs in the calcareous beds very similar to *A. glomeratus* of Say, a recent zoophyte common on our coast.

BONES.

SAURODON. *Hays.*

S. Leanus. (Hays.) Portions of the jaw of an extinct Saurian have been described under this name by Dr. Hays, in a memoir read before the American Philosophical Society, but not yet published. These remains are said to be nearly allied to the genus *Saurocephalus* of Dr. Harlan,* brought originally from Missouri, by Messrs. Lewis and Clarke. The saurodon was discovered in the Marl at Woodbury, New Jersey.

MOSASAURUS.

In the former part of this paper I mentioned the remains of this animal with a question, arising from the positive assertion of M. de Blainville that the teeth attributed in this country to the Maestricht animal were those of the *Ichthyosaurus.* In a late number of the† annals of the New York Lyceum, Dr. De Kay has carefully investigated this subject, and expresses his unequivocal conviction that these relics are really those of the *Mosasaurus,* and not, as the French naturalist asserts, of the Ichthyosaurus. I have no hesitation in adopting Dr. De Kay's opinion.

GEOSAURUS. *Cuvier.*

In the memoir just mentioned Dr. De Kay also announces the discovery, in New Jersey, of some dental remains of the Geosaurus, a subgenus of the Mosasaurus.

Remarks.

The *Lignites* of our ferruginous sand are exclusively Dicotyledonous, (*Exogenites* of M. Brongniart.) In some rare instances the

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* Jour. Acad. Nat. Sc. Vol. IV.

† Vol. III.

woody fibre is replaced by silex; but in this instance, as in most others, these ligneous remains have the perforations of the Teredo.

I have lately examined some Baculites from Missouri, and find them specifically the same with the marl fossil B. ovatus. The occurrence of this shell, together with remains closely allied to the Saurocephalus, may lead us to inquire, whether there is not a formation in Missouri contemporaneous with that of New Jersey.

I cannot close this paper without making a few extracts from a letter recently addressed to me by Prof. Buckland, of Oxford, in reference to my papers in the Journal of the Academy. With respect to the *Plesiosaurus* that distinguished geologist observes—" if you can establish it, it will as far as our European experience goes, be decisive in favor of secondary formations." " Your recognition of the *Mosasaurus* is highly interesting; we have it according to Mr. Mantell, in the *chalk* at Lewes; but this is a rare fossil with us; nor is it much known on the European continent beyond the neighborhood of Maestricht." "I entirely agree with you in thinking some of the shells you mention, especially the Ammonites and Scaphites, to be characteristic of secondary formations. I have never known a single shell of either of these genera in tertiary beds. The Belemnite, also, is almost exclusively limited to secondary: the only exception I know of is the equivocal rock immediately resting on chalk at Maestricht, clearly posterior to the Chalk."

" With regard to the mere abundance of *greensand* in any stratum, we find green particles almost as abundant in tertiary beds above the chalk, as in the beds immediately below it. This character, therefore, *alone*, will decide nothing in the question between yourself and Prof. Eaton. Amber I have never seen except in tertiary beds; but I see no reason why we may not expect to find it, as we find lignite, in secondary formations also: still, so far as our knowledge goes, we must allow amber to be indicative of tertiary."

In reference to the last remark of this eminent geologist I will just observe that Cuvier and Humboldt both give instances of the occurrence of Amber with the lignite of secondary beds; these authorities have been quoted for the fact in the former part of this synopsis. Prof. Buckland's letter was written before the publication of this memoir, which I have no doubt he will admit to contain much additional evidence in support of the position I have taken.

With respect to the clay beds which are associated with our marls, I have not hitherto been able to ascertain that they hold any uniformly relative position. Clays containing lignite occur in the midst of arenaceous deposits,—above them,—and below them: similar clays occur under similar circumstances in Europe without being there referred to the plastic clay *formation*. If the latter does exist in contact with our marls, it will be found, as I formerly mentioned, at Bordentown, White Hill, and some other places in New Jersey. Prof. Eaton informs me that he has uniformly observed the clay and lignite beds to be subordinate to the marl: I have noticed the same fact in some places and the reverse of it in others; and must repeat, that in this respect there appears to be no uniformity.

The strata at the Chesapeake and Delaware canal present a very interesting series of phenomena; and as the excavations at this place have been carried to a considerable depth, and an accurate register kept of their mineralogical and geological features, I will here offer a vertical section of the strata taken about a quarter of a mile west of the summit level by Mr. A. A. Dexter, one of the Engineers. At this place the excavation is upwards of sixty four feet deep; and beginning at the surface, the following appearances are observed.

1. Several beds of red sand, gravel and iron crusts, containing occasional large fragments of primitive rocks. Diluvial.
2. Dark blue mica sand, without organic remains.
3. Clay and sand of a bluish brown color, containing multilocular shells, Echini, Amber, pyrites, and Lignite: the latter being even imbedded in the solid casts of the ammonites.
4. Dark green and blue argillaceous sand, containing the same products.
5. Dark grey sand and clay; a thin stratum with few fossils.
6. Loose green micaceous sand with Lignite and Amber.
7. A darker colored argillaceous sand, with similar products.
8. A light gray loose sand, with Lignite, Amber, and Pyrites.

A little farther west all these strata are penetrated through in the progress of excavation, and are found to rest upon yellow ferruginous sand and gravel, containing considerable masses of these substances cemented by oxide of iron; but no traces of Lignite, Amber or organic remains have been observed, although this stratum has been penetrated to a very considerable depth.

It will be seen, then, that lignite occurs in the first bed which contains organic relics; that it increases in quantity as we descend, until the mass of strata reposes on a bed of sand, which in physical characters most resembles the upper, or diluvial deposits of this section.

Now, if we cross the Delaware river to Mullica Hill, (about twenty miles in a northeasterly direction) we shall find similar mineralogical appearances with those last named, sand, gravel and some clay, (but of a mixed brown and green color,) and crowded with the characteristic fossils of the marl-region. Here mineralogical appearances are therefore too variable to be relied on, especially where fossils are abundant. The latter must prove one thing or the other; and I am disposed to take them at their full value until we can find a better substitute.

Prof. Eaton informs me that he long ago convinced himself "that European strata present more recent characteristics than their equivalents in America." If this position can be proved to be a fact, it will settle an important question in Geology; but when we see so great an analogy between the two continents in the other formations, we should be cautious in admitting so great a variance in this one.

Time does not permit me to pursue this subject farther at present; but I am convinced that enough has been said, (particularly if considered in reference to the annexed plates,) to prove to the reader the striking affinity that exists between the organic remains of the Amercan ferruginous sand, and those strata which constitute the great chalk series of Europe.

I have not yet been able to give any additional attention to the *plastic clay formation* of our coast; and I trust this division of American geology will fall into other and abler hands.

Explanation of the Plates.

PLATE 1.

Fig. 1. *Belemnites americanus;* natural size, but an uncommonly large individual.
2. Transverse section of the chambered portion of the same fossil.
3. Same species, subfusiform.
4. *Belemnites ambiguus,* something larger than natural.
5. Transverse section of same specimen, natural size.
6. *Baculites ovatus,* showing the concentric rings.
7. Transverse section of the same fossil.
8. Same species, in which the rings are obsolete.
9. 10. *Anthophyllum atlanticum.* Varieties.

PLATE 2.

Fig. 1. *Ammonites placenta,* taken from a specimen fifteen inches in diameter.
2. Transverse section of the same fossil.
3. Septa of the same fossil, natural size.
4. *Ammonites delawarensis.*

PLATE 3.

Fig. 1. *Gryphœa vomer*, natural size.
2. Lateral view of a smaller specimen.
3. *Ammonites Vanuxemi.* Natural size.
4. Back view of the same specimen.
5. *Pecten quinque costatus.* Figured from a cast. Fragments of *shells* are abundant, but too imperfect to figure.
6. *Scalaria annulata.* Vide page 281, Vol. XVII. I venture to give this shell a specific designation. (Jour. Acad. Vol. VI.)
7. *Ananchytes cinctus.* Vide first species of this synopsis, p. 287.
8. *Ananchytes cruciferus.*
9. *Ananchytes fimbriatus.*
10. *Spatangus cor marinum?* Parkinson. Vide first species of the synopsis.
11. *Spatangus stella.*
12. Plate of a mammilated *Echinùs.*
13. Spine of an *Echinùs.*
14. } 15. } *Terebratula Sayi.*
16. *Terebratula Harlani.*
17. *Terebratula fragilis.*
18. *Vermetus rotula,* (vide Spirorbis ? page 282.) I have now no hesitation in considering this fossil a *Vermetus* as defined by Sowerby.
19. } 20. } *Ostrea falcata:* a very variable species.
21. *Cucullœa vulgaris.* A *cast* only is figured, on account of the imperfection of the shells.
22. Ostrea crista-galli ?

The Scaphites Cuvieri, Exogyra costata, Gryphea convexa and G. mutabilis, are so accurately figured in the sixth Vol. of the Journal of the Academy of Natural Sciences, that I have thought it unnecessary to add them to the annexed plates.

ART. V.—*Notices of ancient and modern Greece, in a letter to the Editor, from* Dr. SAMUEL G. HOWE, dated Isthmus of Corinth, Dec. 20, 1829.

REMARKS.

Dr. Howe is so well known to all lovers and admirers of ancient and modern Greece, that any communication from him is sure of being eagerly read. In the hospital and in the field, he has proved himself, in her darkest hours, the devoted friend of Greece ; and his letters have justly commanded entire confidence, especially on the part of those who have watched with intense solicitude, the vicissitudes of a struggle, to which even Grecian warfare presents no parallel.

The history of the late Greek revolution, by Dr. Howe, is one of the most thrilling interest; we are assured that it is true, for he was himself a witness and an actor in many of the scenes which he describes, and enjoyed the best opportunities of knowing, correctly, the history of men and events; both he pourtrays with graphic skill, with moving eloquence, and with fearless impartiality; and we are happy that he can now, on the same classic ground, that has been immortalized by so many illustrious actions, and illuminated by such floods of intellectual and moral light, contemplate, in security, the revival of all that is most dear and ennobling to man. Grecian liberty has risen from the tomb; arts, learning, commerce, and religion, are even now beginning to awake from the long sleep of ages; the new institutions will be those of regulated freedom, and Greece will soon arise and put on her beautiful garments.

LETTER, &c.

TO PROFESSOR SILLIMAN.

My Dear Sir—From the date of this, you will perceive I am on one of the most interesting, and it may one day again be, most important spots in the world. The Isthmus of Corinth has been the scene of so many important actions, and the uniting point of so many expeditions; it has been traversed by so many armies of so many nations, and it has been, and is by its peculiar situation, so important, in a commercial point of view, that you would expect from one on the spot, an interesting description of its present appearance. But here, as every where in Greece, the field is so wide and interesting, that one hardly knows where to begin, or when he has commenced, he is at a loss where to end. The Isthmus is, geographically, well known, and the late researches of the French savans, will give you a more correct idea of its geology than I can. I think they however, have deceived themselves, in supposing that the narrowest part of the Isthmus is the best adapted for the cutting of a canal; it is indeed two miles narrower between Callimachi and Coutraki than at the extremity nearest the Peloponnessus, and the ancients had there commenced their canal, the remains of which are still visible; but the nature of the soil is ill adapted to such an undertaking. On the North West side of the Isthmus, and about a mile from the foot of Mount Geranion, you perceive the commencement of the attempted canal; it must have been of great width and depth, for it is still lower than the surface of the Gulf of Corinth, and you walk up in its bed for a mile, between two vast ridges, formed by earth and stones, thrown up on each side; then you arrive at a narrow cut through the rocks, where the marks of the chisel are still visible, and a flight of steps also cut in the rock, is very perfect: a little farther, after passing other similar cuttings, you lose all traces of the canal, and the dry sandy soil seems to have presented a still greater obstacle. I may observe here, that the Isthmus is traversed, lengthwise, by a ledge of heavy pumice stone, which is visible in the center from the excavations made by the ancients to procure stone for their buildings; this ledge which is highest in the center of the Isthmus, is in some parts above the surface, and appears to sink away on each side to a far greater depth than the surface of the sea. It is a common idea, that the ancients were deterred from pursuing their undertaking, by the fear, that an inundation of the islands of the Egean would take place from the rush of the waters from the Corinthian Gulf, which were, and are vulgarly supposed to be many feet higher than the contiguous sea: it is difficult however to suppose, that men, advanced as they must have been in mechanical acquirements, should have been deficient in the means of deciding this question in hydraulics; although any person standing on the centre of the Isthmus, and judging simply from sight, would pronounce the waters of the Corinthian Gulf to be much higher than those of the Egean; the fact is accounted for however, by the nature of the slope, that toward the Corinthian side being gentle, while on the other it is abrupt.

The question, of the practicability of cutting the Isthmus by a canal, is decided in the affirmative; but another question remains to be settled, that is, how much commerce must augment here before it would be a profitable undertaking; this has been much discussed; but I have not yet seen noticed one objection that would be of considerable force, viz. the prevalence of westerly winds in the Corinthian Gulf, which is so great, that getting out is difficult; I venture to say, that more than eight tenths of the time, that the wind blows over the gulf, it is from the west.

In every part of the Isthmus you meet with some remnants of the works of the ancients; the stupendous wall which they constructed across it, although now a heap of ruins, still, by its extent and the immense mass of wrought stones, gives evidence of the enterprize and power of its builders: this wall has at different times been repaired; and last by the Venetians, whose army of thirty thousand men, were incessantly employed upon it for fifteen days and nights.

The remains of the Isthmian town are very visible, and considerable; an extensive platform of stone, and blocks of enormous fluted columns, mark the site of the temple of Neptune; the benches of the theater are in front, and to the right, the Stadium remains perfect in figure, though its marbles have disappeared. But as much as man has done to embellish and improve this spot, all his exertions are nothing in comparison to what has been done for it by the hand of nature; it would be difficult to describe the rich, extensive, and varied prospect from the Acro Corinthus, so as to give you a tolerable idea of it; that from the house in which I am living, though less grand and extensive, is one of the most interesting imaginable. The house is situated on a little elevation at the foot of the mountain, which terminates the Isthmus on the Peloponessian side; to the right you have the ever tranquil Egean, spread out like a lake; you see Egina, Salamina, and Attica, closing it in on that side, and the eye, glancing along "dun Cithaeron" and Geranion, rests, with rapture, on the lofty peaks of Parnassus, which are seen in front beyond the Corinthian Gulf, which stretches away to the left, and is shut in by the elevated plateau of Sicyon, and the higher hills of the Peloponessus: the mountain of the Acro-Corinthus forms not the least striking part of this picture, it stands solitary, separated from the rest of the chain, and its vast, black, rocky surface, rising to a great height, crowned by extensive walls and battlements, all strongly depicted against the horizon of the west, forms, at sunset, one of the most striking objects in nature. Then, it has been the scene of so many spirit-stirring actions, that the heart burns within one at the bare sight of its ramparts. As a military position however, the fortress of Corinth is by no means of that consequence, that the immense extent of its fortifications would make one suppose it had been considered by its builders; the circuit of the walls is so great that three thousand men would hardly suffice it for a garrison, and it is evident from the magazines, caverns, cisterns, &c. that it had been calculated for tens of thousands. It is a question somewhat curious, why such immense cisterns should have been made in a place abounding with water, nor is it less curious that at so elevated a point, on the summit of a rocky mountain, entirely disconnected with others, there should be so much spring water: there are about three hundred ancient wells, and more than half of them still filled with the coldest and purest water.

The guns of this fortress never could prevent the passage of an army into the Peloponessus, and it is too far from the sea on each side to admit of keeping up its water communication; so that it can easily be blockaded on all sides, and starvation has been the means employed by Greeks and Turks to take it.

The remains of the once proud and powerful Corinth, however few, are made striking by contrast with the modern town: every where you meet traces of the works of a mighty and enterprising people, and you gaze with more strange feelings of awe upon the column of a temple, from seeing it made part of the wall of a hut; and the foundations of walls of ancient buildings seem more everlasting from their serving for supports to modern houses, hundreds of which have crumbled away in succession, and left them as immovable as ever. The position is unhealthy, and this is one of the reasons that Corinth has not recovered from that complete destruction which all the towns in the Morea suffered during the revolution; and it is so great a disadvantage that I doubt whether it will ever recover, and become what it was even ten years ago. Opening commerce will point out the Isthmus as the place best adapted for the town, and I hope future years of security will remove the cause which made the ancient and more modern Greeks choose the site of Corinth; that reason was its vicinity to the Acro-Corinthus, to which they could fly in time of danger. Nor was this the case in Corinth alone; all the ancient cities of importance were built with the same view: we may except Lacedæmon, where the noble sentiment prevailed that the best walls were the breasts of brave men.

One of the best proofs of the veracity of the old Greek historians is in the geography of the country; for you may find your way, from place to place, with Strabo and Pausanias alone for guides. It was nature and not human institution that marked the line of division between the different states of Greece; and the astonishment that one feels in reading the accounts of so many separate independent states, in so small a space, is diminished on visiting the country: you find a plain of twenty, or thirty, or fifty miles in circumference, hemmed in on all sides by mountains; be sure this formed an ancient state: you find, at some part of it, a rocky elevation, still covered with the vestiges of enormous walls; be sure this was its Acropolis; this was the fortress into which the inhabitants of the plain drove their cattle and repaired themselves in cases of invasion. In every part of Greece you meet vestiges, more or less perfect, of those ancient states, and the traveller who is intimately acquainted with ancient history, sees in every plain and upon every height, objects of the highest interest to him, though they may be passed by as unimportant by another. The vestiges of Mycenæ, the residence of the "king of men," which are close at hand, and which I visit often, are wonderful from their extent, from the enormous size of the blocks of stones of which the walls are composed, and from their almost perfect state of preservation: you enter the Acropolis through the "gate of the lions," which are still in their place, and you gaze with feelings of inexpressible interest on the walls, the piles of ruins, and the immense heaps of stones which mark so distinctly the residence of Agamemnon, that it would seem but a century since he had left it, and not thousands of years.

ART. VI.—*Upon the solvent and oxidating powers of Ammoniacal Salts, &c.; by* Prof. JOHN P. EMMET, of the Univ. of Virginia.

THE muriate of ammonia has its composition well determined, it is strictly neutral, as far as one atom of acid and one of base can effect such a condition, and yet, as is well known, it strongly reddens litmus. Moreover, it is supposed to undergo no decomposition when sublimed (which requires a temperature a little below redness,) and, when prepared for commercial purposes, it generally results from the mutual decomposition of two neutral salts—sulphate of ammonia and common salt. How, therefore, are we to account for its acidity?

Feeling desirous of investigating the circumstances, I subjected several of the ammoniacal salts to a series of experiments which tend to prove that this property, instead of being peculiar to sal ammoniac, is almost characteristic of the genus of simple ammoniacal salts, the principal exception being the carbonate. The investigation has further led me to discover a method of converting such salts into chemical agents, as powerful as the *uncombined mineral acids.*

Muriate of ammonia appears to acquire its acidity by exposure to air and moisture for it was found, upon trial, that heating the salt to its subliming point rendered it perfectly neutral, or at all events, litmus could then be mixed with its solution in cold water, without becoming red. *Boiling water* restored the acidity and this result was accompanied by the liberation of some of the base.

The ammoniacal salts are, indeed proverbial for the facility with which they undergo decompositon, but I was not prepared to find this peculiarity so very easy of development and of so extensive a character. Upon trial, it appeared that crystallized specimens of nitrate, succinate, and other supposed neutral salts of ammonia, redden litmus at the ordinary temparature, with as much facility as the muriate; and, in other cases, where this effect was not at once obvious, (as when the sulphate or oxalate was employed,) the addition of *hot water* was sufficient to produce it. In making these experiments, the litmus was boiled with water so as to discharge any redness resulting from carbonic acid, and to the solution the crystallized salt was added.

It appears, from these and other results, that the ammoniacal salts either undergo spontaneous decomposition by exposure to the air, or else, they admit of change by the agency of water and moderate temperatures. In the end, the alkali escapes while the acid predominates to such an extent as often to occasion a brisk effervescence, when carbonates are mixed with the solutions.

This result, evidently, depends upon the volatility of ammonia and, upon reflection, I was induced to believe that the presence of a *fixed* base, as a substitute, would render the decomposition so energetic that the ammoniacal salts might be even employed for effecting chemical solution and producing the same compounds as when the *free acids* are used.

Such I actually found to be the case whether the salts were in solution, fused, or simply triturated with the oxides. It is unnecessary to detail all the experiments, made to verify this conjecture, as it was soon determined that by far the most effectual mode of developing the acidity is to employ the *fused nitrate*, either alone or mixed with the muriate. One of these experiments, however, I will notice as it affords a good example of chemical action between solids. Litharge was found to be capable of decomposing the salts of ammonia, by simple trituration; indeed it liberates the alkali with as much facility as quick lime, and heat very much promotes the effect. In those cases, (as of the carbonate, sulphate, chloride, or succinate,) where the lead forms *insoluble* compounds, this result is less remarkable; but no such additional force exists for the nitrate of ammonia, and the fact shews how very important it is to avoid precipitating the oxide of lead through solutions holding an ammoniacal salt. Several other oxides were found capable of decomposing these salts either by simple digestion at the ordinary temperature, or by passing the saline solution repeatedly through a filter holding the oxide. Such examples are however, of far less importance than those which illustrate the action of the *fused salts.*

Nitrate of ammonia melts at a temperature a little above 280°F. and exposed to this degree of heat, duly regulated, gradually evaporates but preserves its fluidity to the last. In this particular condition it readily dissolves solids, like other fluids, and always possesses very strong acid and oxidating properties. Carbonates disappear, with brisk effervescence, and several metals are oxidated with prodigious violence; when *muriates*, as of ammonia or soda, are mixed, they become dissolved, a brisk effervescence ensues and concentrated nitro muriatic acid is gradually formed. The muriate of ammonia is preferable to that of soda, or any other with a fixed base, because the excess may be removed by sublimation. The mixture of these salts which may be styled a nitro-muriate, when fused, dissolves gold leaf with the greatest ease and when assisted by the addition of a little pounded nitre or chlorate of Potassa, oxidates all the metals which I have had an opportunity of examining. With the fused nitro muriate or the triple mixture, when necessary, I satisfactorily dissolved rhodium, platinum, iridium, gold, sulphuret of molybdenum, native oxides of uranium, cerium and titanium, and crystallized chromate of iron besides all the common metals and their ores. It is a remarkable circumstance, however, that *sulphur* resists the action of these very energic salts. It liquefies with them becoming deep red, but does not appear to be otherwise affected, and the odor is that of sublimed sulphur, or its hydrate, without any resemblance to that of sulphurous acid. In no case was it found necessary to resort to a higher heat than that of a spirit flame.

I cannot but regard these fused ammoniacal salts as capable of affording very valuable assistance to the mineralogist, in his operations upon small portions of matter. They are, not only more portable than the free acids, but far less liable to injure articles of dress or tarnish instruments, and, although a large portion of the salts necessarily escapes by sublimation, the inconvenience is far less than that arising from the copious fumes of free acids.

Such indeed is the proper limit to their application, for, in the laboratory, it will always be found far more convenient to employ the common solvents. The best mode of using these salts, according to my observation, is to rub together in a mortar, equal parts of sal-ammoniac and nitre; this mixture is to be heated upon a watch glass, over the flame of a spirit lamp, and in contact with the pulverised mineral; nitrate of ammonia, in powder, is then to be added from time to time, until the solution is effected. In most cases, the nitre may be omitted with advantage, as it is impossible to remove any excess by heat.

The following experiment is very indicative of intense chemical action.

When the nitro-muriate (composed of equal parts) is fused between two watch glasses, the under glass becomes corroded nearly to one half of its thickness and the effect even extends to the cover. The heat of a spirit lamp is quite sufficient for this purpose. Here, without water or even perfect fusion, the alkali is entirely removed and the silex left, forming a snow-white, opaque surface, so soft as to admit of being cut through with the point of a needle or knife; green glass is not so easily affected, owing to its greater hardness and the absence of lead. The fused nitrate alone, if confined between watch glasses, also produces slight corrosion, but the effect is so remarkable when the nitro-muriate is employed, that a person, operating upon an unknown mineral and ignorant of this property, would be induced to attribute the result to the presence of fluoric acid. Indeed, when we consider that the effect appears to depend upon the liberation of nitro-muriatic acid or, perhaps, even to highly concentrated nitric acid alone, it does not seem improbable that similar cases have often occurred by the common modes of analysing, and this opinion is further strengthened by the fact that some minerals, as the chondrodite, appear to have furnished fluoric acid to one operation and not to another.

Fused nitrate of ammonia alone has some very peculiar properties, which may here be noticed. In the following experiments it operates with the energy of nitric acid itself.

It instantly attacks crystallized ferrocyanate of potassa, liberating the acid and then rapidly effecting its decomposition, so that nothing remains but the iron, of the ferrocyanic acid, in the state of peroxide.

Chromate or bi-chromate of potassa undergoes decomposition so suddenly as to produce an explosive effect. If a little water be mixed with these salts and heat applied, chromic acid is merely liberated and imparts its fine ruby red color to the mass, but, without this fluid, the mineral acid is immediately converted into the brown or deutoxide.

Hydriodate of potassa also suffers instantaneous decomposition; it becomes brown and free iodine escapes abundantly.

In all these examples (and no doubt many other similar ones exist) it is easy to perceive that the nitric acid, of the ammoniacal salt, takes possession of the fixed base, potassa, while the different acids, ferro-cyanic, chromic and hydryodic, incapable of resisting the further power of the acid salt, speedily suffer decomposition. Hence the effects are extremely analogous to those of strong nitric acid, but other examples are not always as satisfactory. Thus, with respect to the metals, it is not easy to explain why the fused nitrate should have no action whatever upon pure tin and iron, when we consider how very rapidly these bodies are oxidated in the free acid. Perhaps the difference is owing to the absence of water from the fused salt. Mercury and arsenic also appear capable of resisting the action of the ammoniacal nitrate. Upon silver, copper, bismuth, antimony and nickel, if heat be constantly applied, it readily effects oxidation, but the metals which best illustrate its oxidating and solvent powers, are zinc and lead. The zinc disappears with as much rapidity as when exposed to the strongest mineral acids and, at the same time, so completely sustains the requisite temperature, that it becomes unnecessary to continue the application of heat, after the action commences.

During this very turbulent operation, *nitrogen gas*, ammonia and water, are given off in abundance. A mercurial thermometer indicated that the nitrate is decomposed by zinc at 280° or 300° Fah. (temperatures a little above its point of fusion,) but the heat liberated, even by small pieces of the metal, was so great as to indicate 540° in a very short time. The most remarkable circumstance attending this decomposition, and which appears inconsistent with the usual products of nitrate of ammonia when exposed to an elevated temperature, is, that no protoxide of nitrogen, or nitric oxide, could be detected in the gas collected over water. Indeed I am convinced, from several experiments, that this decomposition furnishes pure nitrogen as conveniently as that of any other process known to chemists, and as such I will here venture to recommend it.

The following method was found most convenient.

A tubulated retort is to be partly filled with the nitrate of ammonia, and a cork fitted to the tubulature. Through this cork is to pass, freely, either a knitting needle or an iron wire, holding, by means of a hook, the coil of zinc. As soon as the salt has entered into fusion, the knitting needle must be pushed down far enough to place the zinc in contact with the nitrate. This arrangement is not only convenient but necessary, for, if the zinc be thrown at once into the fused salt, the action will prove too violent and unmanageable; whereas, when contact is not constantly maintained, there is a strong tendency towards a vacuum in the retort, which would endanger its safety. By the process, here recommended, there is no liability to accident, and the quantity of nitrogen may be easily regulated by raising or lowering the zinc. Every grain of the metal furnishes nearly a cubic inch of the gas, while the ammonia, which also escapes, becomes wholly condensed as soon as it enters into the water of the pneumatic cistern.

When I first ascertained that the gaseous product of this decomposition was nitrogen, I concluded that the zinc, together with the hydrogen of the ammonia, abstracted all the oxygen from the nitrate so as to leave nothing but nitrogen gas; were this the case, however, 1 grain of metal should liberate 1.38 c. inches, which is a greater amount than was actually obtained. Lead may be substituted for zinc, although not with advantage, as a considerable quantity of nitrous acid makes its appearance. The nitrogen, also, is generated much more slowly and in smaller quantity.

Fearing that my communication has already passed beyond its proper limits, I shall refrain from offering any further remarks, but conclude with the hope, that this novel and interesting view of the ammoniacal salts, may soon engage the attention of persons better able to extend and improve it.

Bromine and Iodine in Kenawha waters, Va.

Extract of a letter from Prof. J. Emmet to the Editor, dated University of Virginia, April 20th, 1830.

Dear Sir.—I perceive, by your last number, that Mr. Hayes and yourself have discovered *bromine*, in the waters of Saratoga and the brine of Salina. It gives me pleasure to be able to add another example of its occurrence. I have lately been able to obtain it in considerable quantities from the bittern and natural brine from Kenawha county in this state. Iodine is also present in small quantity. The bittern is remarkable for the large proportion of lime which it contains united with muriatic acid, and, as I have reason to suspect, with hydro-bromic acid. Even the salt prepared for sale, becomes yellow by exposure to chlorine or nitric acid, and thus indicates the existence of this singular element. Strong ethereal solutions have been prepared both from the salt and bittern. Indeed, so far as I can at present judge, (the samples having been nearly exhausted by a general analysis,) the bromine exists in the Kenawha bittern in sufficient abundance to admit of being prepared for sale.

ART. VII.—*On the red color of flame as produced by Strontian and as characteristic of minerals of that genus; by* Lieut. BADDELEY, R. En. Up. Can.

TO PROFESSOR SILLIMAN.

Kingston, (U. C.) April 19, 1830.

Dear Sir—The object of this letter is to point out to such mineralogical students as may not have acquired a more intimate acquaintance with chemical phenomena than myself, an error into which they are liable to fall, when consulting mineralogical writers on the distinguishing characters of the natural strontians, as most of the authors on mineralogy, *appear* to make the reddening of flame a character peculiar those minerals. Bakewell, indeed says, that it not only distinguishes strontian from barytes but from every other earthy mineral. Should the *mere* mineralogist dissolve a little carbonate of lime in muriatic acid, and apply, by means of a small piece of stick, a little of the solution to the wick of a lighted candle he will instantly perceive, that a portion of the flame, generally towards the edges, is colored of a beautiful rose red and this without the assistance of any alcohol, the intensity of color appearing to increase as the solution *approaches* saturation. Meeting with this character, for the first time, in a mineral under his examination, would he not, influenced by the works he consults, be induced to suspect the presence of strontian; ignorant perhaps that the carbonate of lime, an *earthy* mineral, when so treated, is converted into a muriate of lime, a salt of too soluble a character to occur native in a concrete state; and ignorant also, that the salt thus formed, has the character of giving a red color to flame. Thomson, Parkes, and other chemical writers mention this latter fact. Parkes says, "Pulverize some of this salt and throw a little of it into a spoonful of burning alcohol; this will produce a beautiful red flame, the color of which may be rendered still more intense by agitating the mixture during the inflammation. I have tried this experiment by dropping powdered carbonate of lime into an inflamed mixture of muriatic acid and alcohol, and found it to succeed perfectly. It answers equally well, if the powder be added before the mixture is inflamed, but I always found the presence of the muriatic acid necessary, although not of the alcohol, as the candle will answer almost as well. The magnesian carbonates of lime, when so treated, exhibit the same phenomenon, but the *pure* carbonates of magnesia do not; hence is derived a very ready if not delicate test for distinguishing them.

As might be expected, the sulphates of lime, when similarly treated, are deficient in the character of reddening flame, unless, as is not uncommon, some carbonate of lime is present.

With regard to the sulphate of strontian found at this place, I am inclined in this case also, to attribute the rose red color which, when treated with muriatic acid, it communicates to flame, to the presence of some carbonate of lime; for, after digesting its powder in muriatic acid and washing it, a repetition of the process before found to be successful, fails to produce the red color.

Having just perused your note upon this subject, in the last number of the Journal, I feel more inclined to think the above opinion correct. Had carbonate of strontia been present, the washing would not have prevented the exhibition of the colored flame.*

I converted a portion of the sulphate of strontian into a sulphuret, by mixing it, in a state of powder, with one eighth of its weight of charcoal and submitting the whole in a crucible to a red heat for four or five hours, but I found that it still required the presence of muriatic acid to develop the rose colored flame, and I could observe no other effect produced, in that respect, than an increased development of the coloring matter both in point of quantity and strength. From these observations it appears to me

1st. That to give a red color to flame is not peculiar to strontian.

2nd. That the natural sulphate found here, does not *appear* to do so, unless muriatic acid and lime be present.

3rd. That the earths of barytes would also appear to exhibit that character if moistened with muriate of lime.

4th. That however distinguishing this character may be between the two earths in the state of purity, it is not one, upon which any dependence can be placed in order to distinguish them in their natural state unless any portion of lime which may be accidently present is removed previously to decomposition. It would be an interesting inquiry how far the coloring principle in the muriate of lime and pure strontian may be the same, an investigation which might repay the individual who engaged in it, by some interesting discovery.

In the absence of that satisfactory species of evidence which chemical analysis affords and in consequence of what has been

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* It appears reasonable in consequence of the interesting facts stated by Lt. Baddeley, to attribute the red color in this case, to the presence of carbonate of lime; but had carbonate of strontia been present, it would, by the same treatment, have been turned into muriate which would have also reddened flame, and being a very soluble salt, it would have been removed by the washing.—*Editor.*

said, one character alone remains among those described as belonging to the sulphate of strontian, of this locality, which can be considered as distinguishing it from barytes; but that is an important one. In consequence of that part of your note referring to its sp. gr. I carefully repeated the operation with two distinct instruments and two distinct pieces of the mineral. The first with a pair of delicate scales for weighing gold, gave 3.913—the other with Nicholson's Portable Balance, gave 3.916 which (together with my former trials) renders it highly probable, if not certain, that the mineral is strontian and not barytes, the sp. gr. of which is, by all authorities, stated at several tenths above 4.0.

From a note by Dr. Cooper, in his edition of Thomson, Vol. I, p. 289, in which he says that "all the salts of strontian with muriate, nitric and acetic acids, give a red color to flame, when cloth impregnated by them, is dipped into alcohol and burnt." I was induced to make the following experiments with nitrate of lime, oxalate of lime and acetate of lime, (carbonate of lime dissolved in vinegar.)

Nitrate of lime burnt in alcohol, gave a blue flame, edges red.
Do. in the candle, gave a much lighter red, approaching lilac.
Oxalate of lime in alcohol, gave no redness.
Do. in the candle, do. do.
Acetate of lime in alcohol, gave scarcely any.
Do. in the candle, gave very light red.

The slight reddening observed in the nitric solution, was attributed to the presence of muriatic acid, which I believe generally exists in the nitric acid of commerce. And the same may be the case with the acetate of lime.*

Art. VIII.—*A new Instrument for taking Specific Gravities; by* Lieut. J. W. Baddeley, R. En. Up. Can.

EXPLANATORY LETTER.

TO THE EDITOR.

Kingston, (U. C.) April 16, 1830.

Dear Sir—I lay no claim to invention in submitting to your notice and that of the public, the following description of an instrument for taking the sp. gr. of minerals, the principle on which it is constructed is, we all know, "as old as the hills;" there may be, however,

* I request the indulgence of your readers, for the foregoing observations, as coming from one at the threshold of scientific inquiry.

something new in the mode of applying it. The only method hitherto resorted to in taking the sp. gr. of minerals is to compare the actual weight of the mineral in air with the loss of weight it sustains in water. The mode adopted here is to compare the actual weight of the mineral with the weight of water displaced by its immersion.

The theory appears to me unobjectionable, but I anticipate difficulties in bringing the instrument into correct operation, although none but what a skilful artist might overcome.

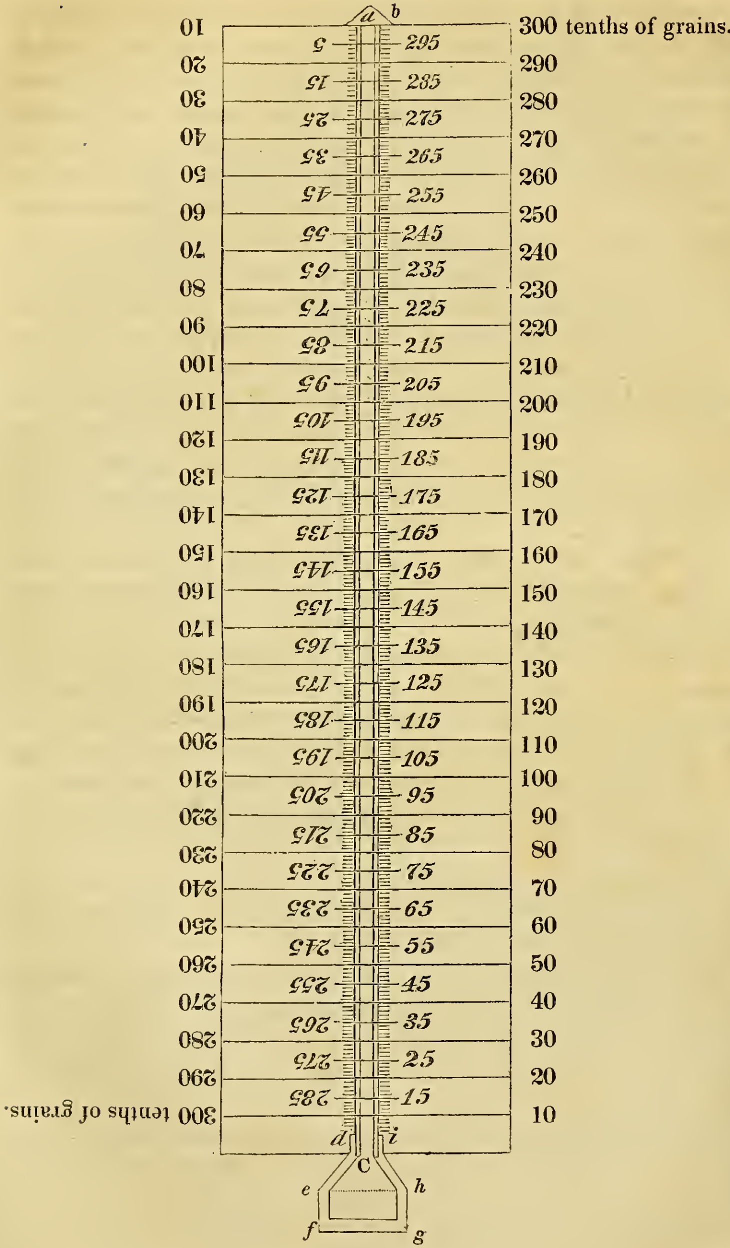
Construction.

A cylindrical tube 0.13 of an inch in diameter will hold by calculation a trifle more than 30½ grains of distilled water. Provide a glass tube of these, or nearly these dimensions and the same in quality as those used for the best barometers. Let one end of the tube (*b*) be supplied with a top (*a*) to screw on and off and to be perfectly water tight when on. Let the other end of the tube (*c*) be luted into a low round glass bottle about half an inch in diameter and the same in height, the upper half of which is to be funnel shaped and made, by means of a metal joint, to screw on and off the lower half, but like the top (*a*), to be perfectly water tight when on. This bottle is marked (*d*, *e*, *f*, *g*, *h*, *i*,) in the accompanying sketch and the position of the screw is shewn by the dotted line (*e*, *h*.) The tube, thus prepared, is fixed to a board such as is used for thermometers and in the same manner with the exception that the bottle projects beyond the lower end of the board.

Carefully weigh in a delicate pair of scales turning with a tenth of a grain, 30 grains of distilled water at the temperature of 60° of Fah. which pour into the tube (*bc*) by the funnel (*d*, *e*, *h*, *i*,) observe the height at which this water stands in the tube in its present reversed position and score the same on the board. Divide this height into as many equal parts as there are tenths of grains in the water and score these also on the board commencing with 5 or 10 near the bottom and terminating at 300 at the top—every one of these divisions will of course represent a tenth of a grain which mark as in the sketch.

Manner of using the instrument.

Turn the top (*a*) downwards and unscrewing the cylindrical portion of the bottle (*e f g h*) fill the tube with water by the funnel (*d e h i*) and observe the height at which the water stands, then screw on the part (*e f g h*) and allow the water to fall through the tube into the bottle


a
b
300 tenths of grains.
290
280
270
260
250
240
230
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
295
285
275
265
255
245
235
225
215
205
195
185
175
165
155
145
135
125
115
105
95
85
75
65
55
45
35
25
15
d
i
C
e
h
f
g

the size of which should be so regulated that the water may not only fill it but rise a few tenths in the tube, observe the height to which it does rise (say 15 tenths.) Reverse the instrument again and when the water has returned into the tube, unscrew the portion *efgh* once more and introduce into the funnel shaped portion of the bottle, a small fragment of the mineral, &c. whose sp. gr. is required, having previously taken its actual weight in air, which suppose to be 200 tenths. Again screwing on the portion of the bottle *efgh* turn back the instrument to its proper position and unscrewing the top (*a*) to prevent the reaction of confined air observe how high the water now stands in the tube which suppose to be 115. Now, as before the mineral was introduced, the water stood in the tube at 15, its introduction has evidently displaced a column of water, (equal to the bulk of the mineral) weighing 100 tenths of grains or the difference between 115 and 15; but the actual weight of the mineral is 200, consequently its sp. gr. is 200 divided by 100, or twice that of distilled water.

The water will be observed to fall gradually in the tube when minerals which absorb it are under trial; in this case the greatest height must be taken.

This instrument is calculated also to shew the sp. gr. of mineral waters or of wines, spirits, oils, &c. by a comparison of the weight shewn by the tube with the actual weight; thus, if a spirit stands in the tube when reversed at 115 and weighs only 100, its sp. gr. is to that of distilled water as 100 is to 115 or as 869, &c. is to 1.0; but 1.0 is the sp. gr. of distilled water therefore .869, &c. is the sp. gr. of the spirit.

The actual weight of the spirit may be taken, when it is in the tube, by deducting the weight of the tube, without the spirit, from the weight of the tube with the spirit.

Solid substances also, which float on water, are by this instrument readily weighed, specifically, without attaching any heavier body to them because they must be submerged, that is if they be larger than the orifice of the tube which will of course in that case prevent them from rising in it.

Another advantage peculiar to this method of taking the sp. gr. is, that it is of no importance what description of water is made use of in weighing hydrostatically solid bodies, as the quantity by *measure* displaced will be in all cases the same. To color the water with some vegetable substance will be found useful.

Art. IX.—*Springs and Artificial Fountains.—From the Annales de la Societe D'Horticulture de Paris.—Considerations, Geological and Physical on the reservoirs of subterranean water, relative to the spouting fountains of wells, obtained by boring; by* M. Le Vicomte Hericart De Thury, President of the Horticultural Society of Paris.

Translated for this Journal by Gen. H. A. S. Dearborn, Brinley Place, Roxbury, Massachusetts.

1. Water is every where elevated in the atmosphere by evaporation.

2. A part of the mist, dew, snow and rain falling on the mountains, appears to act by affinity upon the clouds, and to collect them around their summits.

3. Thus arrested and concentrated about the mountains, the waters infiltrate between their different superpositions. They follow their declivities or inclinations, until they meet impermeable strata, which retain them, upon which they flow subterraneously, and whence they pour or spout out, whenever these strata present any opening, especially on the flanks of the mountains and hills, where these strata are broken and denuded by some convulsion.

4. Besides, there exist springs upon the elevated plains and even on the hills which are more lofty than the surrounding country: for example, the perpetual springs of Mount Cimone, near Modene, are more elevated than all the country which surrounds them.

5. In primordial formations or primitive mountains, subterranean infiltrations are very rare, nevertheless springs are frequently found but generally not very copious; still the borings which have been made, prove that the water infiltrates threw them, as in the secondary and transition mountains, either between the superpositions of the different strata, which constitute them, or by the veins and crevices by which these mountains are often cut in all directions, and even to a very great depth.

6. Commonly, the overflowings of rain water or from the melting of the snow, do not take place in primitive countries, but on the surface of the mountains, their masses being generally, too dense and compact to permit any infiltration.

7. The waters which are found in the primitive earths vary in quality, like the earths which conceal them.

8. Those which flow to the surface are generally good, fresh and salubrious.

9. Those which infiltre between their superpositions, appear to partake of the nature of the different substances, which they encounter and traverse.

10. In the excavations, made by miners in the primitive mountains, springs of water are sometimes found, of a pure and excellent quality. Such are the springs which the veins of Chalanches, Gardette, Grave and Saint Christophe, in Oisans, of the department of Isere, present, such are also, according to Cordier, the waters of Vic in Carlodes, at the foot of the Cantal, which issue immediately from the granite, and which are almost pure.

11. Generally the waters which flow from granitic earths are gaseous, sulphureous and saline.*

12. When they are found in compact granite, these waters should have their origin in these rocks, or below them.

13. These waters are almost all thermal, and even of a very high temperature. Such, in France, are the thermal and gaseous waters of Ar, department of Ariege, of Chaudes, Aigues, near Saint Flour in the Cantal; of Vals, near Aubenas, in Ardeche; of Bonnes, valley of Assan, Hautes, Pyrenees; of Cauterets, Hautes Pyrenees; of Bagneres de Luchon, Haute Garonne; which issue from granitic mountains, at a temperature, which varies from 30 to 90 degrees.

14. In the juxtaposition of the secondary formation, or of the depositions upon the primitive, there are frequently found abundant infiltrations, which not being able to penetrate the very compact mass of the latter, follow, subterraneously, the parts or surfaces under the secondary. The examples of these infiltrations, are very numerous, in the chains of the Alps and Pyrenees, and in all lofty mountains.

15. These infiltrations being thus formed, in the most elevated parts of the chains of mountains, extend under the earth, for distances and depths, whose limits it is impossible to determine.

16. The waters of these fountains are generally fresh and of a good quality, when they are near the surface of the earth.

17. When waters are procured from a great depth they are almost always gaseous sulphureous and saline.

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* This is not true in the United States

18. The secondary mountains and their form of superposition, allow the waters to penetrate to much greater depths, than the primitive mountains.

19. They follow, in secondary formations the dip, more or less inclined, of the beds or strata of their different formations.

20. The waters of these formations are those which present the greatest varieties in their character. It is, in fact, in these formations that are found the greatest number of the mineral and thermal springs, and the saline and gaseous waters.

21. These waters although issuing from secondary formations, do not always appertain to them, and many of them probably proceed from primordial formations, which are situated below them. It is to these formations that it is proper to refer the waters of Cambo, in the Bosses pyrenees; of Vicky, of Bourbon l'Archamboud, of Neris, department d'Allien; of Bourbon Lancy, department of the Saone et Loire of Cramsoc, Sansoi, in Aveyron, of Bagneres de Bigorne, Hautes Pyrenees; of Ussat, near Tarascon, Ariege; of Bagnoles, near Mende, Lozene; of Leuxeuil, near Vesoul, Haute Saone, and Plombieres, near Remiremont, in Vorges, &c.

22. Fresh water, of a good quality and very abundant, is also found in these formations, which issue from the earth with impetuosity, and often present this peculiarity; that they spout up in the vicinity of gaseous, mineral and thermal waters, and that they often flow together, through the same aperture, although it is very certain, they have their origin in different formations. This phenomenon is very frequent in those countries where saline springs exist, and it is sometimes very difficult to separate the springs of fresh and saline waters.

23. The Alpine calcareous mountains, those of *calcaire jurassique* (limestone of the Jura; transition Limestone) and the depositions which cover their base, contain, like the primary, very different waters as to their nature, quality and temperature.

24. We find abundant fresh water, often forming very strong and rapid currents, which give existence to certain remarkable springs, such as those of Vaucluse, of Laise, of l'Orbe, &c.

25. We find mineral and gaseous, thermal and saline springs, such as those of Campagne, near Limaux Aude of Saint Felix de Babneres, near Condat, Lot; of Aix, Bouchede, Rhone; of Greou, near Digne, Basse-Alpes, of Balaruc, near Montpellier, Herault; of Bourbonne les Buns, Haute Marine; of Chateau Salins, Salins in Meurthe and gura; of Paugues in Nievre; of Paint Amond near Valenciennes, Nord, &c. &c.

26. The superior oolite and chalky calcareous depositions and formations; argillaceous and sandy depositions, coarse limestone, the marles, the fresh water limestone or, (belonging to the) *terrain lacustre* are more favorable than the preceding to the infiltration of waters, which descend from greater elevations. These formations present abundant waters in the superpositions; they have a constant analogy in their composition and properties. The predominant salts are the carbonate and sulphate of lime, the sulphate and carbonate of iron, and sometimes the sulphate of magnesia; when they are filtered though chalky or sandy masses, these waters are generally fresh and of a good quality.

27. They are ferruginous when they pass and infilter through, pyritous earths, or mines of iron, or through pyritous argillaceous earths, such as those of Passy, near Paris, and of Forges, in the Seine. Inferieure, or those of Ferrienes, near Montargis, and of Segrais, near Pishiviers, which issue from superior formations to coarse marine limestone.

28. The only example of sulphureous water, well attested, at this time, in earths of this formation, is that which the waters of Enghien present, containing sulphuretted hydrogen gas, the sulphate and muriate of magnesia, the sulphate and muriate of lime, &c. &c.

29. Generally, the waters, of all these earths, are of the mean temperature of the place where they gush out, and are that which is called *cold*, in opposition, to the *thermal* waters.

30. Alluvial earths, like the preceding, yield abundant fresh water.

31. Generally, their waters proceed from the filtration of rain and melting snow, which penetrate, extend and flow between the beds of marl, clay, or sand, where we attempt to reach them by our wells.

32. The alluvial earths, of alluvial sand and gravel, sometimes present natural fountains, which indubitably proceed from more elevated districts, and probably from secondary or primary earths; such are the fountains of Moses, near Suez, described by Monge, situated on the summit of small sandy hills, raised by the winds and aggregated by the sulphate of lime, which the waters of these fountains hold in dissolution; such is that fountain of fresh water, flowing above the waves of the Mediterranean, near Spezzia, and described by Spallanzani; such is the beautiful spring, in the sand bank, on the shore of Alvarado, in the gulf of Mexico: this sand bank, forty years since, was not more than 0.66 centimetres high, and about half a mile in

area, now by successive accumulations, this sand bank forms a hill more than thirty metres in height, where the inhabitants of Alvarado and the crews of the vessels, which frequent this port, daily go to procure water, from the spring, flowing at its summit, which is fresh and of a good quality; finally, such is the spring of Lairet, at the chateau of the *Source-Morogues*, near Orleans, which rises from a very deep pit, formed of sand on its borders, and of rock at the bottom, and which yields a volume of water of more than thirty cubic metres.

33. Volcanic earths and those of *trachyte*, which are now generally considered as having been thrown out from below the granite, by the action of subterranean fires, afford springs of fresh water, which proceed from infiltrations; their superior parts often present lakes and other large collections of water. Among the numerous examples which we are able to cite, there are none perhaps, more remarkable, than the beautiful springs in the grotto of Royat, which supply the fountains of Clermont. Few countries afford so many springs, as the volcanic mountains of Puy de Dome and of Cantal.

34. The *terrains de trachyte* and volcanic ejections contain many mineral and thermal springs, which present, in their temperature and composition, the same characteristics as those of the primitive earths: thus these waters are more or less charged with sulphuretted hydrogen, carbonic acid, carbonate of soda, and lime, of silex, &c.; such are those of Mont d'Or, Saint Allyre, Viele-Comte, Chatel-Guyon, near Riom, Chap des Beaufort, and Chalusset, &c. &c.; the two last are remarkable for the quantity of carbonic acid gas, which is disengaged from the earth, from which they issue. As to those of Deux-Landes, which issue from trap rocks, covered by compact calcareous formations, they present this peculiarity, that at a temperature of 60°, they are almost pure, and contain but a very small quantity of magnesia and sulphate of soda.

35. According to some natural philosophers, the theory of the waters rising above the surface of the earth, through perforations made by boring with an auger, has sometimes been considered as analogous to that of jets d'eau, and at others, to that of the syphon. The shaft made by boring, they say, being only the second branch of a great syphon, whose first branch is the subterranean spring, which flowing between the impermeable strata, these confined waters proceed from a more elevated region, than that in which the boring has been excavated. (Plates I. and II.)

36. According to others, these shafts can and ought to be considered as tubes, which show the pressure of the water upon an earthy or stony bed, in which these shafts end.*

37. These two opinions appear to us equally admissible. In fact, the labors in exploring the mines and quarries, have taught us, that in certain kinds of formations the waters are subterraneously diffused in veins, streams, and sometimes even in torrents more or less powerful, through the crevices, fissures and natural perforations of the interior of the bed of rock; while in other kinds of formations, the waters form level sheets, more or less abundant, between the beds of sand, of earth, or of stone, permeable and impermeable.

38. The grand calcareous masses of the chains of the Alps and of Jura, present numerous examples of these torrents, or subterranean streams, which have their sources or origin in the high mountains, and which after a longer or shorter course, form the admirable fountains of Vaucluse, Laisse, l'Orbe, Sassenage, &c. &c. Some quarries in Paris and the environs, offer frequent examples of vestiges of streams, or subterranean currents, which have formerly passed through the calcareous mass, at different heights, by the means of fissures and crevices; which generally intersect it in all directions.

39. The manner in which the springs exist, which are extended along the declivities of hills, to an almost constant height, in formations and beds, particularly in those of alternate formations of sand and clay, establish and characterize this disposition of the waters, which we have said is in a *sheet*, and whose origin is attributable, either to the subterranean effusions, which proceed from more elevated regions, or to the infiltrations of snow and rain water, which are arrested by these beds of clay.

40. This *sheet* of water has been assimilated to a bed of clay, of sand, or of chalk. If the water is considered as placed between two curved surfaces, like two cups or basins, of different diameters, whose superior borders shall be in the same plain, or irregularly denticulated, or in part closed, the liquidity of the water is the cause of the pressure, which the tube formed by boring measures; but if it is supposed that instead of a *sheet* of liquid water, it was a sheet of ice,

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* Mineral and thermal waters, rise to the surface of the earth, from the interior of primitive formations in consequence of the disengagement of gas and compressed vapors, which press and rest upon the surface of these subterranean waters. This has been perfectly demonstrated by M. Berthier, chief engineer of the mines.

the pressure would be resisted and would not be indicated by the tube, but it would be changed into a force of cohesion.

41. When the waters, whatever besides be their manner of extension, subterraneously, in descending from the superior regions toward the inferior, either in veins, streams or torrents or in a level *sheet*, happen to meet any outlet in the earth, (Plate I. and II.) they enter it and are elevated to a height, equal to the level, *or point of departure*, or in other words to a height, which balances the pressure, which the water exerts against the sides of the channel which contains it.

42. Whence it follows, that to obtain a fountain, which shall rise to the surface, it is necessary, 1st, to endeavor, according to the nature of the earth, at a greater or less depth, to meet an effusion of water descending from superior basins, flowing in the bosom of the earth, between compact and impermeable beds; 2d, give to this water by the aid of a tube, formed by boring, the possibility of rising to a height, proportioned to that of the level from whence it proceeds; and 3d, prevent by metallic tubes, forced down the shaft, the escape of the ascending water through sand, crevices, or fissures of the earth, traversed by the perforation made by the auger.

43. And from whence it is perceived, that water can be made to rise to the surface, by the aid of the auger, in almost every country which presents in the structure of its formations, *sheets* of subterranean water, between the alternate and continued superpositions of permeable or impermeable beds, extending to the regions, or mountains, which conceal the reservoirs of these sheets of water, and whose basis or declivities are covered by these superpositions.

44. But nevertheless it is possible, that a second shaft, bored a little distance from another, which affords water, would not yield any, if this last was supplied by a subterranean current, instead of a *sheet* of water, or if it was pierced upon the extremity of an elevated bed, supported against a formation of a different nature.

EXPLANATION OF PLATES I. AND II.

Whatever be the origin of the water produced by a shaft made by boring whether it proceed from a sheet of subterranean water (§37), or results from a subterranean stream or current (§38), the explanation can be sought in the theory of jets d'eau, or in that of the syphon.

In fact natural overflowing fountains are always formed, when there exists a superior basin, from which the water can flow, through natural channels; it is seen:

1st. That a shaft, formed by boring, is really but an artificial issue differing only from these natural conduits, by the regularity of its sides and direction, which tend to facilitate the ascent of the water;

2d. That the success of boring will be much more certain, when attempted in a region composed of impermeable strata, separated by beds of sand or gravel, through which infiltrate the effusions of a volume of subterranean water, or of superior basins.

And 3d that there are fewer chances of success, in compact and entirely impermeable formations, which afford only streams or subterranean currents, which escape through the crevices, fissures or irregular perforations of beds, or strata of stone and consequently rendering it uncertain what place to select for commencing boring.

Plate I. represents the geological section of a region, in which the primitive formation is covered in one part, by transition, or intermediary formations, partly compact, and in part crystallized, disposed in inclined strata with crevices and fissures, which traverse these strata in different directions; and in another part with secondary depositions, and by horizontal alluvial beds, which rest against the intermediary and transition formations, and cover them deeply.

The superior parts of the region present at different heights, basins, lakes, or rivers, A, B, C, sometimes placed upon the line of juxta-position of the alluvial and transition formations, and sometimes on the last.

When the waters of these basins, lakes, or rivers find crevices, fissures or drains, below their beds, they lose themselves, or infiltrate by these issues and are subterraneously diffused, and form the sheets *aa*, *a′a′*, *bb*, *b′b′*, in the sand or gravel, upon the clay or impermeable formations, or constituting irregular streams, as presented by the line of superposition *cc*, of transported earths upon those of deposition,—"*sediment.*"

The bored shafts *a′*, *a″* and *a‴*, descend to the sheet of water *aa*, supplied by the effusions of the basin *a*, yielding in the shaft *a′* the ascending water, which reaches to the surface of the earth, while in the shaft *a″* it spouts above, and in the shaft *a‴* it remains below the surface, rising in each of these perforations, at a height proportioned to that of the level of the basin A.

As to the shaft A'''' which is twice as deep as the preceding, notwithstanding its greater depth, and the two sheets of water which it has passed (*a a* and *a'a'*) the water does not rise higher than in the shafts A', A'', A''', because these two sheets of water are both supplied by the basin A.

It is the same with the shaft B. Finally the shafts C', C'', C''', supplied by the irregular stream *cc*, which has its origin in the basin C, show 1st. that the shaft C'', if it was only bored to the depth of the shaft C' would not yield water, because the stream pursued the irregular course of the surface of the inferior formation and that it is necessary to bore deeper to reach the water at C''. And 2d. that the shaft C''', descending still lower, does not yield any at this depth, in consequence of the elevation of the intermediary, or transition formation which interrupt in this part, the flowing of the stream *c c*, or that if this shaft afforded overflowing water it would rise from the sheets *b b* and *b'b'* which it had intersected, and that thus, notwithstanding the great depth of this shaft, the ascending water could never rise above that of the two shafts B', and B''.

The plate II. represents, like the preceding, the section of an intermediary, or transition formation, upon strata of primordial rock, but with this difference, that the strata of intermediary rock, are elevated and inclined against the primitive, but as they descend deeper, they become horizontal and are finally covered with tertiary formations, or detritus (*de transport*) and alluvial in horizontal beds.

There are seen in the superior regions, three basins A, B, C, and at the junction of the transition and the detritus, a fourth basin D; finally, the four basins have the subterranean outlets AA, BB, CC, DD, between the impermeable strata.

The shaft D', bored through the alluvial depositions, reaching only the sheet of water DD, will not yield water above the surface of the earth, as the basin D, from which this sheet proceeds, being in a region of country of an inferior level to that where this shaft is bored.

But the shafts C', B', and A' yield waters above the surface of the earth, to a height equal to that of the basins C, B, A, in which they have their origin.

OBSERVATIONS.

These two plates present only the application of all the figures of jets d'eau and syphons, in our *Treatise d'Hydrodynamique et d'Hydraulique*, to the over-flowing of water in shafts, formed by boring.

They are in conformity to the ideas communicated by the learned Spallanzani in his *lettres a Vallisnieri sur l'origine des fontaines.*

The explanation which has been given of the overflowing of the water from shafts made by boring, is in conformity with that which was published in 1691, by Bernardini Ramazzini, in his *description des fontaines jasillisantes de Modine,* a work which is now very scarce, and what is still more remarkable, the author, in explaining the theory of these fountains, which were then considered as wonders, proves, that he was as good a natural philosopher, as a geologist, and that he possessed very superior knowledge, for the time in which he wrote.

Art. X.—*Remarks on the Resolution of Equations of the fourth degree; by* Mr. C. Wilder, of New Orleans.

(See Vol. XVI. p. 271, of this Journal.)

The equation $y^4+ay^2+by+c=0$ may be resolved thus: assume the function $\frac{x^{12}+S_4x^8+S_8x^4+S_{12}}{x^3+yx^2+px+q}\ \frac{(A)}{(B)}$, and determine S_4, S_8, and S_{12}, so that (B) may be a factor of (A), independent of x, y, p, and q, and we have then

$$\frac{x^{12}-(y^4-4py^2+4qy+2p^2)x^8+(p^4-4qyp^2+4q^2p+2q^2y^2)x^4-q^4}{x^3+yx^2+px+q}\ \frac{(C)}{(D)}$$

put the ratio $\frac{(C)}{(D)}=\frac{ny'x^8}{y'x^2}$ and make y equal to nothing, and we have

$$\frac{x^{12}-2p^2x^8+(p^4+4q^2p)x^4-q^4}{x^3+px+q}=\frac{ny'x^8}{y'x^2},$$

and by composition,

$$\frac{x^{12}-(2p^2-ny')x^8+(p^4+4q^2p)x^4-q^4}{x^3+y'x^2+px+q}=\frac{ny'x^8}{y'x^2},\ \frac{(E)}{(F)},$$

but (F) is a factor of $x^{12}-(y'^4-4py'^2+4qy'+2p^2)x^8+(p^4-4qy'p^2+4q^2p+2q^2y'^2)x^4-q^4$, (E′), and consequently of (E) – (E′) or of $(y'^4-4py'^2+4qy'+ny')x^8+(4qy'p^2-2q^2y'^2)x^4$: now if we make $x^3+y'x^2+px+q=0$, we have also $(y'^4-4py'^2+4qy'+ny')x^8+4qyp^2-2q^2y'^2=0$; but the arbitrary n, allows one hypothesis, we therefore make $y'^4-4py'^2+4qy'+ny'=0$, and then we have, by writing for ny' in (E), $x^{12}-(y'^4-4py'^2+4qy'+2p^2)x^8+(p^4-4q^2p)x^4-q^4$, dropping the accent, and comparing this equation and the given, $y^4+ay^2+by+c=0$ we have

$$4p=-a, \qquad (1)$$
$$4q=b, \qquad (2)$$

and $\quad -x^4+2p^2-(p^4+4q^2p)x^{-4}+q^4x^{-8}=c$

or $\quad x^{12}-(2p^2-c)x^8+(p^4+4q^2p)x^4-q^4=0: \qquad (3)$

the equations (1), (2), and (3), joined to $x^3+yx^2+px+q=0$ are sufficient to determine y.

Next put $p=0$ and $\frac{(C)}{(D)}$ becomes

$$\frac{x^{12}-(y^4+4qy)x^8+2qy^2x^4-q^4}{x^3+yx^2+q}=\frac{np'x^4}{p'x^2}, \frac{(G)}{(H)},$$

and by composition,

$$\frac{x^{12}-(y^4+4qy)x^8+(2q^2y^2+np')x^4-q^4}{x^3+yx^2+p'x+q}=\frac{np'x^4}{p'x^2},\frac{(G')}{(H')};$$

but (H′) is a factor of $x^{12}-(y^4-4p'y^2+4qy+2p'^2)x^8+p'^4-4qyp'^2+4q^2p+2q^2y^2)x^4-q^4$, (G″), and consequently of (G′)–(G″) or of $(4p'y^2-2p'^2)x^8-(p'^4-4qyp'^2+4q^2p'+np')x^4$; if we now make $x^3+yx^2+p'x+q=0$, we also have $(4p'y^2-2p'^2)x^8-(p'^4-4qyp'^2+4q^2p'-np')x^4=0$; n being arbitrary we assume $p'^4-qyp'^2+4q^2p'-np'=0$, and writing for np' its value in (G′), we have

$$x^{12}-(y^4+4qy)x^8+(p'^4-4qyp'^2+4q^2p'+2q^2y^2)x^4-q^4=0,$$

and dropping the accent and comparing this equation with $p^4+ap^2+bp+c=0$, we have

$$4qy=-a, \qquad (1)$$
$$4q^2=b, \qquad (2)$$

and $\quad x^8-(y^4+4qy)x^4+2q^2y^2-q^4x^{-4}=c$

or $\quad x^{12}-(y^4+4qy)x^8+(2q^2y^2-c)x^4-q^4=0: \qquad (3)$

(1), (2), and (3), joined to $x^3+yx^2+px+q=0$ are sufficient to determine p. Lastly put $q=0$ in $\frac{(C)}{(D)}$ and we have

$$\frac{x^{12}-(y^4-4py^2+2p^2)x^8+p^4x^4}{x^3+yx^2+px}=\frac{nq'}{q'}, \frac{(E)}{(F)},$$

and by composition,

$$\frac{x^{12}-(y^4-4py^2+2p^2)x^8+p^4x^4+nq'}{x^3+yx^2+px+q'}=\frac{nq'}{q'}, \frac{(E')}{(F')},$$

but (F) is a factor of $x^{12}-(y^4-4py^2+4q'y+2p^2)x^8+(p^4-4q'yp+4q'^2p+2q'^2y^2)x^4-q'^4$, (E″), and consequently of (E′)—(E″) or of $-4q'yx^8-(4qyp^2+4q'^2p+2q'^2y^2)x^4+nq'+q'^4$: the above expression becomes equal to zero when $x^3+qx^2+px+q'=0$. Let us make $4q'yx^3-4q'^2px^4-q^4=nq'$ and then we have, by writing for nq' in (E′) its value, $x^{12}-(y^4-4py^2+4py+2p^2)x^8+(p^4+4q^2p)x^4-q^4=0$, which compared with $q^4-aq^2+bq+c=0$, gives

$$4px^4=-a, \qquad (1)$$
$$4yx^8=b, \qquad (2)$$

and $x^{12}-(y^4-4py^2+2p^2)x^8+p^4x^4+c=0$; (3)
eliminating y and p from (3) and we have

$$x^{36}-\left(\frac{a^2}{8}-c\right)x^{24}-\left(\frac{ab^2}{16}-\frac{a^4}{256}\right)x^{12}-\frac{b^4}{256}=0: \qquad (4)$$

equations (1), (2), (4), and $x^3+yx^2+px+q=0$, are sufficient to determine q.

Art. XI.—*Practical Instructions on the Culture of Silk, and of the Mulberry Tree in the United States; Vol. I. and Vol. II.* 214 *pages,* 8*vo. with plates; by* Felix Pascalis, M. D., Honorary Member of the Linnæan Society of Paris, &c.—*New York, J. Seymour,* 1830.

Essay on Silk, by { Mr. D'Homergue, &c. and Mr. P. S. Duponceau, &c.

(Communicated.)

Since the middle of the 18th century, there has never been a greater excitement among commercial nations, towards the promotion of the culture of silk, than that which seems to prevail at the present time. Many ancient silk districts of France and Italy furnish us with the works of distinguished agriculturalists and philosophers, anxiously investigating, either new modes or systems of improvement, or experimenting on the natural laws which govern this production, or which can command a better quality and greater quantity of it. It is no longer supposed, that the success and benefits derived from its growth can be depended upon, only in warm or southern climates. They are now sought for in the northern latitudes of Germany and France, whilst the factors of manufacturing nations ransack all the corners of the world where *raw silk* can be obtained. We are told also, of new and more perfect sorts of Mulberry trees, that have been discovered and imported from distant regions, and which are to be authoritatively introduced, to replace ancient orchards of considerable silk establishments at Pondicherry in Asia, and at Cayenne in South America. This general and simultaneous excitement has probably been kept up by the long and destuctive war in Greece, and other portions of eastern and southern Europe, which were the principal nurseries of silk for the manufactories of England, of Lyons, and of Italy. Nevertheless, we rejoice that the same anxious spirit for the general adoption of the culture of silk is also extending throughout all ranks of our fellow citizens. This country certainly possesses all the elements for advancing this rich branch of agriculture, and we are gratified by the numerous attempts already rewarded by flattering success, especially in the states of Connecticut and Ohio.

After the general government at Washington had published and distributed the valuable *Manual on Silk*,* there appeared in this country several essays or treatises relative to the promotion and extension of the culture of silk. These were elicited chiefly from the pens of several respectable editors of periodical and agricultural journals; *Vernon*, *Fessenden*, *Gideon B. Smith*, *&c.* but within the last year our attention has been called to some more considerable works from different quarters: *Essays on Silk by d'Homergue and Duponceau*, and the last from Felix Pascalis, M. D. a physician originally from France, but long a resident citizen of Philadelphia and New York. We look at this production as very important also, in relation to fundamental principles, and to the philosophy of the author's proposed improvements.† The first volume of the *Practical instructions* opens to us the ancient and classical history of silk, which, as an animal and vegetable production can be traced to the most remote ages of heroic or mythologic fables.

"The *Golden fleece* of the ancients is so far connected with our subject, that *Hager* the author of the Pantheon Chinois, conjectures that it was *raw silk* in its natural state, resembling so many flowing threads of gold. In addition to this authority we beg leave to remark, that Colchis, a region on the east of the Euxine sea, celebrated for the expedition of the Argonauts, was the Emporium of the *Seres* or Chinese, who brought there their silk, which according to custom they displayed under the flag of their nation, representing a dragon. The hero *Jason* must then have commanded an expedition for plunder or for commerce. There are other analogies in this fable, especially that of *Medea* his wife, punishing her rival *Glauce*

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* Document 358.

† Our acquaintance with Messrs. Duponceau and Pascalis, whose scientific reputation, and writings are equally distinguished in this as in their native country, has commanded a great degree of our confidence; we understand that Dr. Pascalis has had much experience in this branch of industry and natural history; and the Linnæan Society of Paris have shewn their confidence in his knowledge by making him president of their American branch.

by means of a poisoned gown which had been given to her by the Sun her father. Indeed many poets have said that silk was the produce of the sun upon the trees. For the enumeration of these and of the writers who have alluded to the article of silk, to establish also the identity of the *Seres* with the *Chinese*, we refer the reader to a dissertation by professor Anthon of Columbia College, appended to his splendid edition of Horace, lately issued from the press, in a letter to Doct. Felix Pascalis.*

As a substance which could be woven with gold and silver for ornamental tissues, the silk from China or from other distant Asiatic nations, was introduced by them into Rome, soon after the conquest of Greece and of Egypt; and finally, it was cultivated by Europeans in the 6th century of the Chr. era. To the American readers, however, one of the most interesting objects in this historical sketch, is to learn, how the mother country devised and sedulously pursued a plan to naturalize both the mulberry tree and the silk-worm in these her ancient colonies; as they had been frustrated in repeated attempts to transplant this culture from southern Europe, and to establish it at home. Most of the southern provinces of North America were foremost in their zeal, and so successful as to have supplied London with considerable quantities of raw silk. The eastern states would soon have participated in the benefits of similar crops, had not the revolutionary war interrupted their progress and labors, and ultimately provoked the absolute abandonment of it. Our author thinks, however, of another cause. The measures authorized by provincial authority were at first pursued in the southern colonies, in which the necessary labors must be carried on by slaves, who are not fitted to sustain the intelligent cares and unwearied attentions, required for the rearing of the delicate silk insect. This labor is better adapted to our females in domestic life—to our wives and daughters, whose senses are better guides of the proper temperature and purity of nurseries than thermometers and hygrometers; and who, besides, can be bound by interest to the raising and improving of the costly material of their most elegant and desirable garments.

In the second part of this historical introduction, arguments and facts are adduced to point out the importance of silk culturists furnished with a proper degree of practical instruction. This is also illustra-

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* Vid Anthon Horace. p. 277 of Excursus on silk, &c.—(p. 12, Vol. I.)

ted by quotations of prejudicial errors derived even from learned books; by the mortifying results of advice and reports circulated in newspapers or other publications which lead into error; by facts proving the immense destruction of silk-worms and crops of silk from miscalculation of the necessary space, room and fodder in nurseries;—by competition for public honor or for profits; and by the general insufficiency of personal experience and observations.

To these reasonable accessory remarks, is subjoined the important subject of the culture of the mulberry tree which the author informs us, is abridged from the celebrated Count de Verri of Tuscany, and whose establishments and agricultural labors in his possessions, situated under the most congenial climate, similar to that of our middle states and of southern France, are the most worthy of being recommended.

It appears somewhat extraordinary that a tree reckoned as one of the most easy growth even in common lands and soils, and perhaps unfit for any other kind of produce, should, nevertheless, remain the subject of considerable care, skill, rules and precepts, before it can be depended upon as an operative means for obtaining crops of silk: There are, however, for obtaining these quantities, many important causes and weighty reasons; first in relation to the quantity of foliage necessary to be always at hand and provided for expected consumption. We refer particularly to the economy and convenience, indispensable in all matters of labor and service, in order that a peculiar form should be given to the mulberry tree for a convenient disposal of its foliage; and this is the preparatory work which commences at the first budding of the plant; also to the preservative cares and skilful tillage necessary for preventing the rapid decay, frequent diseases, and the failure of produce in a perennial plant, subject every year to the destructive operation of stripping its foliage; and which in fact, renders it necessary annually to alternate the use of the trees, or else their productive existence cannot average more than ten years.

The natural history of the silk-worm follows next; and is drawn by the pen of an experienced entomologist. Two new questions seem to have more particularly engaged his attention and researches. The first is to ascertain by the anatomy of the *Bombyx mori*, what element in nature is the source of its vital power; and thereby to enable himself to judge and establish the best system or method of rearing it. There is in the body of this caterpillar a strong pulsatory and visible movement of systole and diastole, and yet not any vestige of a respiratory organ has been detected in it for the admission of atmospheric air which could be put in contact with any internal part; for if the insect is opened or crushed, its fluids become suddenly discolored with black and purple tints: on the other hand, the contrasts of light and darkness, and of heat and cold, which by continuation would impair the health and vigor of the silk-worm, do not appear to possess any influence upon its vitality. That principle therefore must emanate from the *idioelectric* nature of its body or of the silk, of which it is never deprived; but other demonstrative proofs of that character are afterwards adduced.

The second question arises from the great reproductive powers of the *Bombyx mori:* Each female papillo being able to furnish nearly five hundred fecundated eggs. Yet no sexual character could ever be distinctly assigned to the male. The learned Abbé Sauvage, a great practical silk culturist, gave up the problem, because, in an infinite number, of the larva he could trace by the scalpel, but one *ovarium*, indicating only one sex; it would seem, however, that our author has unravelled the mystery; (page 88, vol. I.) the sexual attribute is the last organic formation in the animal when its growth is completed, and when it no longer requires food. The change of the ovarium into *vasa deferentia* is the first step to the state of chrysalis, as we find that in spinning its silk, the male is at last recognized by the peculiar shape of its cocoon. This alteration probably depends upon a greater degree of vigor in one third portion of the whole brood, which will thus suffice to fecundate the two others; and in this last phasis, although smaller than the female, the silk papillo is elegant in shape, liveliness and activity; so much so, that for its longer preservation, Dandolo recommends to keep it in absolute darkness. This entomological phenomenon is in this case the more credible, as it is necessary for all insects subject to metamorphoses, that organs of reproduction, should be substituted to those of alimentary digestion; the latter being no longer required, are obliterated.

The second volume embraces the practical instructions derived either from the ancient and modern culturists, or from new theories and proposed experiments. The author wishing to afford his reader the means of judging and comparing, has condensed, in seventeen precepts, the old method of rearing silk-worms, and such as prevailed in Italy and France more than one hundred and sixty years ago; next he subjoins a diary of a recent system recommended by the Count

Dandolo, as embraced and exemplified by M. Bonafous of Piedmont. This last document is so perfectly devised for application to any quantity or proportion of silk to be obtained in small or large nurseries, that numerous editions of it have been rapidly exhausted throughout the European silk districts; and it literally embraces every detail which can be desired in a book of practical instructions.

Still Dr. Pascalis finds fault with the method or system of the noble Italian culturist, for the following reasons.

1. Because this method supposes, that heat to a great degree is absolutely necessary, and recommends it to be obtained by the blaze of light wood fires, incessantly renewed. Our author on the other hand avers, that this is dangerous in cottages and country huts; and that heat is always the greatest source of diseases among the insects: it is proved also that a moderate summer heat is the best and safest temperature, and the only one required.

2. Because the apparent success of the above method is attributed solely to the renewal or purification of the confined air of nurseries; whilst in truth, it should be referred to a more abundant renewal of atmospheric electricity.

3. Because Dandolo prescribes fumigations in the nurseries, or the formation of artificial gases, that may chemically decompose other floating aerial impurities; which expedient has been, is, and will always be, an unphilosophical argument, or mode of ascertaining what specific element is necessary for animal life, or for the preservation from diseases.

4. Lastly; because demonstrative proofs are adduced, that not only atmospheric air is not the direct element required for the *vitality* of the insect, but in fact that during a considerable part of his life, it must remain absolutely sequestered from its contact, (vid. pps. 38. 39. 40. Vol. II.)

From these premises and consistently with his own view of the subject, the author enters into the exposition of what he entitles: *The American method of rearing silk-worms;* conducted and detailed in eight chapters.

To each volume of the practical instruction, a number of the *silk culturist* is *affixed;* this appears to have been intended as a periodical publication to be continued, should the progress of our industry evince its expediency and necessity, or provide for it the necessary support. Such a journal must be highly important and useful to our commercial and agricultural interests, as it would embrace all matters of intelligence foreign and domestic, relating to improvements and success in the culture of silk; its value; comparative price; the necessary machinery; the modes of manufacture; the demands and all those movements in the market which are necessary to be noticed.

1. In the Culturist No. 1. p. 116, we notice the narrative of the experiments carried on during the spring of 1829, upon different parcels of silk-worms, some of which were conducted under the influence of electricity; the comparative results of these experiments are decisive in favor of the discovery not only with respect to the quantity and quality of the silk, but to the saving of time, abridgment of care and of artificial heat; in testimony of which we notice the letter of J. Everett an eminent medical electrician, in New York, who applied the electric fluid, with the evolutions of which he is particularly familiar, (vid. p. 67. Vol. II.)

2. This improvement promises good success; it has received as we understand, the approbation of a Parisian savant, who has already testified to the propriety and ingenuity of the application of electricity and to the great benefits to be derived from it in this important branch of industry. We trust that the author will soon communicate to the public the views of his philosophical correspondent and his own, on the natural means by which the electric element can be still more conveniently fixed or accumulated than by mechanical apparatus, especially in our climate which is declared to be the most Electrical in the world: this agent is in the authors' view, all important to the silk-worm; since according to his observations, neither air light or heat are directly influential to the life and energy of the insect.

3. Another improvement is not unimportant to culturists, especially when they undertake to obtain large crops of silk; it is that of providing some durable and more convenient apparatus than brushwood; great quantities of which are required for the spinning of the silk caterpillars. Dr. P. candidly informs us that he was led merely by chance to his present method, by the absolute want of brushwood at the most critical moment for the preservation of his brood and fine silk balls. The set of hurdles which he procured for litters were nicely made of split rattan of about 3 ft. by 4; which being coupled together one higher than the other, and placed vertically and transversely on the edge of litters, offered to the wandering and mounting caterpillar the most convenient space at all points for an equilateral triangle, to which during the whole sixth age, the instinctive insect

is necessarily led to append the outstanding silk riggings of his mansion. The slides were rapidly filled up, leaving not a single individual out of the way, nor any vacancy in the length or in the breadth of the slides. Another remarkable advantage of this mode, arises from the simplicity of an establishment of *rattan hurdles*, which if proportionate, and coupled by hinges, can be used level, or raised for both purposes, without any further trouble: first they serve as litters for feeding; next, as the best mounting slides, saving the trouble of brushwood not always easy to procure and not so well adapted in shape and form; lastly, they afford a durable provision for any number of succeeding years. A good plate of the same is offered, page 105, with explanations, &c.

4. In the American Silk Culturist, we have the pleasing intelligence of the most perfect species of mulberry tree, not only diffused and transplanted in France under the auspices of government, but already procured for the United States by our author and through the exertions of others, and likely to be soon in a state of the most rapid propagation of which it is susceptible. The following is the history and characteristics of this mulberry: *Morus multicaulis*, Perottet. Nine years ago this distinguished Linnæan member of the society of Paris, returned from a botanic excursion of three years around the world, in a national corvette, with the largest importation of plants and seeds that has ever been obtained. Among these was a large stock of the *Morus multicaulis* or *Morus sinensis*, in excellent state of vegetation which were immediately deposited in the Royal garden, for further propagation. M. Perrotet who took his specimen from one of the Philippine islands mostly inhabited by Chinese emigrants, reported, that they assured him, that, to that tree alone, owing to its admirable properties, their nation was indebted for riches, greatness and durability; its leaves are very large and of so great fineness, that the youngest worms can be fed by it: and therefore a second crop of silk is, in China, very easily obtained, and profitable. It buds very early in the spring, and is propagated by shoots from the roots, as well as by seeds. The French authorities have ordered plants to be distributed to their proprietors of Mulberry orchards, inviting silk culturists to substitute it for their best white mulberry; and through some of them, the same have already reached the shores of the new world.

The last prominent subject treated of by Dr. Pascalis in the *Culturist* No. 2. is a review of the *Essays on Silk*, by John D'Homergue, *a silk manufacturer*, and by Peter S. Duponceau a distinguished counsellor, and member of the Philosophical Society of Philadelphia, who has openly and warmly embarked in the cause of silk and as an antagonist of the Pennsylvania Silk Society.* This young gentlemen's essays are almost all analysed by our author who unquestionably reposes great confidence in all that he teaches. His work is confined to the filature of silk, until it is prepared and made up for different weavers and looms. The first error which he wished to correct we suppose, was the practice of directing their whole labor to the art of making *Sewing Silk* with the best of the materials; a losing concern indeed, and which Dr. Pascalis points out, in his first volume, (p. 32.) When speaking of the quantity of silk raised by the people of three counties in Connecticut, he says, "that he regretted their employing and turning their best silk into sewing silk, which in the manufactories of Europe is always made up with the refuse silk of the nurseries from the processes of filature." This sound principle M. D'Homergue has endeavored to illustrate and to inculcate upon our own culturists, by giving besides a practical and technical description of all the progressive operations; in which they have indeed great need to be instructed. A great profit is lost to the country, besides the competent additional labor on the produce; since a large quantity of sewing silk neither is, nor can be, disposed of in market, except in the way of trade and exchange for dry goods; and on such terms as seldom reach a value equal to that of the same quantity in weight of a plain, properly reeled Raw Silk. This is always, and every where, rated at a sterling price, according to its quality and degree of beauty; and, moreover, succeding progress in acquiring practical skill in the preparation of *singles*, *organzines*, and of *tram*, is prevented, and so much towards the manufacturing process is indefinitely delayed. The culture of silk is not therefore prosecuted by a sufficient number of candidates; because they neither hear of, nor see purchasers enough from abroad, either of raw silk, or of perfect or imperfect cocoons; and the culture of silk is now, and long will remain in a languishing state, until we change our method, and pursue a more judicious plan. The succeeding essays of Mr. D'H, admirably well composed and drawn up, relate, however, only to the above and other operations of the filature, which seldom or never can be associated

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* It is well known that some *legal* difficulties exist between this gentleman and the Phil. Silk Society.

with the labor of the culture of the mulberry tree, and with the art of rearing silk worms; although we doubt not but many women or females in our country, have gradually rendered themselves capable of perfectly reeling their own cocoons; but we are every day besieged by foreigners in quest of occupation and especially from England and Scotland, whom we would be happy to introduce to silk culturists if there was enough of silk in the country. Dr. Pascalis had already told us, (Vol. I. p. 33.) however strange it might appear, the fact is true, that a silk growing country always abounds with competent manufacturers; but these do not seek for employment in their pursuit unless where a sufficient quantity of the best materials invites their enterprise. There is therefore, as is suggested by the writer of the preface of the essays (p. 5.) no great difficulty in procuring such hands; nor is it true that there is enough of the mulberry tree in the country; enough of silk-worms rearing, nor more than it is generally supposed necessary to justify expensive establishments of filature; since we can prove quite the reverse to be the case in the most commercial and agricultural sections of the United States, as New York, Pennsylvania, New Jersey, Delaware, and Maryland.

In the vicinity of the capitol, we have a few groves of the tree, mostly left uncultivated; but as a scattered plant, it is rare throughout, the country, although fine orchards are already reared, or forming in the eastern states, in Delaware and Pennsylvania; nevertheless we hear not much of silk growers and experimenters except from Connecticut. In New York, an offer was made by Dr. P. of silk-worm seeds, gratis, to all who could conveniently feed them; but this offer has, we are told, been attended to, by very few applicants. In an address of the Pennsylvania Silk Society, published January last, we find, that an appeal was made for the purchase from culturists of cocoons to be reeled by competent operatives, which procured only a few pounds of that production that was accepted, and this was of an inferior quality and size, and badly fed; and the rest had absolutely to be rejected. It is not our task to account for all these disappoinments, unless by the words, in the preface already quoted, alluding to "impositions of pretenders to a knowledge they do not possess." (p. 17.)

Mr. D'H. having visited Baltimore in search of cocoons assures us, that he found there at least one hundred quintals of cocoons. Unfortunately this assertion is contradicted by a silk culturist of that city, Mr. *Gideon B. Smith*, (vid. Gazette of Baltimore, Apr.) The error was pardonable because the visitor has related that these cocoons were in bad condition and could not be used in the preparation of silk ! In conclusion, we feel authorized to assert, that there are not in the country mulberry plants enough in cultivation, nor a sufficient quantity of silk to justify those legal provisions which would be necessary for all branches of filature, &c. except it be that of reeling from the best cocoons, as is perspicuously and learnedly explained in the manual from the treasury department, (p. 134.) the extract of which has very fairly indeed, been affixed as an appendix to the essays of Mr. D'Homergue, preceded by remarks which are pertinent and proper, although the reader may not always concur in opinion.

Nine pages of directions for raising silk-worms are appended to the essays of Mr. D'H.; which is the shortest treatise we have ever met with upon such an important point. This gentleman has frequently adverted to the superior quality of the American silk over that of the French and Italian, in so much as to require one third less of cocoons to afford an equal quantity of silk ; on the other hand, he has seen in Pennsylvania and Baltimore, cocoons the inferior quality and imperfections of which, attested the want of proper care and management in the rearing of them ; it should therefore have been expected that he would have said something more on the growth of silk than what he has condensed into less than four pages, or that the topic would have been wholly omitted. By this omission he could lose nothing in our estimation ; for we know of old that his branch of practical skill is never associated in his country, and is almost incompatible with that of rearing silk-worms ; for even in that little remembrancer of *directions*, besides important omissions, there are exceptions not altogether admissible.* Yet, Mr. D'H. has already well merited of this country. He had the best authority to enforce the principles and rules of his art. Doubting not that they have merited, and will more and more merit the attention of the American reader, we hope that he may reap the satisfaction of having done much good.

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* The test proposed to judge of genuine worm seeds, p. 90, as resembling in their appearance and color, the seeds of Poppy, *Papaver rhœas*, we think is very strange. We have seen such seeds, and of different species too, of the same genus ; but except that kind which perchance is sometimes fraudulently substituted or mixed with the silk-worm eggs, we never heard nor read of the comparison. *Poppy* seeds are ¼ or ½ smaller than those of the insect, and globular. They are also either whitish or yellowish. Now the silk-worm seeds if mature and well fecundated are of a slate color, somewhat lighter or darker. Any other color is either suspicious or bad. They are flattened on one half of their diameter and a little point of depression is seen at their center, and finally, it takes 80 or 86 of them to a grain.

Art. XII.—*Mineralogical Journey in the northern parts of New England; by* Charles Upham Shepard, Assistant to the Professor of Chemistry and Mineralogy, and Lecturer on Botany in Yale College.

(Concluded from p. 136.)

Since the publication of my remarks upon the Franconia Iron Works in the first number of the present volume, Mr. Richardson, the proprietor of the Upper Works has very obligingly communicated to me some additional information relating to his establishment, which I consider worthy of insertion in the present memoir.

And in the first place, I am happy in being able, from this source, to correct a statement erroneously made in my former paper, concerning the manner in which his forge is supplied with air: instead of leathern bellows, two cylindric machines, five feet long and three feet in diameter, are employed,—the pistons being worked by cranks and pit-men.

The "iron chest," or crucible of the forge, used at these works, (and which is of the class known in Europe under the name of the Catalan forges) is built of thick cast iron plates, open at the top, and provided with a bed of pulverized charcoal, in order to preserve the melted metal from calcination. For the escape of the slags; the front, or cinder plate of the iron chest is perforated with five holes, which are kept open or closed, according to the discretion of the workmen. In ordinary work, the loup is allowed to acquire the weight of one hundred pounds before it is withdrawn to be placed under the hammer; but a much larger mass may be accumulated, when required by the nature of the work. Five hundred and fifty bushels of charcoal, from hard wood, are at present consumed at Mr. Richardson's works, in the manufacture of a ton of iron. His forge is kept in operation by two men, fourteen or fifteen hours each day; and yields about two tons of iron per week.*

Mr. Richardson has introduced into his manufactory, since our visit, the valuable "Magnetic Separating machine," invented by Mr.

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* M. Gueymand of Allevard in France, whose method of reduction is the same with that practiced at these works, asserts, that four workmen who are relieved every six hours, make eighty six Cwt. of iron per week; the expense of labor upon which, is estimated at eighty cents per Cwt. *Minéralogie appliquée aux Arts.* par C. P. Brard. Tom. I. p. 390.

Samuel Browning of Boston, and of which a patent has been secured. The following abstract of Mr. Richardson's description of this apparatus will conclude my remarks upon the Franconia Iron Works. The machine consists of a frame, four feet long, three feet wide, and six feet high; containing two cylinders, which embrace nearly three thousand magnets, together with a third cylinder furnished with cams to move a wire sieve placed upon friction rollers. The ore, after being roasted in the kiln, is wheeled to the pounding house, which contains the machine; here it is pounded through grates, the bars of which, are one quarter of an inch apart, and thence conveyed to the "Hopper" of the machine, from which it runs into the sieve, in required quantities, regulated by a guage. Passing through the sieve,* it is conveyed by an apron or guide under the first or largest cylinder, from which the magnets take up all the ore they are capable of holding, leaving the remainder to pass on, regulated by another apron to the second cylinder, which attracts the balance; while the residue, being siliceous matter, is suffered to drop down, and is thrown away as it accumulates, by the workmen. The cylinders constantly revolve upon their axes, and the sieve is subjected also to a slight motion. A large brush is maintained in front of each cylinder; which, as the cylinder turns, removes the ore accumulated during its revolution. The ore, thus brushed from the cylinders, is conveyed by a spout or trough, adjusted at a proper angle, from the pounding house to the forge. The whole machine is kept in motion by water power. By the use of this apparatus, Mr. Richardson assures me, that he saves one hundred and fifty bushels of coal in the manufacture of every ton of iron; and besides, that he is enabled to produce iron of superior quality and with a considerable saving of time:—advantages, it would appear, of sufficient consequence to introduce the invention of Mr. Browning into very general use.

7. *White Mountain Minerals.*

In passing through the Notch of the White Mountains, we had little opportunity for mineralogical observations, in consequence of a violent storm of wind, accompanied by snow and rain. We were

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* That portion of the pounded ore which does not go through the sieve, is free from foreign matters, and is therefore transferred directly to the forge without farther pounding.

permitted, however, to notice the granite, which here offers the aspect of immense beds frequently divided by fissures in two opposite directions, one of which is vertical, while the other is parallel to the plane of the horizon,—the cuboidal or prismatic masses being piled upon each other, after the manner of rude masonry. Two or three miles after having passed the narrow defile, which is more strictly denominated "the Notch," and at no great distance from the Willey house, we began to notice by the road side, large fragments of a dark grey rock, composed of an intimate mixture of compact feldspar quartz and mica; and which in some instances, presented the characters of micaceous or even argillaceous schist, of a black and somewhat carbonaceous aspect. This last variety contained an abundance of *Macle*, though the crystals in general are rather obscure and imperfect. These masses appeared to us to have been brought down, by recent slides, from the heights above; where, indeed, we imagined we could observe them *in situ*, alternating in beds with the granite: and we were led to conclude, that the specimens of *crystallized brown Quartz*, and of *radiated white Quartz* containing *imbedded octahedral green Fluor*, which are often found among the slides of the Notch, must have had their original repository in the veins of this rock.

The notices we had received concerning the geology of these mountains made the appearance of any other rock than granite, quite unexpected; and our surprise was not a little heightened on being presented by Mr. Cook of Fryeburg (Me.) with specimens of a decidedly brecciated, or recomposed argillaceous slate, which he assured us, covered, to a considerable height, the flanks of the Kearsarge mountain,—an elevation of nearly four thousand feet, and which must be considered as a part of the White Mountain range. I am disposed to believe, that whenever these mountains shall be more closely studied than they hitherto appear to have been, a much less degree of uniformity will be found to exist in their composition than has generally been supposed; though I am far from supposing that granite is not the principal rock, and that it does not constitute the summits of their most considerable elevations.

8. *Fryeburg Beryls.*

We are indebted to Mr. Cook, the Preceptor of the Fryeburg Academy, for a knowledge of the interesting deposit of *Beryls* that occurs in this town. It is situated about half a mile west of the public house, upon the western declivity of a granite hill, which lies directly upon the public road. The Beryls occupy a vein a few feet in width, and ten or twelve in length. In dimensions, they vary from one, to two or three inches in diameter; but the closely aggregated manner in which they occur, is not very favorable to a high degree of finish in their form. Crystals that are tolerably complete, may however, be obtained, and occasionally, those with polished, terminal faces; but we find them, more generally, with faces very unequally produced; as, with two lateral faces very widely extended and imparting a tabular appearance to the crystal, or with four planes so enlarged as to give a rhomboidal aspect, or finally, with the alternate faces protracted in such a manner as to form a trihedral prism The most interesting circumstance connected with these crystals, however, is their color, which varies from a delicate bluish green to a white; those of the first mentioned shade, possessing the ordinary transparency of the species, while those of the latter are only translucent on the edges. The vein stone is quartz, slightly brown, with an occasional intermixture of imperfectly formed feldspar crystals. The longer crystals of Beryl offer the same peculiarity as respects the fractures and reunion of the laminæ at right angles to their axes, as were noticed in the large Beryls of Acworth.* The deviaion from a straight line which the axis suffers, in consequence of this disturbance, amounts in some instances to 5 or 10° ; and the quartz which penetrates between the joints, is in layers of half an inch in thickness. In addition to this peculiarity, we observe here, also, a slight curvature in some of the crystals, unattended by any fracture in the prism. These observations I am induced to make with the more particularity, since they appear to me important in the consideration of the much agitated question among geologists, respecting the origin of granite. With a celebrated writer upon geology, I am persuaded, "that much light must, at some period, inevitably be thrown on the greater geological phenomena, by considering the chemical and mechanical relations existing among the smaller portions which constitute them; and that the language of Nature is often as intelligibly spoken in the minute space of an inch, as in the immensity of a mountain."*

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* A large joint of the Acworth crystal, in the possession of my fellow traveller, Dr. Heermann, illustrates these fractures in a very interesting manner.

* Transactions of the Geological Society, Vol. II. p. 433.

Near to the vein of Beryls, and a few feet from a spot whence the granite has formerly been quarried, we obtained distinct crystals of *brown Mica*, from half an inch to two inches in diameter: their form is that of the oblique rhombic prism, sometimes truncated upon the acute lateral edges.

On our road to Paris, which is thirty five miles distant from Fryeburg, we noticed very frequently by the road side, large irregular masses and bowlders of Trap, but they were in no instance, embraced in the granite. In the town of Waterford, however, I once saw this rock penetrating the granite, in numerous veins, from a few inches to upwards of a foot in width; their direction was generally vertical, although sometimes smaller seams appear to have diverged from the main mass of the vein, and to have followed the horizontal stratification of the granite.

9. *Paris Minerals.*

I arrive now at the description of a locality of minerals yielding in interest to none in North America, if we take into view the variety and richness of the specimens it has afforded in times past, or those which it still produces in the greatest abundance. Nearly every variety of the Tourmaline species has been here obtained, in crystals, which for size, transparency and richness of color, are unrivalled: crystallizations also, of brown and white Quartz, threaded by crystals of Tourmaline; large foliae of Mica penetrated by acicular green Tourmaline; Lepidolite of every shade of color; chatoyant Felspar, and the most exquisitely delicate fragments of Rose quartz.

For our first information concerning this deposit of minerals, we are indebted to Mr. Elijah L. Hamlin, formerly of Paris, and to Dr. Holmes, at present a teacher in the Gardiner Lyceum. A memoir relating to it, by these gentlemen, is contained in Vol. X. (p. 14.) of this Journal. An additional notice of the spot is likewise to be found in the appendix of Dr. Robinson's Catalogue of American Minerals, (p. 278.) It will be my object, at present, to give a more particular account of the most interesting minerals to be found here, avoiding, as far as possible, a repetition of the observations contained in the above mentioned notices. In the first place, I shall confine my remarks to the present condition of the locality, and I will afterwards, add a description of some uncommonly interesting things which I obtained there during a visit in 1825, and of which, nothing similar appears to have been since obtained.

The locality in question is situated upon the farm of Mr. Chesley, who lives upon the road leading from Paris to Buckfield, one mile east of the village of Paris. The rock of the vicinity is graphic granite, and except where it breaks through the soil in large ledges, as it does in several places, it is very much shattered by decomposition. This is particularly the case upon the farm of Mr. Chesley. In the field where the minerals occur, angular fragments of graphic granite, of all sizes, are seen protruding above the surface of the ground; and on digging, we find a soil apparently just formed, consisting of gravel mostly derived from feldspar, and as yet, but slightly discolored with vegetable mould. In the highest part of the field, and just in front of a little wood, the granite makes its appearance in a continuous mass, for the compass of a few square rods, and it is here possessed of a higher degree of integrity. Such, however, is the abundance of foreign substances which it contains, that its graphic character is no longer obvious. It is here, that the Tourmalines and other minerals, with the exception of the Rose Quartz, occur. When the locality was first visited, large masses of Lepidolite, in some instances entirely coated with Rubellites, and loose crystals, and fragments of crystals of the different colored Tourmalines, together with groups of crystallized Quartz, were found dispersed over the surface of the hill. These, however, have long since wholly disappeared; and the collector who is now in search of these minerals is obliged to lay open the solid rock by the aid of gunpowder.* The granite is composed chiefly of feldspar; and on this account, is the more easily quarried. It is traversed by several irregular veins of Mica and Lepidolite, the latter of which are, occasionally, nearly a foot in width. These veins, as well on account of the Mica and Lepidolite, as the substances they embrace, are the principal objects of pursuit with the mineralogist.

The *Mica* forms veins of six or eight inches in width, and exists in large foliae, among which, small portions of quartz and feldspar are interfused. When detached, it presents imperfectly formed rhomboidal crystals, with a tendency to the figure of the *Mica prismatique.* Some of these attain a foot in length and seven or eight inches in

* Mr. Chesley, with the same liberality which characterized his father while living, is always ready, in the most obliging manner, to promote the objects which the visitors of his place have in view; and for a very reasonable compensation is accustomed to undertake the necessary drilling and blasting.

breadth; in general, however they do not occur in pieces above half of this superficial size, and with a thickness of about one inch,—the laminae composing them being straight and closely aggregated. When held between the eye and the light, with the prismatic axis towards the eye, the light transmitted is faint, and of a rich, reddish brown color: but on giving the crystal a revolution through half a circle, more and more light is transmitted, until it is in a position nearly perpendicular to the axis, when the light penetrates the crystal most freely, and this, notwithstanding the quantity of matter through which it is obliged to pass, in the latter position, having become considerably augmented,—the light continually changing in color as well as in intensity, and finally becoming of a greenish yellow tinge.

This Mica, although interesting on its own account, is still more so, on account of the *Tourmalines* which it embraces; and which are disposed in long acicular crystals between its laminae. The largest of these are about a quarter of an inch in thickness, and three or four inches in length. They are, for the most part, of a leek green color and transparent. They are rarely isolated; but much more generally, variously grouped. In a few instances, I have noticed two prisms crossing each other (with mutual penetration) at right angles. The most common composition, however, is that of several crystals diverging from a common point, all situated in the same plane; and that plane parallel with the cleavages of the Mica. Bundles of this sort, forming 60°, 90°, and in some cases, 180° of a circle, are frequent,—the latter aggregation forcibly reminding one of the representation in a picture of the diverging rays of the rising sun, when half above the horizon: especially, when the mass of Mica is held between the eye and the light, owing to the greater freedom with which the light flows through the crystals of Tourmaline than the Mica. Indeed, we occasionally observe an exceedingly thin film of Cleavelandite feldspar filling up the spaces intermediate between the fibres of Tourmaline, and thus increasing the opacity in those directions.

No gangue could be equally favorable for bringing into view these delicate compositions of Tourmaline, as that of the Mica, since by holding a mass of it between the eye and a strong light, the crystals may very easily be detected even when far below the surface; and nothing is easier, than to remove the superfluous laminae without in the least disturbing their arrangement.

The Lepidolite of this place seemed to us also very interesting, from the abundance in which it occurs, the variety of the tints it offers, and the beauty of its imbedded minerals. Little difficulty, I imagine, would be experienced in obtaining pieces one foot in diameter. Its colors go through every possible variety of peach-blossom red from the deepest tint to that which is the palest. Its composition is granular, consisting of imperfect, hexagonal concretions of various sizes, from that of a pepper-corn to a pin's head, which are intimately and confusedly aggregated, often with an intermixture, in the deepest colored specimens, of transparent quartz,—the Lepidolite completely penetrating the quartz. Masses of the last description are broken with the greatest difficulty; being surpassed in toughness, by no mineral with which I am acquainted, excepting perhaps nephrite and petalite. This variety I am persuaded would prove exceedingly beautiful if cut and polished; and must resemble the finest avanturines *a pluie d'argent.*

Like the Lepidolite of Rozena in Moravia, it contains crystals of ***Rubellite***, which though less abundant, are perhaps more remarkable for their size and delicacy of color. The paler varieties of Lepidolite, which are more free from quartz, but which contain occasional admixtures of Cleavelandite feldspar, afford the most delicate crystals of this mineral. They are tolerably perfect, six or nine sided prisms of about one inch in length, and possesed of a very delicate rose color. The deeper colored Lepidolite, on the other hand, in those parts where the quartz and feldspar predominate, affords, ocasionally, large crystalline masses of the same colored Rubellite, one or two inches in diameter, and sometimes in lengthened prisms, inclosing Indicolite of an intense blue color and a somewhat conchoidal fracture. The sea-green colored Tourmaline accompanies, more rarely, the above mentioned varieties; but none of them occur in pieces sufficiently exempt from flaws, or endued with the requisite transparency to entitle them to the character of gems, like the specimens described in the sequel.

The *Crystallized white Talc*, is found in quartzose cavities among the Lepidolite, and coating the larger crystals of green Tourmaline, that occur imbedded in the Mica. To the naked eye, the crystals appear to consist of globular masses; but under the microscope, they present the aspect of the frustra of two cones, applied base to base, the curved superficies of which are channeled lengthwise. It is so minute a mineral as scarcely to attract attention.

The *Beryls* occur in that part of the ledge which abounds more particularly with black Tourmalines, and are diffused among the imperfect crystals of this substance, common feldspar and quartz. They rarely exceed an inch in length; are quite perfect, and of a white color, or of a white slightly tinged with blue. In the same aggregate, occur the crystals of *Zircon;* and which were first pointed out to me by Mr. Nuttall of Cambridge. They are comparatively rare, and very minute,—requiring a microscope for their observation; by the aid of which, they are seen to be of a clove-brown color, and to be crystallized in four sided prisms, surmounted by four sided pyramids with rhomboidal faces, the planes of which correspond to the lateral edges.

Of those minerals which this place continues to afford, the *Rose quartz*, only, remains to be described. This is found about twenty five or thirty rods in a south easterly direction from the spot above described, in a low piece of ground near the public road. It occurs loose in the soil, among the fragments of graphic granite. One spot has afforded all the pieces which have hitherto been obtained. Considerable labor, however, is requisite to procure even a small number of specimens: for much soil and loose materials require to be removed and carefully examined; and occasionally large masses of quartz, are to be reduced to fragments, since not unfrequently these contain the finest pieces. But, so rich are the specimens which this locality affords, that the collector will not regard the labor he is obliged to encounter. They certainly appeared to us, as the finest pieces, for color and fracture, we had ever seen. Those who have not enjoyed an opportunity of observing good specimens from this place, may conceive of them best, by imagining the Madagascar pebbles of Rock crystal changed from transparent to translucent, by a slight milky cloudiness; and then, equally tinged throughout of an exquisitely delicate rose red color.

I now proceed to the notice of a collection of Tourmalines and other minerals, which I made at this locality in Sept. 1825. I commenced my researches directly upon the top of the Tourmaline ledge, not indeed, in the firm granite; but rather, in a covering of loose materials reposing upon it, to the depth of four or five feet. Here a slight digging had been commenced, over a surface of a few feet, apparently in search of the fine crystallizations of *brown Quartz*, with which it would seem, that this particular spot formerly abounded. On causing the exploration to be renewed, an abundance of this substance was thrown out; and very soon, I began to meet with masses of Lepidolite, completely studded over, and penetrated by, finely colored crystals of green and red Tourmaline; drusy fragments of granite, whose cavities were lined with the same minerals,--the Feldspar being nearly opaque, of a delicate whiteness and possessing the beautiful *chatoyement* which this species often presents; crystals of greyish white Quartz, several inches in length and thickness, and penetrated by Tourmalines; and, finally, loose crystals of Tourmaline and Rubellite, from a quarter of an inch, to two inches, in diameter. Thus we followed the digging, in every direction, so long as it continued to afford these products; which it did, until within a short distance of the rock. The majority of pieces, however, seemed to occupy a vein one foot wide and three feet long, by about two feet in depth. From this state of things, it seems fair to conclude, that the granite here, when in a state of integrity, must have possessed a drusy cavity open from above; and it is by no means improbable, that the loose specimens of Tourmaline, smoky Quartz, &c. which were found about the sides of the hill on the discovery of the locality, had their original repository in this cavity.

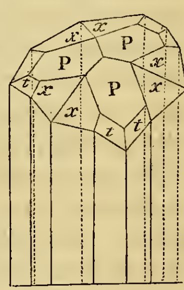
The crystallized Quartz, it has already been mentioned, is of two kinds,—the brown or smoky, and common Quartz; between which, notwithstanding they were formed in the same crystalline vault, there are such remarkable differences both in the modifications which they offer and in other respects, as clearly to evince, that the crystallization of the one, was subsequent to that of the other. The brown Quartz is much clearer and better crystallized; and its crystals are singularly characterized by the alternating re-appearance of the prismatic faces, after the pyramidal faces have begun to form. A fragment of a crystal measuring two inches and a half across its prismatic faces shews these alternations, repeated for a great number of times, and forming steps in some places, one eighth of an inch in depth. Moreover, these crystals are entirely free from any penetrating minerals; while the white crystals show nothing of the above peculiarity in their structure,—being uniformly tabular in their shape. Besides, the larger ones are wanting in that perfection of fracture and tendency to a pyramidal termination, (except at one extremity,) which characterize the smoky Quartz; and are every where penetrated by crystals of Tourmaline and often by Felspar and Talc. Farther, I possess one crystal of brown Quartz, having a crystal of the other variety attached to it, but between the two, notwithstanding the coincidence of their prismatic axes, (one crystal being placed directly upon the summit of the other,) a perfect line of demarkation can be traced. From these observations, I am led to infer, that the brown Quartz was first deposited from solution, and surrounded the walls of the granitic cavity with its crystals; and that the Tourmalines crystallized next, to which succeeded the Talc and Felspar; and that, finally, the white Quartz was deposited around the other substances. And we observe, consistently with what is noticed concerning crystallizing fluids in our laboratories, that the last portions of such fluids afford crystals possessing less perfectly the attributes of crystallization,—the white Quartz is much inferior in transparency and delicacy of fracture to the smoky variety.

The large, loose crystals of Tourmalines affect the general form of trihedral prisms with convex faces, which are deeply striated. They resemble each other very considerably, as respects transparency, fracture and color,—being as clear, for the most part, as the intensity of their colors will allow; free from flaws, except for a thin coating at their surfaces; and where the crystal possesses any considerable length, green at one extremity and red at the other. They have a tendency to break across at distances of about the diameter of the prism, and with a highly conchoidal fracture so as to result in fragments almost globular in shape, (*gouttes de suif,*) which are quite free from flaws, and "of the finest water." Of these crystals and fragments of crystals, I shall describe a few which appear to me to be the most interesting.

No. 1, is one inch and a half of the extremity of a green Tourmaline, whose diameter equals its length. Its color is an intense grass-green with a tinge of blue. It is regularly terminated by polished faces, as represented in the annexed diagram.

Inclination of

P on P	Common Goniometer,	133°	30′
P on x	" "	158	12
x on x	" "	158	45
x on t	" "	157	
t on t	" "	149	15
P on t	" "	151	



No. 2, is a fragment, three quarters of an inch in length, by one inch two tenths in diameter; the extremities of which have been rendered flat by the lapidary. Its colors are faint; and it exhibits the transition of pink into green. Although the green color seems to preponderate when the crystal is viewed in a line perpendicular to the axis, yet, objects seen through it, in a direction parallel to the axis, have a delicate pink tinge. This specimen illustrates with remarkable distinctness the property of double refraction. When it is brought to the eye, in the last mentioned position, and a pin, or slender wire, is held at the distance of ten inches or a foot, two distinct images of the pin or wire become obvious.

No. 3, is a crystal two inches long, by one inch and a half in thickness. Its sides are coated with green Tourmaline to the depth of about a line,—the whole interior, from end to end, consisting of the most beautiful Rubellite. The color is more intense at one extremity, and is deepest throughout at the center. One end is of a dark and exceedingly rich, blood-red color,—becoming slightly amethystine towards the circumference; while the other approaches more the color of a crimson, in which little, if any blue, is discernible.

No. 4, is a crystal two and a half inches, by one inch. Viewed across its axis, at one extremity, it exhibits a fine sea green; while at the other, it is of a rich crimson red. A joint, detached from the green end, presents, when viewed in a line parallel with the axis, a grass-green, bordering on a pistachio-green, color.

No. 5, is a crystal measuring an inch and a half each way; its color, when viewed across the prism, is sea-green with a large proportion of blue; but it passes into a pale rose color at one extremity. A broach was cut from the green end of this crystal, which measures nineteen twentieths of an inch long, sixteen twentieths broad and eight twentieths in thickness. It is cut after the manner of a large emerald. The large plane forming the front face, and which is situated at right angles to the prismatic axis, is two thirds of an inch in length, by a little more than half an inch in breadth. Its color is intermediate between grass-green and pistachio-green, and its transparency perfect. It contains but one flaw; which is invisible, when the broach is held in ordinary positions.

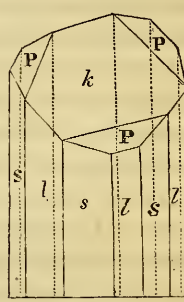
No. 6, is a section of a prism about one inch in length by two inches in diameter, of a pale pink color, except a thin coating, which is green. This crystal is an exception to the others here enumerated, as regards its transparency, freedom from flaws, and beauty of colors; and is noticed only on account of its magnitude.

No. 7 is a Rubellite broach, cut after the manner of the green one above described, and which measures three quarters of an inch in length, thirteen twentieths of an inch in breadth and four tenths of an inch in thickness. When viewed by transmitted light, it reminds one of the finest Syrian garnet; but seen by reflected light, it gives much of the crimson red, peculiar to the oriental ruby. Its freedom from cracks, united to its transparency, luster and beauty of color, have caused it to be much admired by jewellers.*

Among the smaller crystals which penetrate the crystallized quartz, a few are perfectly colorless and transparent. Their form is that of the *Tourmaline nono-septimale*, H.; and from their exquisite finish, they are well fitted for goniometrical examination. The following figure and accompanying measurements are intended for their illustration.

Inclination of

P on *k*	Reflec. Goniometer		152° 40′
P on *l* . .	"	" . .	117 13
k on *l* . .	"	" . .	90
l on *l* . .	"	" . .	120
s on *s* . .	"	" . .	120



A few crystals of transparent Indicolite, of a deep color, were met with, which were associated with Rubellite, and imbedded in Lepidolite. From one of these, I had two tables (five eigths of an inch by half an inch) cut and mounted; but, although of a good color, their beauty is injured by several cracks. Fragments of a less transparent variety of Indicolite were pretty abundant; also small, somewhat flattened crystals of Rubellite, with one or two polished faces, and possessed of a good color and considerable transparency; and a few transparent prisms of the green Tourmaline, precisely resembling the same mineral from Brazil.

I had formerly observed, that fragments of the above described Tourmalines became electric, on being held to the fire for a few moments; but it was not until very recently, that I discovered the extreme sensibility of my polished specimens to electrical excitement. Having placed the Rubellite broach for a few moments near some

* These Tourmalines were cut and polished by Messrs. Montanye & Mason, Lapidaries, 93 Reed street, New York. Another crystal, which I have in the hands of a lapidary in London, I am informed, has afforded a red broach, which is regarded as "a great curiosity."

warm ashes, I found, as might have been expected, it attracted the metallic needle, on bringing it near one of the little knobs by which it is terminated. Five or six hours afterwards, having occasion to explain this action to a friend, I had brought the Rubellite no nearer than three quarters of an inch of one of the balls, when it began to approach; and such was the force of the attraction, that the impetus acquired by the needle in coming up to the broach was sufficient to give it, very nearly, a complete revolution. This experiment we repeated a number of times, without observing any diminution in the attracting force. The broach had been laid aside, in an apartment without fire, and during the experiment was attached to a card, to avoid the warmth of the hand. The same phenomenon took place the succeding morning, though with less activity; and I have scarcely ever had occasion to repeat the experiment since, (notwithstanding the weather has not been warmer than 75°,) without observing the same effect. Whenever I have desired to render the excitement more energetic, it has only been necessary to place the thumb upon it for half a minute, or to hold it in the rays of the sun for a little while. The other polished Tourmalines do not appear equally sensible to electrical excitement, although the warmth of the finger, or the sun's rays, are always sufficient to put the needle in motion.

The specific gravity of the transparent Rubellite is 3.021; that of the green Tourmaline 3.009; and that of the Indicolite 3.055.

The Rubellite, on being heated to redness before the blow-pipe, loses its color; and on increasing the heat, whitens, becomes opake and swells, at the same time opening by numerous little fissures. Examined in this condition by the microscope, it evinces a partial vitrification and a rounding of the extreme points. With borax, it dissolves readily with effervescence, into a glass of a deep rose color, and with soda, into an opake glass of a green color, with a shade of blue,—the color being discharged on being brought within the inner flame of the blowpipe. The green Tourmaline grows pale on being heated to redness, and on continuing the heat, it becomes milk white, swells, cracks, and vitrifies with less appearances of fusion than the Rubellite. With borax, it dissolves,—producing a transparent glass with a slight tinge of iron. The Indicolite retains its color perfectly, when heated to a low redness; in a higher heat, it swells slightly, turns of a yellowish gray, vitrifies and undergoes a partial fusion at its angles. With borax it dissolves easily, and presents a pale green transparent glass. With salt of phosphorus, it dissolves, leaving a skeleton of silex, and offers, while hot, a feeble color of iron. From the foregoing experiments with regard to the fusion of the Paris Tourmalines, it is inferred, that they belong to the first of the three groups into which M. Gmelin has divided the present species: viz. the Tourmalines which contain Lithia; since this class is remarkable for its resistance to fusion, alone, before the blowpipe.

Note.—Since the foregoing notice was in type, I have received information of the existence of several Tourmalines, in the Imperial Cabinet of Vienna, which leads to the opinion that the Paris locality, had been visited at a period, considerably anterior to that given above for its first discovery. In a letter from Baron Lederer, (which I mention by permission,) he remarks,—"I was present at the opening of the cases of Minerals belonging to the collection of the deceased Mr. Vander Null, which was purchased by the Imperial Cabinet at Vienna. These cases had not been opened several years previously. In them, were a few loose Tourmalines, exactly like those from Paris in Maine, so that I supposed they were from that place. They were labelled '*America*,'—not Paris."

If these crystals were from the present locality, they were no doubt from the cavity above described; and I can only suggest, to account for their early transportation out of the country, that they might have been picked up by some pioneer or surveyor, at a time when little attention was paid to such objects in this country, and so very naturally have found their way into Europe, and into the hands of one of its most active Mineralogists.

Art. XIII.—*On the use of Anthracite in Blacksmiths' Shops; by* G. Jones, Tutor in Yale College.

In a recent visit to Mauch Chunk and the vallies of Wyoming and Lackawana, I was struck with the universal employment of anthracite in the blacksmiths' shops of those regions, and with the strong terms in which the workmen expressed their preference for it over every other kind of coal. To use their own words—"they would not substitute charcoal, if it were brought and offered them for nothing, at their doors." Though familiar with it in the grates of parlors and in furnaces, on our sea-board, the present was a use to which I had not hitherto seen it applied. I gave the subject some attention, and as the results may be useful to the public will endeavor to offer them.

The kind of coal to be employed.

Every one, familiar with anthracite, in place, knows that its varieties, even in the same bed, are very great. Some of the strata are usually slaty, portions of others are charged with sulphuret of iron, (iron pyrites,) while other parts, generally far the greater portion, are almost entirely carbonaceous. The last is always preferred by the smiths, and the value of pure coal to them is so well known, that in one mine, near Wilkesbarre,* which we visited, a stratum was reserved for them, the coal from which was sold for two dollars per ton, while for the remainder but half this price was demanded. As the proprietors of the different mines, however, are desirous of acquiring a good reputation for their coal, only the best is now sent to the sea-board, and it is probable that but a small portion of the anthracite in our market is unfit for the heating of iron. The proper coal is easily distinguished: I seated myself by a heap of anthracite, near a smith's shop, in Wilkesbarre, and with a little assistance from the owner learned, in five minutes, to discriminate between the different kinds. The slaty coal is inferior in lustre, and an experienced eye will easily distinguish the delicate lines of the slate: its fracture is also even, while that of the pure anthracite is more or less conchoidal. The sulphuret of iron forms usually fine white specks, and may be easily observed from its contrast with the glossy jet of the coal. If any difficulty however is found in making the distinction before heating, there can be none when the coal is in the furnace. The slaty coal soon becomes covered with a white ashy coat, and has a dull appearance: the pyritous coal has a bright glow, but on being moved, will send up numberless brilliant sparks; its smell is also stronger, but the smiths rely more on the former circumstance than on the smell. The slaty coal will not injure the iron; its only evil is in the inferior degree of heat it affords. The case is different with the pyritous anthracite. Yellow iron pyrites is a bi-sulphuret: when heated one proportional of its sulphur combines with the bar to be forged, making it a proto-sulphuret, and giving consequently a brittle character, which renders it difficult to be wrought. When in small quantities, however, neither the slaty nor the pyritous coal is to be dreaded: if the latter is in larger proportion, the smiths find an easy security from its influence, by throwing common salt upon

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* The Baltimore mine.

the fire. Only a small quantity is needed: they simply scatter it upon the ignited coal and then work confidently, as in other cases: I was informed that it is uniformly effectual. Salt is sometimes used by them to assist in igniting the anthracite: I have observed, since my return, that it is also used as a guard against sulphur in bituminous coal.

The manner of constructing the furnace.

The general construction need not differ from that in other shops, the bellows and the hearth being the same. The tuyere-iron, (pronounced by the smiths as if spelt *tue*-iron,) however, must have a greater diameter: in the shops which I have examined, it varied from three fourths of an inch to an inch; about seven eighths of an inch, for the inside diameter, was usually considered the best. As there are no sparks or smoke, a chimney is not needed; and although one might be of service in carrying off the gases which arise from the coal, the shops at Wilkesbarre are usually constructed without any chimney, an opening in the gable end near the roof being found to answer the purpose nearly as well: even this is used only during the summer. In visiting these shops, a person is struck with the cleanly appearance of the workmen, the dust from anthracite, though penetrating, not being of a character to soil either furniture or clothes: I frequently heard the workmen speak boastingly of the fact that they could now be as clean and comfortable as persons engaged in any other trade.

The manner of using the coal.

Charcoal or dry wood is requisite for igniting the anthracite; when fairly ignited, it will need no foreign help, provided the iron to be heated is small and is to be operated upon to no great extent at one time. If the bar is large and requires a diffused heat, a small quantity of charcoal must be mingled with the anthracite, as without this, the bellows are not able to ignite a large quantity of the mineral coal. The iron to be heated should not be thrust down so near the tuyere-iron as is the case when charcoal is employed. Most of the failures, at the first use of anthracite, I was informed, arise from ignorance of this circumstance, from having the diameter of the tuyere-iron too small, and from leaving the iron too long upon the fire. Anthracite will heat a bar in one half the time that is requisite for charcoal, and until the blacksmith is familiar with its use, the heating process must be closely observed, or the iron will be burnt, before he thinks that it has been sufficiently heated. The bar may easily be watched, as from its being so far above the tuyere-iron, the quantity of coal above it is smaller than in the charcoal furnace, and it may be kept constantly in sight. While in the fire it should be suffered to remain undisturbed; if moved about, as is common in the charcoal fires, the heating will be retarded.

Advantages of the anthracite coal.

Some of these may be inferred from the preceding remarks. They consist chiefly in the saving of time and of money. From the rapidity with which the iron is heated, the quantity of work done is about one third greater than when charcoal is employed. The gain, as respects the cost of materials, will depend on the price of anthracite, which from its weight, increases rapidly in value as we recede from the mines. The Carbondale Company state that they will be able to offer it in the New York market, the coming season, for $6,50 per ton; and the time will soon arrive, when from the increased facilities for transportation from the various coal regions and from the rivalry of the different companies, this fuel may be had at a price far less. At its present cost, however, even at remote places, it is much cheaper than charcoal. A ton of anthracite will heat as much iron as two hundred bushels of the latter, which at the average price of seven or eight dollars per hundred bushels, will give a saving of about one half in favor of the anthracite. I visited a shop sixty five miles from Mauch Chunk, from which mine the owner was in the habit of bringing his coal in wagons: he said it cost him ten dollars per ton, delivered at his door, but that even at this price it produced a saving of 80 per cent in his material, and he seldom employed any other coal. The use of it has extended to a considerable distance, in all directions from the coal region, and is now increasing rapidly in Philadelphia: in a few years, it will probably be general throughout the country. The first effort at employing it, will generally be attended by difficulties: sometimes the smith fails entirely and throws it by in disgust; but I believe I have not heard of one case, in which a fair trial has been made, that has not resulted in a great fondness for this species of coal. Still, however, its best friends acknowledge that for some purposes it is not well adapted. When a *hollow heat* is requisite, it will not answer; nor will it suit in forges where the fire must be greatly disturbed by the removal and replacement of the bar. It is said also not to be good for *tempering*, but I have seen it employed for this, and in Mons. Brard's *Minéralogie appliquée aux arts*, I observe it is spoken of as highly useful in the manufacture of a variety of delicate edge tools.

June 5, 1830.

Notice of the first Introduction of Anthracite Coal on the Susquehanna; communicated to the Editor at Wilkesbarre, by Judge Jesse Fell, May 24, 1830.

There has been some enquiry, when and by whom this coal was first used. I have made some effort to ascertain the facts. The late Judge Obadiah Gore, a blacksmith by trade, came into this valley as a Connecticut settler, at an early day, and he himself informed me that he was the first person that used the coal of this region, in a blacksmith's fire; it was about the year 1768 or 1769. He found it to answer well for this purpose, and the blacksmiths of this place have used it in their forges ever since. I find no older tradition of its being used in a fire, than the above account. About forty two years ago, I had it used in a nailery; I found it to answer well for making wrought nails, and instead of losing in the weight of the rods, the nails exceeded the weight of the rods, which was not the case when they were wrought in a charcoal fire. There is another advantage in working with this coal—the heat being superior to that of any other fire, the iron is sooner heated, and I believe a blacksmith may do at least one third more work in a day, than he could do with a charcoal fire.

From observation, I had conceived an idea, that if a body of this coal was ignited, and confined together, it would burn as a fuel; to try the experiment, in the month of February, 1808, I had a grate constructed for the purpose, eight inches in depth, and eight inches in height, with feet, eight inches high, and about twenty two inches long, (the length is immaterial, it may be regulated to suit its use or convenience,) and the coal after being ignited in it, burned beyond the most sanguine expectation. A more beautiful fire could not be imagined, it being clear and without smoke. This was the first instance of success, in burning this coal in a grate, in a common fireplace, of which I have any knowledge; and this experiment first brought our coal into use, for winter fires, (without any patent right.) From that time it has become a matter of great attention and speculation. When, how, or of what matter it was formed, I know not, and do not ever expect to know, but its usefulness we do know, and appreciate, still believing its use to be as yet only in its infancy.

ART. XIV.—*Notice of the Anthracite Region in the Valley of the Lackawanna and of Wyoming on the Susquehanna.*—EDITOR.

THE Anthracite coal formations of this country have become very interesting to Science, to the arts, and to domestic economy. Having recently, at the request of many of the inhabitants, visited and examined the valley of Wyoming and of the Lackawanna, I have drawn up for their use, a notice of the Anthracite coal of this region the substance of which, in the popular form in which it was written, is subjoined, with some additional observations.

In the discharge of this duty, I have received every possible assistance from the zeal and kindness of the gentlemen of the valley, as well as of the scientific friends* who accompanied me through the mines and mountains.

In the remarks which I now offer, I lay no claim to discoveries; these were made before, and some of them long ago; I aim, to present only a few general views, and shall allude to particular interests, only so far as they are subservient to general conclusions.

The anthracite region of the Susquehanna is between sixty and seventy miles long and about five broad; that portion which I have particularly examined is forty miles in length, and although distinguished as the vallies of the Wyoming and Lackawanna, it is, in reality, without a natural division, and constitutes but one formation. In exploring it, upon both sides, and by many sections and windings, we traversed at least one hundred and twenty miles, and although a longer familiarity with this region might have led to more precision, I trust that no important error will be found in the following statement.

It is well known, that there are three principal regions of Anthracite coal in Pennsylvania, namely, on the Schuylkill, on the Lehigh, and on the Susquehanna; the two latter I have visited, and the former, from want of time to complete the tour, as originally projected, is reserved for a future opportunity. The region of the Schuylkill is therefore unavoidably omitted on the present occasion. In another paper, in the next No. of this Journal, I shall say something of Mauch Chunk, and the Schuylkill will be remembered whenever it is in my power to visit that region.

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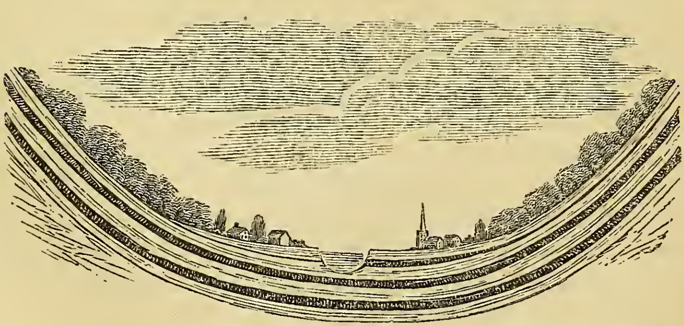
* Prof. Ed. Hitchcock, of Amherst College, and Mr. George Jones, Senior tutor in Yale College.

Valley of Wyoming and of the Lackawanna.

The double barrier of nearly parallel mountains, through whose included valley, flow the Susquehanna and its tributary the Lackawanna, is a perfectly well defined coal formation, and its geological structure is equally intelligible and interesting. Coal is often situated in basins; this region is, however, not a basin, but rather a trough; and its strata, seen in a transverse section, would present a series of elliptical curves. Leaving out of view its irregularities, this valley may be regarded, as the lower half of a vast flattened tube, lying horizontally, within which are laid a series of sections of smaller tubes, whose sides continually diminish, in height, and end with the omission of those towards the centre; the bottom of these sections represents the strata in the lower parts of the valley, and the sides, those of the slopes of the hills and mountains. The Lackawanna creek and Susquehanna river flow through a natural canal, scooped out longitudinally, in the lower part of the upper strata; winding, irregularly, in a line, nearly, but not exactly central, and tending most towards the side which represents the western barrier of mountains.

The annexed wood cut is intended to give an ideal section of the strata as regards their position and arrangement, without any pretension to accuracy in the proportions or number of strata; and the occasional irregularities, as well as the steep ascent up the mountains, to the extreme right and left, are intentionally omitted.

Ideal Section, at Wilkesbarre.



The strata or natural beds included in this great valley are those of the Anthracite coal formation. The particular strata that require to be noticed are only three. Supposing them all present at any particular place, they are arranged as follows,—beginning at the top;

1. A rock composed of fragments or ruins of other rocks, the parts and cement of which are principally siliceous; the fragments are of various size, from that of pebbles to that of sand; in the latter case the mass is called sandstone; in the former, puddingstone; other names might be mentioned, but these are sufficient; most geologists, however, will call this series of rocks grauwacke; and when they are slaty in their structure, they obtain the name of grauwacke slate. They are usually referred to the transition class.

2. Argillaceous slate, in many varieties of fineness and firmness, and often abounding with vegetable impressions, which are found also, but more sparingly in the siliceous rock.

3. Anthracite coal, in regular strata, between roof and pavement.

This simple arrangement of three members in the series, appears to embrace all that is essential in the construction of the valley; I omit, of course, accidental rocks and unimportant varieties.

The usual roof and floor of the coal is clay slate; but sometimes the sandstone lies directly upon the coal, the slate being omitted, and not unfrequently, when the coal is near the top of the ground, both rocks are absent, having probably been removed, either by violent causes, or decomposed by time, into loose earth; in such cases, the coal and slate, in a state of minute division, are usually mixed with the earth, and even with the soil, which is thus rendered more or less black, and frequently appears on the surface, in what are locally called, *coal blossoms.*

The inclination of the strata varies, generally, between four degrees and fifteen or twenty, but it occasionally becomes much greater and is in some few instances nearly perpendicular; I have never seen it quite so in this valley or quite horizontal. The direction of the strata is between N. and N. E. and S. and S. W.; the dip is generally towards the rivers, and of course it is opposite on the opposite sides of the rivers; on the eastern side, it declines to the west, and on the western side to the east.

The strata of particular mines, however, generally copy the form of the upper surface, immediately over them; they are therefore sometimes curved, or irregular, or saddle- or mantle-shaped; and I saw one that was dome-shaped.

Between Pittston ferry, at the junction of the Lackawanna and Susquehanna, and Mill Creek just above Wilkesbarre, a distance of eight or nine miles, on the eastern side of the river, the strata, immediately on the river's bank, dip to the east, contrary to the inclination of those of the neighboring mountains on the same side of the river, but they soon resume the general arrangement, to which this fact does not form an exception, but proves only that the river did not there find its way through the lowest part of the curve of the trough, but obtained a passage a little west of it. On the declivity of the eastern barrier of mountains there is, however, a place where the strata, for a short distance, dip in a direction contrary to that of the general arrangement, and there may be other exceptions which I did not observe.

It is scarcely necessary to insist on various other irregularities of the strata, in particular situations; these irregularities have apparently arisen from convulsions, and exhibit strange contortions, not affecting the general order of the stratification, which is, on the whole very constant. The preceding statements are essential to the just comprehension of the position of the strata of coal, which lie between the strata of rocks, and follow all their changes of form, and position with almost exact regularity.—This is seen particularly in the great excavations, such as some of those in Plymouth and Wilkesbarre, where roofs of almost perfect regularity correspond to floors equally uniform, and in one of these mines, the cavity extends thirty five rods into the mountain. The coal lies in beds, and not, as is commonly said in veins: veins cross and intersect the strata, at all degrees of obliquity; beds lie between or parallel with them, whether they are flat or inclined, and I have never seen the coal intersecting the strata, but always parallel with them. The coal beds of this valley are of every thickness, from a foot to twenty seven feet; none are much regarded by the proprietors, that are not as much as three or four feet in thickness; few are wrought that are less than six; a great number are found from six to twelve; a considerable number from twelve to twenty and several mines are from twenty to twenty five or more. I speak of course of solid coal, without reference to the rocks.

The lateral extent of the beds is immense. They break out in the precipices and hills, and upon the banks of the Susquehanna, and Lackawanna; they form, in some places, the pavement of these rivers, and they appear in the sides and channels of almost every stream from the mountains; they blacken the soil in numerous places; in the Lackawanna valley many wells are sunk in the coal—several, in the valley of Wyoming, and even in the borough of Wilkesbarre.

There is no reason to doubt, that, excepting the agency of violent causes and the slow operation of time, in removing portions of the upper strata, the beds of coal are continuous through the whole region; that they pass under the rivers and accompany the strata of coal rocks, through the lowest depressions of the valley, under the flats and meadows, and up the hills and mountains, on the sides of which and even near the summit, and in the banks of the rivers, they break into view. The whole region is completely underlaid by coal beds, repeated again and again, with their attendant rocks; five repetitions of the series of coal beds and rocks we distinctly saw, and sometimes in natural sections, made by rivers and other causes, three or four were, at once, in view; we understand that seven were ascertained by the late Mr. Jacob Cist of Wilkesbarre, than whom, both as a scientific and practical observer, it would be difficult to cite a better authority; he supposed that the entire depth of the coal strata, and their attendant rocks, is one third of a mile. It is not certain however, that the number of beds is limited to seven, or the entire depth to one third of a mile; it is indeed altogether probable that other beds exist, at a depth still greater. Except as a matter of science, there is however no necessity of deciding this question, for the quantity of workable coal in the valley is altogether inexhaustible; and (especially if we add the vast magazines on the Lehigh and Schuylkill,) there is a sufficient quantity of anthracite in Pennsylvania, to supply remote generations and countries.

Wherever in the valley of the Susquehanna and Lackawanna, the puddingstone or sandstone and slate are repeated, there we usually find the coal as a third member of the series; I would not venture to say that there is no exception; but all the appearances in the valley countenance the opinion that this is a general arrangement; no instance to the contrary was observed by me, or was remembered by the inhabitants, and I am persuaded, that if the position is not universally, it is, at least, generally, true. If the preceding observations are just, it follows, that all the lands of this great valley are coal lands, and there can be no reasonable doubt that the coal beds may be found beneath every acre of ground.*

It does not however follow, that the coal can be, in every situation, profitably explored; there is much room for the exercise of good judgment in the selection of proper situations and the following cautions may prevent fruitless expenditures.

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* In numerous instances, the people draw the coal for domestic consumption, from their own grounds.

1. Never to undertake an expensive excavation where the coal is not actually in sight, without previously ascertaining its existence and thickness by the auger. Tunnels, galleries and pits, are enormously expensive, compared with the simple and comparatively cheap operation of boring.

2. At present, not to undertake a new mine, where great draining by mechanical power is necessary.

These obvious cautions are the more necessary in the valley of the Susquehanna and Lackawanna, because the number of excellent mining situations in that region, is very great. In most of the coal mines, now wrought in those valleys, there is little or no inconvenience from water; it runs off by the natural declivity, and by a judicious arrangement of the work, a drainage may, in a great majority of instances, be established, both in the mines now worked, and in those that are to be hereafter opened.

The great work at Carbondale,* at the head of the valley, being wrought, like that at Mauch Chunk near the Lehigh, as an open quarry, there is of course the greatest facility in coming at the coal, and the water subsides into lower situations. In the valley of the Susquehanna and Lackawanna many such mines may be opened and worked, like quarries. Since 1824, I have been familiar with the use of anthracite, in most of the varieties known in this country. For the results of my own experience, I beg leave to refer to some papers in Vols. X and XI of this Journal for 1825 and 1826 : I would cite also the valuable remarks of Mr. Cist, Vol. IV, and of Mr. Pierce, Vol. XII, and of other gentlemen who have communicated their observations through the same channel. Without depreciating wood and the bituminous coal, which must ever be held in high estimation for fuel, my impressions of the value of the anthracite have, by experience, constantly acquired strength; and I regard the vast deposits of Pennsylvania, as an invaluable national treasure, more important than mines of gold and silver.

There are varieties in the qualities of the anthracite of Pennsylvania, from different regions; from different mines; and from different parts of the same mine; these varieties, relating chiefly to the ease of igniting, the intenseness and endurance of the heat, the more or less rapid consumption of the fuel, and the proportion of residuum, are, among those interested, frequent subjects of discus-

* They are now beginning to mine into the hill between roof and pavement.

sion and preference; but the varieties, after all, appear to be merely shades of difference in the members of the same family; and they are fortunate differences, as they afford a more perfect adaptation to the various purposes of the arts and of domestic economy. There can be no doubt that the anthracite of the valleys of Wyoming and Lackawanna contains all the varieties that are found in the other anthracite regions of Pennsylvania. To the eye of the mineralogist it presents every appearance, indicative of the excellent qualities that are known to belong to the anthracite of the Lehigh and Schuylkill, and there can be no reason to doubt that the best coal of these valleys is equal to the best in the world, and the inferior qualities, like those of the other mines, are all applicable to important uses.

It is interesting to observe the numerous uses to which the coal is applied by the inhabitants, and the decided preference which they give to it, over the wood and charcoal of their own forests. The smiths uniformly employ it in their forges; and in the kitchens the anthracite fire, kindled in a long and capacious grate, never goes out, either in winter or summer, and perfectly answers every culinary purpose*. Its use also in almost every art requiring fire is nearly universal, and numerous favorable attestations, from the most respectable practical men, may be seen in Vols. IV and X, of this Journal.

The large quantities of argillaceous or clay iron ore which are connected with the coal strata of this valley, and the bog ores which appear also to abound here, are well worthy of the attention of the inhabitants, and it can scarcely be doubted, that the difficulties hitherto experienced in the use of the anthracite in the smelting of iron will be overcome, and then all the means of manufacturing iron will be here at hand.

The chalybeate mineral springs which flow from numerous places in this coal region, are worthy of some attention as sources of health, and of attraction to strangers, and it might be well to exclude the rain water from some of them, and to put them in other respects in order.

I have seen with much pleasure, the great progress already made, towards opening an easier communication with this important and interesting valley. The canal which is just entering it at the south, and which has already advanced within eight miles of Wilkesbarre, will, without doubt, be continued through the entire valley, and also to such other points as shall connect it to the north with similar communications from the interior lakes, canals, and rivers of New York.

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* The fixed ovens are heated with wood.

The noble mine, railway and canal, of the Delaware and Hudson company, shew what can be done, by the resources, enterprize, and perseverance of an association of individuals; and it cannot be doubted, that the two most opulent and powerful States in the Union, having already led the way, so successfully, in the great field of internal improvement, will continue to consult the high interests of their citizens, by completing all the communications and especially the northern ones, with this important valley. Those already begun on the south, will doubtless, be finished by the State, and the inhabitants will themselves take care that all the additional communications through the valley, on both sides of the river, which their interests may demand shall be in due time established. The importance of the coal beds will justify and require a canal on each side of the river, and numerous rail ways leading from different mines. We may expect soon to see this noble valley become a great thoroughfare of travelling and of business, and a seat of numerous manufactures, for which its great fertility, its vast magazines of fuel, its fine water powers, and its excellent population, give it rare advantages.

Mining districts are rarely rich in soil,—the sterility of the surface being compensated by the mineral treasures below. Seldom are both advantages combined; we see it occasionally in some of the coal districts of Britain; and in this respect, the valley of Wyoming is particularly happy. It is rich in soil and in the best agricultural productions. Its extensive meadows are unrivalled in fertility and beauty, and its undulating surface, between the meadows and the mountains, is a fine region for grass and wheat. In a word, splendid and beautiful in the scenery of its mountains, rivers, fields, and meadows; rich in the most productive agriculture; possessed by the still surviving veterans and by the descendants, of a high minded race of men; full of the most interesting historical associations, and of scenes of warfare, where the precious blood of fathers, husbands and sons, so often moistened their own fields; the valley of Wyoming will always remain one of the most attractive regions to every intelligent and patriotic American.

MISCELLANEOUS REMARKS UPON THE VALLEY OF WYOMING AND LACKAWANNA.

Disputed title.

The severe and long continued struggle for the possession of this country, which was sustained by the original Connecticut settlers from fifty to eighty years since, and the repeated attempts which were made to dispossess them by arms, sufficiently evince the high estimation in which it was held by all the parties. Without recalling the painful circumstances of that unexampled controversy, it is not improper to say, that the prize for which the settlers contended was worthy of all the heroism, fortitude, and long suffering perseverance, which, during so many years, they displayed;* an exhibition of moral courage rarely equalled and never surpassed. Believing themselves, both in a political and personal view, to be the rightful proprietors of the country, they defended it even to the death; and no one who now surveys this charming valley† can wonder that they would not quietly relinquish their claim.

Scenery and surface.

Although the view under which it is now before us, relates principally to science and national resources, I will not hold myself precluded from alluding to some of those additional attractions, which may conspire to draw the intelligent traveller to this valley. Its form is that of a very long oval or ellipse. It is bounded by grand mountain barriers and watered by a noble river and its tributaries. The first glance of a stranger entering at either end, or crossing the mountain ridges which divide it, (like the happy valley of Abyssinia,) from the rest of the world, fills him with the peculiar pleasure produced by a fine landscape, combining richness, beauty, variety and grandeur. From Prospect Hill, on the rocky summit of the eastern barrier, and from Ross' Hill, on the west, the valley of Wyoming is seen in one view, as a charming whole, and its lofty and well defined boundaries exclude more distant objects from mingling in the prospect. Few landscapes, that I have seen, can vie with the valley of Wyoming. Excepting some rocky precipices and cliffs, the mountains are wooded from the summit to their base; natural sections furnish avenues for roads, and the rapid Susquehanna rolls its powerful current through a mountain gap, on the north west, and immediately receives the Lackawanna, which flows down the narrower valley of the same name. A similar pass between the mountains, on the

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* See Trumbull's History of Connecticut and Chapman's History of the Valley of Wyoming.

† The claim embraced also a much more extensive country west and north west of Wyoming.

south, gives the Susquehanna an exit, and at both places a slight obliquity in the position of the observer presents to the eye a seeming lake in the windings of the river, and a barrier of mountains, apparently impassable.

From the foot of the steep mountain ridges, particularly on the eastern side, the valley slopes away, with broad sweeping undulations in the surface, forming numerous swelling hills of arable and grazing land; and as we recede from the hills, the fine flats and meadows, covered* with the richest grass and wheat, complete the picture, by features of the gentlest and most luxuriant beauty.

People—forts—battle ground.

An active and intelligent population fills the country; their buildings and farms bear witness to their industry and skill: several villages or clusters of houses give variety to the scene, and Wilkesbarre, a regular and well built borough, having 1000 or 1200 inhabitants, with churches, ministers, academy, able teachers and schools, and with many enlightened, moral and cultivated people, furnishes an agreeable resting place to the traveller. He will not fail to enquire for the battle ground, and for the traces, now almost obliterated, of the forts which were so often assailed and defended; which frequently protected the entire population from civil and savage warfare, and which have been rendered memorable, by events of the deepest interest.†

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* As I saw them in May, 1830.

† The site of fort Wyoming is now covered by the court house; fort Durgee was half a mile below the borough near the Shawnee flats; there was another fort on the eastern bank nearly opposite to Porter's hotel, a little below the bridge; the redoubts (an admirable look-out station) are still visible on the hill at the north of the village, and near them the solitary grave, without a monument, of the first clergyman, the Rev. Mr. Johnson, who was buried there by his own request.

Mill Creek empties into the Susquehanna, at the north of the borough and near its mouth, both on the same, and on the opposite shore, were block houses which were famous in the wars of the valley; Ogden's blockhouse was here. Two or three miles north of Wilkesbarre, and on the western side of the river, is the site of Forty Fort, near the tavern of Mr. Myers; a mile or two still farther north, is the creek upon whose southern bank, the little army of the planters, bravely led by Cols. Z. Butler and N. Denison, took their judicious station on the morning of July 3, 1778, intending, there to await the enemy; and two or three miles still farther north, is the plain on and near which, most of them were destroyed, in and after the fatal battle, accidentally and prematurely brought on, in the afternoon of that day. The left wing of the combined army of Loyalists, Indians, and British, under Col. John Butler, rested on fort Wintermoot, whose site near the river is now covered by the house of the late Col. Jenkins, while the right wing extended to the swamp

Some of the hoary veterans of that day still survive, and the valley is full of the descendants of those whose blood has purchased the privileges of this now happy country, whose riches, both above and below the surface, and whose fine scenery and heroic and pathetic history, present a rare combination of attractions.

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at the foot of the hills. (See the Map.) The patriot army of 368 men, after a severe struggle, was overthrown by thrice their number of the enemy, and slaughtered, principally in the flight and after surrendering themselves prisoners of war. The plain, the river, and the island of Monockonock, were the principal scenes of this horrible massacre.* Sixteen men, placed in a ring around a rock, which is still shewn behind the house of Mr. Gay near the river, were held by stout Indians, while they were, one by one, slaughtered, by the knife or tomahawk of a squaw. Only one individual, a strong man, by the name of Hammond, by a desperate effort, escaped, and is but recently deceased. In a similar ring, nine persons were murdered in the same way, a little farther north. Many were shot in the river and hunted out and slain in their hiding places (sometimes by their near but adverse relatives) on the now beautiful island of Monockonock. But sixty of the men who went into the battle survived, and Forty Fort was filled with widows and orphans,† whose tears and cries were suppressed after the surrender, for fear of provoking the Indians to kill them, for it was one of their pastimes to brandish the tomahawk over their heads. There are still remaining several survivors of the battle, Messrs. Bennet, Inman, Blackman, and others from whom many interesting particulars may be obtained. Mrs. Myers, now residing near Forty Fort, was in it at the time of the battle and surrender, and is very intelligent and interesting in her communications. Gen. Ross was charged with burying the dead; it was more than a month after the event, and he assured me that owing to the intense heat of the weather, and probably the dryness of the air, the bodies were shriveled, dried and inoffensive, but with a single exception, their features could not be recognized. They were buried in a common grave, on land now owned by Mr. Gay. The absence of two companies of the flower of the young men of the valley then serving in the Continental army, and the urgency of some of the subordinate officers on the ground, who insisted on giving the enemy battle that day, before their absent friends, then on their homeward march, could arrive, were the causes of this terrible disaster, which brought in its train, more calamity than the most sanguinary European battles; for the murdered settlers were connected with the survivors, by the nearest and dearest domestic relations. Much interesting private history of these times may still be gleaned in the valley; but the original witnesses will soon be gone, and their narratives ought to be secured before it is too late. It is much to be regretted that the memoirs of Judge Hollenback have not been written; he was one of the most intelligent and heroic men of the valley; was personally engaged in many perilous adventures; after the fatal battle escaped from the shot of the Indians by swimming and diving in the river, and lived, till within a year or two, greatly and justly respected. It is only by learning from history and biography, at what price the liberty and security of this country have been purchased, that the rising generation can be made, in any good degree, to appreciate the magnitude of the sacrifice or the value of the acquisition. If a scene of heroic and tender association is desired for Poetry and Legendary story, the valley of Wyoming will give it without the aid of fiction; and Campbell, Scott, and Cooper need only to delineate authentic realities.

* Perpetrated by the Indians and tories.

† The war made 150 widows, and 600 orphans in the valley.

Communications.—Carbondale.

When the communication, by the canals and rail way of the Hudson and Delaware company, shall be fully adapted to the convenience of travellers,* they will begin to pass from the Hudson to the Delaware, and then to the head of the Lackawanna valley. The canals and rail way and steam engines, for conveying the coal, will form a very gratifying subject of observation, and the sight of the great mine at Carbondale, is alone worth the journey. Here the thriving village of Carbondale, and the suburb of New Dublin, containing the laborers employed about the mine, have arisen within a very short period.

The mine is situated in the front of a hill; it is quarried, in a continued line, for sixty rods, and presents a front of good coal of twenty feet in thickness, besides several feet more of roof coal, stained and shattered by time and the weather. Great as have been the expenditures of the company, if any mining object can justify them, it must be such a deposit of coal. This mine and other mines in the vicinity—as for instance the rich bed of Thomas Meredith, Esq. and the various other beds already opened in the Lackawanna valley, leave no room to doubt, that the coal is inexhaustible. Several stationary steam engines draw up the coal in waggons, on a rail way from the mine, to the summit level, whence it descends to the canal. The entire rail way is sixteen miles long, and the canal along the Laxawaxen thirty more. From this canal it crosses the Delaware, and proceeds by another canal to the Hudson, sixty seven miles to the vicinity of Kingston.

Last year there was much inconvenience from the breaking of the chains by which the fixed steam engines draw up the coal waggons from the mine; during the season, about fifty waggons were dashed to pieces in that manner, and when the chains parted, the waggon could not be seen in its descent; so instantaneously did it dart to its goal, that only a dim streak could be traced through the air. They now use cables of hemp, and the accidents do not any longer occur.

The establishment at Carbondale, is only the opening of the great valley of the Lackawanna, and of Wyoming. The Hudson and Delaware company, will now convey coal from the other mines, for a rate which may not improbably be hereafter reduced; so that much of the coal of the valley may find its outlet in this way; and other communications to the Delaware, the Hudson, and to the northern part of New York are in contemplation.

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* Which will soon be done.

Roads, &c.

There is, at present, a forest which extends eight or ten miles south of Carbondale, and through which there is only a very muddy and rough road, hardly to be passed with comfort and safety, except on horseback. Still a good road can be made here, at a moderate expense, and when this is done, there will be nothing to obstruct the passage of the traveller to the valley of Wyoming. From this valley, he can easily pass to Mauch Chunk, and then to Pottsville, and thus take in his way the mines of the Lehigh and Schuylkill, and end at Philadelphia; or the opposite course can be, in some cases, more conveniently, pursued. The time is probably not distant, when this will become a favorite tour, as it must always be an interesting one.

There is nothing now to hinder the construction of a rail road from Wilkesbarre to Carbondale, and then the mineral riches of the valley, may obtain also a northern, as they now have a southern vent. The Baltimore coal company have a receiving establishment within the Susquehanna, at Port Deposit, not far from the Chesapeake; and the coal of Wyoming, may hereafter reach Philadelphia by the interior canals and rail ways that are to connect the Susquehanna with that city, as it already passes through the Chesapeake and Delaware canal.

Mines.

It seems to be little known abroad, that several of the coal mines, on and near the Susquehanna, and Lackawanna, are already works of great magnitude; vast excavations either open to the heavens, or between roofs and pavements of solid rock. In several of them there are rail ways, and carts and waggons are driven into others, and return from the bowels of the mountain, laden with coal. Some of these mines are objects of great curiosity, and the most remarkable may be visited with no inconvenience, as they are dry, roomy, and well ventilated; many others are approached only with toil and difficulty, but such places will be interesting only to the scientific or speculating traveller.

Vegetable Remains.

In visting several of the mines of the Susquehanna and Lackawanna, the naturalist is gratified, by seeing the vast deposits of vegetable impressions and remains which accompany the coal, usually in the slate that forms the roof, and occasionally in that of the floor; they exist also, although, in a smaller degree in the sandstone, and sometimes, but much more rarely even in the coal itself. There are instances where they fill the slate for a space of ten feet in thickness, and making due allowance for the compression which they have undergone, the original deposits, must have occupied a vastly greater thickness, than their relics do now. The impressions are very perfect, indicating repose and calm, at the time of their deposition, and excluding the possibility of transport from distant countries; there are many species of ferns, none of them, as is said, modern, and most or all tropical;* there are impressions, sometimes several feet long and broad, of the bark of gigantic vegetables; some botanists say they are palms; occasionally there are entire limbs, carbonized; frequently, broad leaves are found of six or seven inches or more in diameter; culmiferous plants are numerous, and so are the aquatic algæ, and rushes; the leaves of the plants are usually in full expansion, the most delicate parts of their structure being exactly preserved, or copied; and according to Mr. Cist, flowers of a stellated form, are occasionally found. Prof. Hitchcock, believed that he had found a flower with unfolded petals, and so it appeared to me.

The inferences to be drawn from the vegetable remains are very interesting, but there is not time to discuss them fully on the present occasion, or to apply the facts to account for the origin of coal; a subject sufficiently difficult. We cannot however hesitate to say, that vegetable life, on a great scale, attended the formation of this coal, and both preceded, accompanied, and followed that event; that the causes which established its existence were repeated many times, and continued to operate, during the deposition of the sucessive strata; that a sedimentary rock, namely the slate, in a loose and impressible form, was deposited with the vegetables, and enveloped, covered and preserved them; that a fragmentary rock succeeded, composed of pebbles, rounded or angular, or of sand cemented firmly—the ruins of previously existing formations; that the causes which produced these rocks were also many times repeated, and of course, that all the causes which produced such deposits as the various ones now mentioned, were at different times, alternate, successive, and concomitant.

Origin of Coal.

Is the anthracite coal of vegetable origin? Does the fibrous charcoal, frequently found between its layers, owe its origin to the veget-

* Implying, of course a harder nature, or a different climate.

able skeleton? There seems no more reason to doubt the latter fact, than that the vegetable impressions, found in and upon the coal and its rocks, have the same origin. But did the mass of coal arise from vegetables? This has been admitted by many persons with respect to bituminous coal, but, I have heretofore been inclined to attribute anthracite coal to a direct mineral creation; the opinion of its vegetable origin appears however to me less improbable, since I have seen, with my own eyes, the incontrovertible and abundant proofs of vegetable life in these mines. We are obliged, from the facts here seen, to go a great extent, in admitting vegetation in connexion with this coal. But if we seek to trace the entire masses to vegetable matter, how shall we admit the existence and accumulation of the enormous quantities that must have grown or been collected on the spot, to form such stupendous beds, ten, twenty, and thirty feet in thickness, and repeated, again and again, with all their attendant rocks and impressions. But, the plants, from ferns and liliputian vegetables to those of great size, did grow, and were deposited, in connexion with these coal strata; for, there we find their unquestionable and exuberant remains; and they were produced again and again; for we find them in the different deposits, as the coal strata succeed each other at different depths. As the vegetables, whose organized forms or impressions we actually find, did exist in these places, could there by any possibility, have been enough accumulated to form the coal beds? If it is difficult to answer in the affirmative, perhaps it is not quite certain that we must reply in the negative; at least it is not, I must confess, quite so certain, as I once thought it to be.

But, supposing the vegetable matter to have existed in sufficient quantity to have formed the coal; why, if so formed, is there in general, no appearance of ligneous structure, of vegetable organization in the coal itself? On this point it may be suggested, that the vegetable matter may have been so decomposed, as to lose, in a great degree, its organization; it may have been suspended or deposited in water along with the same earthy matter, which formed the accompanying rocks, and particularly the coal slate, and this earthy matter may have been deposited along with and among the particles as well as the masses of coal; now in minute proportion, as we actually find it in burning even the purest anthracite, the form and structure of whose layers, is delicately exhibited by the earthy skeleton, commonly called ashes, which remains; now, the earthy matter may have prevailed to a greater degree and then the coal is more impure, less combustible, and affords a more abundant residuum; again the earthy matter may have prevailed still more, and then the deposit is a carbonaceous slate—and lastly, the carbon may have been supplanted by the earthy matter, and then seams of slate would be formed as we actually find them in the coal beds. Without some such process, it seems difficult to account for the varying proportions of earth and carbon, which we find blended in the anthracites; the extremes being the purest coal on the one hand, and slate on the other, and between these there appear to be innumerable mixtures or combinations of earth and coal in different proportions.

Perhaps the reason why the vegetables found in the slate retain their organized form, is found in the fact, that the fine sedimentary earths, the silicious and argillaceous, of which the slate is composed, may have enveloped the plants too suddenly, to permit them to undergo decomposition, and thus to exhibit an impalpable carbon; while their forms would, of course, be distinctly impressed upon the yielding plastic matter of the slate, rendered soft perhaps by diffusion in water. Pressure is also to be taken into account in reasoning upon the probable obliteration of the organic structure; this force would operate in proportion to the progress of the accumulation whether of coal strata, or of those of superincumbent rock.

Many other considerations present themselves in relation to this subject; such as the time when, and in which, these deposits were made, the original position of the strata whether flat or inclined; if flat, by what force raised or depressed; if inclined, how the materials were prevented from accumulation in thicker masses at the lowest curvature or point of declination, &c. Internal fire may have raised and distorted and modified the coal beds, after they were formed, but it seems more difficult to admit, that coal strata have been in actual ignition.

Conclusion.

But, dismissing theoretical considerations, the coal is in our power and it is destined to produce great results in the United States. Including the bituminous and the anthracite coal of the various regions, there is in our territories, enough to supply the world,* and the country on the Susquehanna and its tributaries will, when the communications shall be duly opened, rise to a degree of importance, at present, not easily realized. It is hoped that the spirit of speculation, so productive of extravagant and erroneous expectations, will not be here substituted for a regular course of industrious exertion, which,

* Not to mention the coal beyond the Mississippi and that in Nova Scotia.

with suitable enterprize, forms the best basis of public and private prosperity.

Remark.—It is a favorite idea among the inhabitants, that the valley of Wyoming was anciently a lake. This is by no means improbable. Every cup-shaped cavity, great or small, on the earths surface, may have been a lake, and its permanency would depend upon the due supply of its waters and upon the firmness of its barriers. See the "Outline" accompanying the American Edition of Bakewell's Geology.

APPENDIX,

Exhibiting the succession of the strata in several mines.

I would remark to the proprietors of mines in the valley, that the following statements being made for illustration only, there has been no attempt to enumerate all the mines, but only a few, by way of example. Those that are omitted (among which are some important ones,) are not neglected; in many cases no minutes were preserved, either because it was not convenient to take them, or because they were thought to be unnecessary. I am indebted for these notes to my companion, Mr. George Jones.

I. *Carbondale bed, owned by the Delaware and Hudson Canal and Rail Road Company.*

1. Soil.—2. Dark earth, 3 ft.—3. Loose slate, 5 ft.—4. Broken coal, called here 2d quality, not considered fit for market, 2 ft.

5. Good coal, called 1st quality, 6 ft.	20 ft. wrought for market.
6. Coal of still superior quality, 1 ft.	
7. Coal, 1st and 2d quality intermingled, 3 ft.	
8. Coal, very good quality, 4 ft.	
9. Good coal with strata of slate intermixed, 6 ft.	

10. Firm slate, with vegetable impressions and pyrites; thickness not known.

The mining has been so far in the open air, but they are now beginning to follow the bed without removing the superincumbent materials; pillars of coal being left to support their weight. About three and a half acres of the bed have been removed: the mining, (including also the removal of the rubbish above and intermixed,) costs the company about 75 cents per ton. They now offer their coal at Kingston, on the Hudson, at $6 per ton; the cost of transportation thence to New York, is 50 cents per ton. The quantity sent off to market averages 250 tons per day, during eight or nine months. A sketch of the railway may be seen on the annexed map.

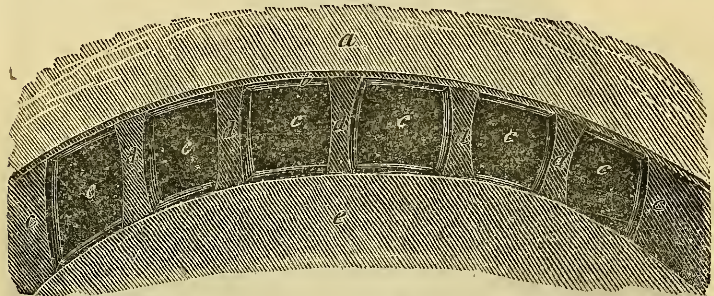
II. *Mr. Ingham's bed, on the W. side of the Susquehanna.*

1. Earth.—2. Graywacke, 8 or 10 ft.—3. Firm slate, 75 ft.—4. Coal, best quality, 3 ft.—5. Firm slate, 10 ft.—6. Good coal, 9 ft.—7. Firm slate, thickness unknown.—Dip 45° S. E.

The impressions on the slate of this bed, are numerous, and remarkable for distinctness, and delicacy.

III. *Mr. Gaylord's bed, on the west side of the Susquehanna River.*

A cross section of this mine is given, on account of the peculiar curvature of the bed; the surface of the hill in which it is situated is parallel to this.



a Graywacke, 15 ft.
b Loose slate, 1 ft.
c Good coal, 6 ft.
d Pillars of coal left to support the roof.
e compact slate, thickness unknown.

IV. *Mr. Smith's bed, on W. side of the Susquehanna.*

1. Soil.—2. Graywacke, 20 ft.—3. Slate, 10 feet, with numerous vegetable impressions.—4. Broken coal and slate, 6 ft.—5. Good coal, 20 ft.—6. Firm slate, thickness unknown.

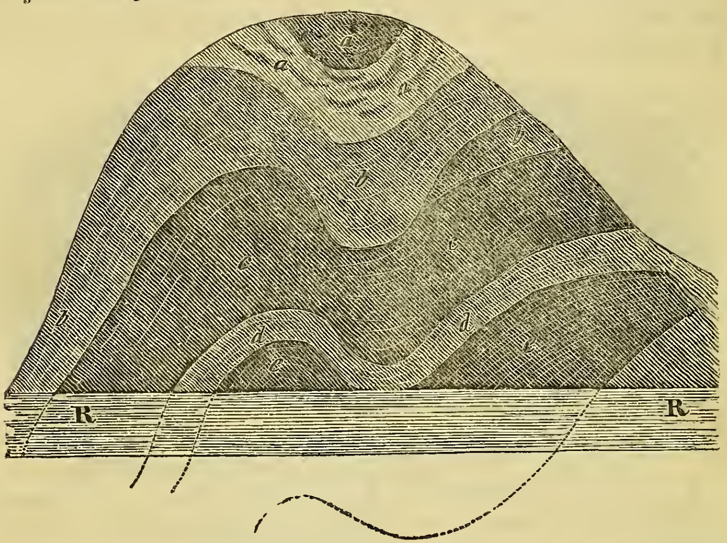
This mine has been extensively wrought, and the scene, both without and within, is exceedingly imposing. The bed is followed into the mountain, large pillars of coal being left to support the superincumbent weight. At first the entire stratum of coal was removed, thus leaving the roof of slate; but the frost operated on the slate, and a considerable portion of the roof fell in. A thickness of one or two feet of coal is now left for the roof, and this practice is followed throughout the coal region. Where the coal stratum is not thick, the roof is sometimes supported by wooden, instead of coal pillars, but this is not considered as safe as the other mode.

Nearly opposite to this mine is that of Borbridge and Donley, one of the greatest in the valley; we preserved no minutes of this mine, which is a stupendous cavern, into which a coach and six might be driven and turned again with ease. Most of the coal hitherto sent down the Susquehanna, has been from these two mines: the quantity left is apparently incalculable: they are about commencing a railroad to the river which is a mile distant.

V. *Mr. Harvey's bed, at the breast work rocks: W. side of the river.*

1. Immense rocks of graywacke.—2. Broken coal, 4 ft.—3. Firmer coal, 4 ft.—4. Good coal, thickness unknown.—Dip 8° to the N.E.

VI. *Front view of a contorted coal bed at Pittston, on the east bank of the Susquehanna River, nine miles north from Wilkesbarre.*



a Loose stones and earth.
b Gray sand stone,
c Slate 12 feet in depth.
d Slate mingled with coal, 4 ft.
e Coal, 13 ft.
R Susquehanna River

VII. *Mr. Hillhouse's bed on the east bank of the Susquehanna, about seven miles north of Wilkesbarre.*

1. Soil.—2. Sandstone, 4 ft.—3. Loose slate, 20 in.—4. Coal, 6 ft.—5. Slate, 8 ft.—6. Coal, 18 in.—7. Slate, probably about 8 ft.—9. Thin stratum of coal.—Dip 5° S. E.

This bed extends a considerable distance along the bottom of the river.

VIII. *Mill Creek bed, nine miles east from Wilkesbarre, and two from the Lackawanna River.*

1. Soil.—2. Slate, 12 ft.—3. Coal, 18 in.—4. Slate, 5 ft.—5. Coal, 4 ft.—6. Slate, 8 ft.—7. Coal, 6 ft.—8. Slate, thickness unknown.—Dip 4° N. E.

This bed is remarkable for the succession of slate and coal strata; Mill Creek, a considerable stream, flows by, and has laid the bed open one eighth of a mile. At one spot is a beautiful cascade of fifteen or twenty feet; the coal here crosses the stream, and the pitch is from its jetty masses, which form a singular contrast with the foam below.

IX. *Bed of Messrs. Bennet & Miner, four miles east from Wilkesbarre, and one and a half from the Susquehanna River.*

1. Soil.—2. Loose graywacke, alternating with micaceous sand stone and slate, 5 ft.—3. Broken coal, 3 ft.—4. Good coal, 5 ft.—5. Firm slate, thickness unknown.

X. *Baltimore Company's bed, 2½ miles N. E. from Wilkesbarre.*

1. Soil.—2. Loose slate, 15 ft., abounding in vegetable impressions.—3. Slaty coal, 2 ft.—4. Broken coal and slate, 2 ft.—5. Broken coal, 2 ft.—6. Good coal, 8 ft., (now wrought.)—7. Coal of first quality, reserved for blacksmiths, 2 ft., (now wrought.)—8. Coal of same quality, 6 ft.—9. Good coal, 2 ft.—10. Broken coal of inferior quality, 4 ft.—11. Firm slate, with vegetable impressions, thickness not known.—Dip, N. W. about 15°.

This bed yields 35,000 tons per acre: it is supposed, by those who have examined, to appear again on the Lackawanna, 18 miles distant, a bed being opened there, in which the succession, thickness and quality of the strata, are exactly the same.

The Baltimore company, began to work this in August, 1829. The bed is followed into the hill, pillars of coal, being left to support the roof.

XI. *Baltimore company's bed on the Peas' lot, 2½ miles southward from Wilkesbarre.*

1. Soil.—2. Broken slate.—3. Broken coal, 4 in.—4. Slate, 8 in. —5. Good coal, about 16 ft.—6. Firm slate, thickness unknown.

XII. *Mr. Robinson's bed, about 2 miles south from Wilkesbarre.*

1. Soil.—2. Loose slate, 6 ft.—3. Broken coal, 1 ft.—4. Slate, 1 ft.—5. Broken coal, 2 ft.—6. Good coal, 8 ft.—7. Firm slate, thickness unknown.—Dip, N. W.

XIII. *Mr. Blackman's bed 2 miles south from Wilkesbarre.*

1. Soil and loose earth.—2. Loose slate, 4 ft.–3. Broken coal, 2 ft.–4. Good coal, 9 ft.—5. Firm slate, thickness unknown. Dip, 12°. W.

XIV. *Mr. Hurlbert's bed 2 miles south from Wilkesbarre.*

1. Earth.—2. Slate.—3. Broken coal, 15 in.—4. Firm slate, 2 ft.—Good coal, about 12 ft.—6. Firm slate, thickness unknown. Dip, 40° N.

XV. *Gen. Coker's bed* 5 *miles southward from Wilkesbarre, and* 1½ *from the Susquehanna River.*

1. Earth.—2. Fine broken slate.—3. Sandstone, 30 in.—4. Loose slate, 4 ft.—5. Broken coal, 5 in.—6. Very excellent slate, 2 ft.—7. Good coal, 4½ ft.—8. Firm slate, thickness unknown.—Dip, 5° W.

There is a bed of coal, (Mr. Babb's) a furlong to the S. E. which from its dip is supposed to pass under this.

XVI. *Mr. Stiver's bed* 7 *miles south from Wilkesbarre, and* 2½ *from the Susquehanna River.*

1. Soil.—2. Sandstone.—3. Slate.—4. Pretty good coal, 2 ft.—5. Coal of better quality, 4 ft.—6. Good coal, thickness unknown, probably 12 ft.

General Remarks.—It will be seen from the slight notice of the stratification and from reference to the map of the valley, that the quantity of coal is immense. Very few of the beds are yet wrought: in many places they are known only so far as they have been laid open by the rapid mountain streams; we made therefore no attempt at ascertaining the quantity of coal now wrought, as it would do nothing like justice to the resources of the valley.

We could not learn that in any one case attempts had been made to pierce through the firm slate beneath the coal, the inhabitants usually being satisfied with what is above it. In one or two instances they have bored into it three or four feet: the impression generally is that there is no coal beneath, but the truth of this remains yet to be tested.

Until recently it was believed that on the western side of the river, the coal did not extend much more than half way up the Wyoming valley; but it is now discovered within a mile of the gap where the Susquehanna enters and even in the Dial Mountain, which is on the northern side of the gap: a mine was shewn us there by Mr. Robinson, and more are known to exist. On Mr. Shoemaker's land, which is on the north-west side of the valley, we saw five distinct successive beds as we ascended the mountain, and another was reported still higher up.


Map
of the
WYOMING & LACKAWANNA VALLEYS
by Geo. Jones
Principally from a Map Constructed by
Col. JOHN L. BUTLER of WILKESBARRE
Susquehanna River
Lackawanna River
WYOMING VALLEY
LACKAWANNA VALLEY
Wilkesbarre
Kingston
Forty Fort
Fort Durgee
Fort Wintermoot
Pittston
Carbondale
Rail Road
Bloody Rock
Monockonock Island
Dial Mountain
Gap
Falls
Ferry
Rampart Rocks
Solomon's Cr.
Mill Creek
Roaring brook
Abbot's brook
Spring Br
Shin brook
This Valley also abounds in coal but the beds have been opened only in a few spots
Scale of Miles
1 2 3 4 5
The circles with a dot represent Coal beds now exposed
Rail Road from the Coal mine at Carbondale to the Canal on the Lackawaxen River.
H.p. Horse power
S.p. Steam power
S.a. Self acting i.e. the loaded cars as they descend
Coal Bed
Summit Level.
Ascent
Descent
Locomotive Steam engines were formerly used here for the ascending cars, but were found too heavy for the rail way; horses are now employed; no assistance is requisite in the descent.
30000 Ft.
Canal
Whole length 85,264 Feet: Whole elevation 855 Ft. Whole depression 913 Ft

Art. XV.—*Extract from an unpublished Essay upon the compounds of Cyanogen;** *by* Dr. William H. Ellet, of Columbia College, New York.

Cyanuret of Potassium.—When potassium is heated in cyanogen, it inflames and absorbs a portion of the gas whose volume is exactly equal to that of the hydrogen, which the same quantity of the metal would be capable of disengaging from water, and a cyanuret of potassium is formed. This compound is, however, more readily and economically obtained by the process of Robiquet, which consists in exposing the ferro-cyanate of potassa to a long continued heat. This salt, as will be hereafter shown, may be regarded, when in an anhydrous state, as a compound of cyanuret of iron and cyanuret of potassium. At elevated temperatures and in contact with air, the former of these undergoes decomposition, while the latter remains unaltered, but in mixture with carbon, metallic iron and oxide of iron. This is to be dissolved in water, the solution filtered and evaporated to dryness, and the dry mass heated to redness in a silver crucible. It is then, if the operation has been properly conducted, perfectly colorless and free from iron. Exposed to heat, it fuses without decomposition, and when moisture is carefully excluded, may be preserved for any length of time without alteration. When acted on by water, it passes into the state of hydro-cyanate of potassa, and the solution is found to exert upon the animal economy an effect precisely similar to that of the prussic acid; and since it is not liable to spontaneous decomposition, it may be advantageously substituted for that article in the Materia Medica. The constitution of this salt is,

Cyanogen,	-	26=1 atom.
Potassium,	- -	40=1 "
		66 representative number.

The cyanurets of the other alkalies, and of the earths may be obtained by analogous processes, and with that which I have described resemble the iodides, chlorides and bromides, in the change which

* Originally communicated to the Rutgers' Medical Faculty of Geneva College, in April, 1829, and honored by their gold medal. Dr. Ellet has in hand a more extended investigation which may not improbably appear in the course of a few months.

they undergo when exposed to the action of water, being all converted into hydro-cyanates of oxides. These salts possess an alkaline reaction which cannot be overcome by the addition of prussic acid in excess. When their solutions are exposed to the air, they pass gradually into carbonates, an effect which is due in part to the mutual reaction of the elements of the water and of the acid, and in part to the absorption of carbonic acid from the atmosphere. The cyanurets of the alkaline and earthy metals are all to a greater or less degree soluble, while the others being with few exceptions insoluble, may be obtained by adding hydro-cyanate of potassa to any of their saline combinations.

Ferro-cyanic acid.—Mr. Porret obtained this acid by dissolving fifty grains of crystallized ferro-cyanate of potassa, in two drachms of distilled water, and mixing this solution with another of fifty eight grains of tartaric acid in the smallest quantity of alcohol capable of dissolving it. The slightly soluble super-tartrate of potassa was precipitated, and the filtered liquid yielded, by evaporation, crystals of pure ferro-cyanic acid. When newly prepared, these crystals are white or of a pale lemon color, but on exposure to air, they gradually acquire a bluish tint. They are soluble in water and in alcohol, and when the aqueous solution is treated with the peroxide or a per-salt of iron, prussian blue is immediately formed. From the experiments of Porret, he inferred its constitution to be,

Carbon, - - -	24=4	atoms.
Azote, - - -	14=1	"
Iron, - - -	28=1	"
Hydrogen, - - -	1=1	"

A suspicion of inaccuracy in this statement of its composition, would naturally arise from the difference it exhibits between the proportion of the nitrogen and carbon, from that in which they are known to exist in cyanogen; and the more recent experiments of Robiquet have proved satisfactorily that no reliance can be placed upon it. According to this chemist, when the ferro-cyanic acid is heated with great excess of peroxide of copper, carbonic acid and nitrogen are evolved in the proportion of two volumes of the former to one of the latter, and hence the relative quantities of nitrogen and carbon must be necessarily the same as in cyanogen. The memoir of Robiquet is inserted in the Ann. de Chimie, &c. tom. XII, and to it I take the liberty of referring, as containing the most satisfactory information on the subject of this acid. His analysis decides it to consist of

Cyanogen,	- - -	52=2 atoms.
Iron,	- - -	28=1 "
Hydrogen,	- - -	1=1 "
		81 representative numb.

Or supposing the cyanogen to be equally divided between the iron and the hydrogen, we have

Cyanuret of iron,	- -	54=1 atom.
Hydro-cyanic acid,	- -	27=1 "

But since it resembles in many of its properties the hydracids, it may I think be regarded with propriety as a compound of bi-cyanuret of iron (ferro-cyanogen?) and hydrogen.

Ferro-cyanogen,	{ 52 cyanogen, 28 iron, }	80=1 atom.
Hydrogen,	- - -	1=1 "
		81 representative number.

Ferro-cyanate of potassa.—When the hydro-cyanate of potassa, which as before mentioned is strongly alkaline, is placed in contact with protoxide of iron, a portion of the latter substance is dissolved; the solution acquires a yellowish tinge, and though still exhibiting an alkaline reaction, may be now rendered neutral by the addition of hydro-cyanic acid. The filtered solution yields, by evaporation, crystals of ferro-cyanate of potassa. This salt is however most frequently obtained in the laboratory by the decomposition of prussian blue by a boiling solution of caustic potassa. It is obtained in the form of quadrangular crystals of a lemon color; it is destitute of odor, and has a peculiar but not very unpleasant taste. When exposed to a temperature a little below redness it gives off 13 per cent. of water, and if the heat be much elevated and continued with access of air, it is further decomposed, cyanuret of potassium being one of the products. No change is produced in its solution by the addition of the alkalies, of sulphuretted hydrogen, of the alkaline hydro-sulphurets, or of tincture of galls; a fact which affords at least presumptive evidence that the iron it contains does not exist in the state of oxide. Dilute muriatic and sulphuric acids when boiled with it produce an evolution of hydro-cyanic acid, with a precipitation of a white substance, which is probably a proto-ferro-cyanate of iron. When submitted to the agency of voltaic electricity, ferro-cyanic acid appears at the positive, and potassa at the negative pole. It consists of

Ferro-cyanic acid,	cyanogen, 52; iron, 28; hydrogen, 1	81=1 atom.
Potassa, - -	potassium, 40; oxygen, 8	48=1 "
Water, - -	oxygen, 8; hydrogen, 1	9=1 "
		138 representative number.

This salt when exposed to heat gives off, as above stated, 13 per cent. of water, a quantity as nearly as possible equivalent to two proportionals, one of which may be regarded as water of crystallization, and the other as formed by the union of the hydrogen of the acid with the oxygen of the base. The residue contains therefore two atoms of cyanogen, one of iron and one of potassium. Supposing the cyanogen to be equally divided between the metals, it will consist, in the dry state, of

Cyanuret of iron, - - - 26+28=54=1 atom.
Cyanuret of potassium, - - 26+40=66=1 "

As the ferro-cyanate of potassa has lately become an article of commerce, and is extensively employed in some of the arts, it is manufactured on a large scale, by igniting a mixture of animal matter and carbonate of potassa in iron crucibles, until the dense and fetid vapors at first evolved cease to be extricated. The dry mass when cold is dissolved in water, and by repeated solution, filtration and crystallization, the salt is obtained in a state of sufficient purity for the purposes to which it is to be applied.

Per-ferro-cyanate of iron—Prussian blue.—This well known substance was accidentally discovered by Diesbach and Dippel, at Berlin, in the year 1704. The process for obtaining it remained, however, a secret until, in 1724, Woodward published an essay in the Philosophical Transactions, containing an account of its preparation and of many of its properties. The attention of chemists, which was thus directed to its investigation, was entirely unsuccessful, until, in 1752, Macquer pronounced it to be a compound of oxide of iron, with a peculiar coloring principle, which being unable to insulate, he considered as *phlogiston.* So enamored were the chemists of that day with the absurdities of the phlogistic hypothesis, that this opinion was immediately and universally adopted. After a long interval, Guyton and Bergmann suggested, and Scheele succeeded in proving, that this compound is a salt. Since that period it has successively engaged the attention of Berthollet, Prout, Vauquelin, Robiquet and others, and its true character may be now regarded as definitively ascertained.

Pure prussian blue is best obtained by adding ferro-cyanate of potassa to per-muriate of iron, and washing the precipitate with hot water. The intensity of its color is equal to that of indigo. It is insipid, inodorous, and insoluble in water or in alcohol, under ordinary circumstances, though when recently precipitated it communicates a blue color to the former, which cannot be separated by the filter. When heated to the temperature of 400° F. in contact with air, it takes fire and burns; and when distilled in a close retort, it yields hydro-cyanate and carbonate of ammonia, carbonic acid and an inflammable gas, and leaves a residue of minutely divided charcoal and metallic iron, which possesses the properties of a pyrophorus. Concentrated sulphuric acid destroys the color of prussian blue, rendering it nearly white, an effect which must arise from the abstraction of water, since no gas is evolved during the change, no trace of iron can be discovered in the acid when decanted, and the original color is restored by the addition of that liquid. Muriatic acid, in great excess, also affects its color, changing it at first to green and afterwards to yellow; and by the repeated action of large quantities of the acid upon small portions of the salt, M. Robiquet succeeded in completely decomposing, and in obtaining the ferro-cyanic acid in an insulated state.

The constitution of this salt has been the subject of much dispute, but after a diligent experimental investigation, and a comparison of my own with the results of other chemists, I have arrived at the following conclusions.

1. That Prussian blue always contains water, and is indebted to it for its color.

2. That it contains carbon and nitrogen in the same proportion as that in which these elements exist in cyanogen.

3. That it contains iron, one portion of which is in the state of red oxide, and may be separated by muriatic acid, leaving a residue of ferrocyanic acid equal to nearly 72 per cent. of the salt employed.

4. That if *all* the iron which it contains be converted by the action of nitric acid into peroxide, a quantity is obtained whose proportion to that separated from an equal portion by muriatic acid is as 5 to 2.

5. That it is a compound of ferrocyanic acid and peroxide of iron, and like all other salts of the same base, contains 1.5 atoms of acid + 1 atom of base—and

6. That the following is the only constitution which can be reconciled with the above facts:

Atoms.	Atoms.	
1.5 ferrocyanic acid	3 cyanogen,	78
	1.5 iron,	42
	1.5 hydrogen,	1.5
1 peroxide of iron	1 iron,	28
	1.5 oxygen,	12
1 water	1 oxygen,	8
	1 hydrogen,	1
		170.5 representative number.

Argento-cyanic acid.—This name I take the liberty of proposing for the peculiar acid which M. Just Liebig first separated from Howard's fulminating silver, and which he described in the Ann. de Chimie, &c. under the name of 'fulminic acid.' In a subsequent essay, which was the joint production of Liebig and Gay-Lussac, a number of experiments are recorded, which tend to elucidate its ultimate constitution, but do not seem to me capable of justifying the inference that has been drawn from them, that the compound is a supercyanite* of silver. When lime water is poured upon the fulminating compound, decomposition ensues, and oxide of silver is separated. When this has perfectly subsided, the liquid is to be decanted, and on the addition of nitric acid, a white precipitate falls, which is the fulminic or *argento-cyanic acid.* In this process we may substitute for lime water, any of the other alkalies or earths, with the exception of ammonia, which holds the oxide of silver in solution, and gradually gives rise to another well known detonating compound—that discovered by Berthollet.

The argento-cyanic acid is a white powder, slightly soluble in cold, but more so in boiling water, and from either solution it may be obtained in crystals. It reddens litmus, and is capable, as we have already seen, of combining with and neutralizing bases. With potassa and soda it forms crystalline salts, of a disagreeable metallic

* In the essay alluded to, which appeared before Serullas had announced the discovery of the *cyanic acid,* the compound was called a *supercyanate* of silver.

taste, and capable of detonating powerfully when heated or struck. With magnesia two compounds are obtained, one of which is of a rose color, insoluble, and merely decrepitating by heat, while the other is in the form of white capillary crystals, detonating violently by a blow. With baryta and strontia, and with the oxides of zinc, iron, copper and mercury, it also furnishes compounds which are slightly soluble and capable of detonating.

MM. Liebig and Gay Lussac, in support of their hypothetical view of the constitution of this compound, point out an analogy between it and the supertartrates, in all of which the excess of acid may be neutralized by different bases. My reasons for rejecting this opinion, and for believing it belongs to an entirely distinct class of compounds, are—

1. That no one has succeeded in separating cyanous acid, either from the fulminic acid, or from fulminating silver.

2. That the results of the analyses by Liebig, of the fulminates of potassa and soda, cannot be reconciled with the belief, that these salts are triple cyanites.

3. That the striking resemblance in properties, existing between the fulminic and the ferro-cyanic acids, each of which contains a metal as one of its elements, and is capable of combining with the oxide of the same metal, or with the oxides of other metals, forming salts of sparing solubility, exhibits an analogy, hitherto, I believe, unobserved between them, and leads to a suspicion of similarity of constitution. For these and other reasons which will be given under the head of argento-cyanate of silver, and which are founded upon the analysis of that salt, I consider the fulminic acid as a compound of 2 atoms of cyanogen, 1 of silver and 1 of hydrogen, or

Cyanogen,	52=2 atoms,			
Silver,	110=1 "	or,	Cyanuret of silver,	136=1 atom.
Hydrogen,	1=1 "		Hydro-cyanic acid,	27=1 "
	163 representative number.			

Argento-cyanate of Silver.—Fulminating Silver.—This compound was discovered by Mr. Howard; it may be obtained by dissolving 60 grains of silver in half an ounce of nitric acid, sp. gr. 1.52, adding two ounces of alcohol, sp. gr. .850, and heating the mixture gently until the ebullition commences. White flocculi soon appear, and then the heat must be gradually diminished. A copious precipitate, exceeding in weight the metal employed, is obtained, which, when washed and dried, is the detonating salt. It is white, pulverulent, and slightly soluble in water. It is dangerously explosive and detonates with extreme violence, when struck with a hammer, or submitted to friction between hard bodies. The contact of sulphuric acid produces a similar effect. When mixed with forty times its weight of peroxide of copper, it may be exposed to heat without danger of explosion, and is then slowly decomposed, giving off water, carbonic acid and nitrogen, the relative quantities of the two latter being such as to indicate the presence of carbon and nitrogen in the same proportion as in cyanogen. When muriate of potassa is added to a solution of fulminating silver, *one half* of the silver is separated in the form of insoluble chloride, and argento-cyanate of potassa remains in solution. Muriatic acid precipitates *all* the silver. The results of experiments instituted by Liebig and Gay-Lussac, to ascertain the constitution of the salt were by no means constant, but the following is given as the mean.

Silver, - - - -	72.187
Oxygen, - - - -	5.341
Cyanogen, - - - -	17.160
Loss, - - - -	5.312
	100.000

The loss of 5.312 per cent., is attributed by these chemists to oxygen, but certainly without sufficient reason. It is to be remarked that no allowance has been made for the hydrogen which is proved to be present from the water obtained as one of the products of its distillation with peroxide of copper. The only reason for attributing so great a loss to oxygen, appears to be that such a supposition is necessary to confirm a previously formed hypothesis, that the fulminating salt is a cyanite, and the fulminic acid a super-cyanite of silver. Having already alluded to the analogy between the ferro-cyanic and the fulminic acids, I will endeavor to prove that a hypothetical statement of the constitution of fulminating silver founded upon an equally striking analogy between it and prussian blue, is more consistent with the result of the French chemists, than that which they themselves have adopted. Regarding the salt then as an argento-cyanate of silver, and supposing it constituted like the prussian blue, it will contain

Argento-cyanic acid,	2 atoms.	Cyanogen,	52	17.93
	1 "	Silver,	110	37.93
	1 "	Hydrogen,	1	.34
Oxide of silver,	1 "	Silver,	110	37.93
			or per cent.	
	1 "	Oxygen,	8	2.76
Water,	1 "	Oxygen,	8	2.76
	1 "	Hydrogen,	1	.34
			290	99.99

For the purpose of exhibiting more distinctly the coincidence existing between these numbers and those obtained by Liebig and Gay-Lussac, I will arrange them so as to admit of an easy comparison, and place them side by side.

Hypothetical constitution.					*Experimental constitution.*	
	In acid.		In base.			
Silver,	37.93 +	37.93 =		75.86	Silver,	72.187
	In base.		In water.			
Oxygen,	2.76 +	2.76 =		5.52	Oxygen,	5.341
	In acid.					
Cyanogen,	17.93 +	—— =		17.93	Cyanogen,	17.160
	In aeid.		In water.			
Hydrogen,	0.34 +	0.34 =		.68	Loss,	5.312
				99.99		100.000

This coincidence, striking as it is, would be rendered much closer, if the loss of nearly five and a half per cent. in the experiments, were, after making due allowance for the hydrogen undoubtedly present, proportionately divided amongst the other constituents. The hypothetical and experimental numbers would then be nearly identical.

Fulminating silver may therefore be regarded as a compound of one atom of argento-cyanic acid, one atom of oxide of silver, and one of water; or, conceiving the hydrogen of the acid to exist as water in combination with the oxygen of the base, it would consist of

Cyanide of silver, - - 2 atoms.
Water, - - - - 2 "

The fulminating mercury, which is prepared in the same way as the fulminating silver, so closely resembles it in properties that little doubt can be entertained that it is analogous in constitution, although it has not been submitted to ultimate analysis. It may therefore be regarded as a mercurio-cyanate of mercury and the acid which it yields, by a treatment similar to that adopted with the fulminating silver, as the murcurio-cyanic acid.

Art. XVI.—*Notice of an Essay on the Remittent and Intermittent Diseases, including generically Marsh Fevers and Neuralgie; by* John MacCulloch M. D., F. R. S., &c. &c. *Physician in ordinary to His Royal Highness Prince Leopold of Saxe Cobourg.* 8vo. Carey and Lea. Philadelphia, 1830.

Perhaps the accurate sciences have not been more prodigal of benefits in any department of human affairs, than in that of the healing art. Chemistry has developed not only immense resources, but principles, which aid the naturalist in his investigations; and a practitioner at this day is expected to be both a naturalist and a philosopher. He is no longer bound to the formulary of symptoms, and names of disorders, with direction to seek in the pharmacopeia for antagonist medicines wherewith to wage battle with diseases; but science unfolds the curious and complicated arrangement of the animated structure, its modes of operation, and the probable causes of its derangement, enabling the philosophical observer to distinguish and apply appropriate remedies. The aim is sufficiently exalted when the diminution of human suffering is the object, and there cannot be one of more "universal concernment, or of deeper personal interest."

Messrs. Carey and Lea, of Philadelphia, have favored the public with an American edition of Dr. MacCulloch's treatises on Remittent and Intermittent Diseases, a work which, although in some parts obscurely written, contains internal evidence of acute scientific investigation.

If the observations of the author are correct, and if his theory of treatment is adopted, they will form an era in physic as regards fever, equal to the discovery of vaccination. He proceeds, with a severe integrity of purpose, through a philosopical enquiry into the natural history of those diseases, and agreeably to the Baconian rule, of proving every thing by experiment, he asserts nothing without the sanction of evidence; and in every case when the subject admits, he brings forward examples and inductions, tested by his own experience. The point at which he aims more than all others, is to draw attention to that vast class of disorders produced by Malaria, at the head of which is intermitting fever; and to shew, that many which are viewed as distinct and independent diseases, are, in fact, referable to a generic origin; and also that errors of treatment, under mistaken views of the subject, have often proved unfortunate and even fatal.

Some account of the localities and causes of ***Marsh poison*** or ***Malaria*** appeared in this Journal in the No. for Jan. 1830, where many of his opinions respecting its effects were noticed.

In the present work he states that there is no ground of doubt that all fevers of any moment are produced either by contagion or malaria, and that these two leading classes constitute the great mass of fevers throughout the world; those which arise from other causes being few in number, and of very little concern from their trifling power over the body. Remitting and intermitting fever he considers identical, *primarily produced by the application of Malaria to the Nervous System.* He anticipates that the popular idea attached to the term *nervous*, may almost bring contempt upon the subject, as the multitude, and even some physicians, deem the nerves metaphysical entities or *nonentities*, and the word nervous as applied to disease, is understood as meaning something unappreciable by human investigation—the misfortune of a feeble body or a feeble mind, a term applied to weak women, or more cowardly men, a property of the valetudinary and hypochondriacal, a permission of the will—an imagination :—but anatomy cannot forget that the nervous system, forms a bulky, weighty portion of the body, equalling in extent and in intricacy in distribution, the more obvious circulating system, though not yielding blood to the sabre cut, or the lancet. Nor can physiology or physic forget, that it is not the circulating, but the nervous system, which is the prime mover, the cause even of all circulation, of all motion, of life itself, governing and regulating the action of every subordinate part—it is the ulterior structure to which the deity has attached the principle of life, through which the soul of man is enabled to act upon matter and to be affected by it." The position of the brain, and the distribution of the nerves are understood, but of the mode in which they perform their "almost miraculous offices," or of the manner in which their substance is affected by disease, nothing is known; disection discovers no secret analogies in aid of enquiry; yet that they are often deranged and subjected to peculiar and painful diseases, is fully demonstrated in the course of the work. These affections are extensively revealed in Remitting and Intermitting fever, and Neuralgia*.

* Neuralgia is a diseased condition of a portion of a nerve ascertained to be brought on by Malaria, by cold, and by local injuries; regulated by periods of twelve hours or its multiples, with intervals free from obvious disease.

Intermitting fever is an unknown disordered condition of the whole nervous system produced by Malaria; generally though not always united to the neuralgia or local disease; essentially paroxysmal; mysteriously regulated in its returns by a period of twelve hours, multiples, or submultiples, with intervals of ease and tendency to relapses; the pain of the local affection, subsiding and returning with the fever. The brain is always in a greater or less degree affected, and the indescribable restlessness and misery, which are coextensive with the whole frame, are referable to this unknown condition, or disorder of the whole nervous system.

The locally affected nerve, by whatever action it is, that it suffers pain when the fever is present, possesses the power of inducing an excited circulation, or an inflammatory tendency in the neighboring vessels, with increased sensibility and tenderness: proceeding often to a species of active inflammation. These effects will vary according to the nature and offices of the affected parts, and the nerves which supply them. Thus when this *peculiar* inflammation occurs, it may produce pleurisy, rheumatism, gastritis, cholera, opthalmia, or other forms of disease with the same *visible* aspects and symptoms, as when arising from other and opposite causes. In other words, there is an action produced by this condition of the nerves analogous to phlegmasia or ordinary inflammation which is not identical with it, though assuming strictly similar appearances; or if identical *in action*, yet being united to, or caused by the diseased state of the nerves, it becomes of an opposite nature or character, not to be treated as identical without injurious results. It is not ascertained in what manner the nervous system is affected by the agency of Malaria, but a probable conjecture is, that it may be similar to the action of narcotic poisons, because in the warm climates when the symptoms are more marked, the attack often commences with apoplexy or sudden stupor, and the sensations immediately preceding the suspension of intellect, are described as resembling those produced by Hemlock, Nightshade, &c. &c.

Every form of intermittent is marked by a peculiarly impaired state of the nervous energy, but whether this peculiarity is produced by the action of the poison, or whether it is a sequel to its destroying effects, it is doubtless the reason why every reducing medicine, and every kind of debilitating agency are found pernicious, and it is this fact which renders the view taken of it in the present work of such vast importance.

The author has shown in his essay on Malaria, where the cause resides, and the manner in which it may generally be avoided. In the present work he has elucidated as far as the present state of knowledge permits, the operation of this cause, in producing the fundamental disease—then the anomalous symptoms which arise under it—and then *the accessory causes* which may *reproduce* it in endless varieties and relapses—showing that all supervening disorders, modifications and changes take the character of the general disease, and require the same system of treatment. He dwells importunately upon the melancholy delusion occasioned by mistaking such for independent or original forms of disease, thus leading in medical practice to most melancholy and often fatal results. Under these delusive forms, which are chronic varieties of the fever or the sequel of severe fevers, are dyspepsia, rheumatism, head-ach, tooth-ach, visceral affections, and a long catalogue of other complaints; requiring the most acute discrimination to detect the remote influence which controls "the effect of remedies, whether for good or evil." For instance, the treatment in simple intermittent, if injurious, is injurious in all, whether the "simulation" appears as pleurisy, cholera, palsy, or whatever else; and remedies successfully employed in cases of ordinary inflammation, are pernicious, and often ruinous in the peculiar inflammation originating in this specific cause.

Of all remedies, he deems the one pre-eminently injurious in these cases, to be blood-letting. Second to this, cupping, leeches, calomel, blisters, &c. &c. The effects are to reduce and prostrate the patient already laboring under a debility inherent in the complaint, thus increasing the morbid action—inducing a tendency to relapses and rendering disorders chronic and inveterate, even where intervals of relief yield the flattering hope that they are cured. This wrong mode of treatment, if persisted in, often results in fixed diseases of the brain, afflicting nervous symptoms, paralytic affections, fatuity, mania, and death.

A distinguishing mark of this genus, through all its varieties, is the effect produced upon the mind. The mental condition is always affected, and in ordinary cases of fever, the hot stage is often accompanied with anxiety and horror. The sufferer next falls into a state of morbid excitability, "exaggerated views of evil," impatience, caprice, and restless sensations without end. If the disease becomes chronic and of long continuance, especially if the patient is reduced by medicine and bleeding, the intellectual faculties become injured or destroyed, the irritable and sensitive state, gives place to sadness—the mind soon after becomes benumbed; listlessness, and submission, and indifference follow, and idiocy and mania close the scene. In hot climates, the effects are proportionally severe. The attack often commences with apoplexy or frenzy, but the usual progress of the mental disorder, when apoplexy or stupor takes place of the cold fit, is irritability, peevishness, restlessness anxiety, melancholy despair, indifference, idiocy, and death.

In severe cases, Dr. McC. remarks, that the irritability and despair are often such as to stimulate the patient to suicide. "In the intermission of the paroxysm, he will request windows to be screwed down, and edge tools to be kept out of his reach," lest he should comply with the insane desire, when the despairing, angry, and raging state of the fever returns. In some parts of the Mediterranean, when these fevers prevail, *fear* is the predominating symptom—while in fenny tracts in mild climates, despondency and low spirits are concomitants of sluggish visceral affections, and sometimes the only indications of disease. So various are the modifications of symptoms, that in some instances no disease appears to be present, but "a languor and want of alacrity, which in the army has been taken *for shamming* among the soldiers, and treated accordingly; and among the opulent classes, particularly among delicate females, the same symptoms are considered indolence and affectation."

It is the opinion of Dr. M'C. that the severe mental and nervous affections of *mild climates*, are the result of misapplied remedies. Thus if a patient is seized with apoplexy or stupor, and bleeding is resorted to, from an idea of a pressure of blood upon the brain, the consequence is almost inevitably palsy or idiocy, if not sudden death. In cases of ophthalmia, cupping and bleeding are often succeeded by blindness, while successive attacks of remittent and intermittent, treated with calomel, blisters and low diet, terminate in some or all the endless tortures of dyspepsia, nervous affection, headach, melancholy, convulsions, epilepsy and insanity.

In short it appears that almost every form of disease may be elicited by this wide spreading cause; and that whenever disease accompanies that unknown condition of the nervous system produced by Malaria, indicated by periodical returns and an obvious mental affection, however severe, or however slender it may be, yet the effect of remedies will be injurious or beneficial as they are appropriate to the primary cause. It is hence easy to see why palsy should be the sequel of improper treatment, for when any nerve which was the servant to a muscle loses its power, from the effect of intermittent or of neuralgia, combined with reducing remedies, the power of motion also is destroyed, and that is palsy. It may happen without disturbing the circulation in that part, and it is thus that partial and even very extensive palsy takes place without destroying life.

A pained or disturbed condition of a point or portion of a nerve or nerves ("Neuralgia") is in the opinion of the author, often mistaken for a rush of blood to the head, by no means owing to the circulations. To illustrate the consequences of bleeding under this mistake, he cites "the case of a military surgeon who was tormented with headache during the paroxysms, and successive cupping and blood letting brought on fatuity." Another instance, under his own eye, though not under his care, was that of a gentleman of sedentary and studious habits, whose physician prescribed blood letting for severe pain in the head. On the following day the headache increased with confusion of thought and great weakness. A second blood letting then took place, and he became delirious in the night. It was then determined by his physicians that "there was inflammation of the brain, and in addition to blisters, shaving the head, and ice, another blood letting was ordered and practised." The delirium increased, the pulse became feeble, the practice was presevered in, and the following day the patient died.

As a strongly marked instance of the misapplied use of this remedy, he relates the case of "a young man of twenty five in the upper ranks of life who had been subject to repeated attacks of quotidian intermittent in several successive years. In a subsequent and similar attack during my absence, his physician prescribed blood letting within the first days of the disease. No very obvious consequence followed the first operation, but on the second it was remarked that he complained less than he had done, which gave the temptation to a third trial, immediately after which he fell into a state little short of idiotism, while the fever became attended with many anomalous symptoms. Thus I found him just in time to prevent a fourth bleeding which would probably have terminated as I have more than once seen in palsy, epilepsy or death. The disease was cured in the usual way by bark, but the debility of the mind was not removed for six months while I have reason to suspect it may prove much more durable."

Another illustration of the pernicious effects of this mode of treatment deserves a conspicuous place.

In a case of opthalmia occurring with intermittent, Dr. M'C. had almost daily an opportunity of observing the progress of the disease, and the effect of remedies, without being permitted to interfere in the practice, the patient being under the care of an oculist of high reputation. The patient was seized in the first place with regular intermittent, accompanied with pain in the face, and tooth ache, the pains intermitting regularly with the fever. After a short time the pain seized the temple followed by a tolerably severe opthalmia. The quotidian cold stage, the pain in the temple and the contraction of the iris were equally periodical and regular, lasting a determinate number of hours. He explained his views of the case to the oculist, and proposed a method of cure, but his suggestions were not attended to, and from that time he adds, "I could only watch the progress of the case for instruction." "The first effect of local bleeding, blistering and topical applications, was a great increase of inflammation, and as the same means were continued and repeated, the disorder became daily more severe, while the local pain increasing in severity and extent, and the intermittent becoming much more strongly marked, it was declared that there was a flow of blood to the head. General blood letting from a vein, together with that from the temporal artery was therefore adopted and repeated, while after a certain progress in this practice, aided by more topical remedies, more purging and more low diet, the patient became so ill as to be unable to attend the occulist, and was sent to the hospital. These operations occupied about two months. After this I was cut off from seeing him, but I ascertained that he was laboring under an inveterate quotidian intermittent with a pain (neuralgia) in the temple which left him no repose, extreme debility, with nervous affections, and a partial fatuity, while the inflammation was such as to extend to the bottom of the eye, from the effect of the excessive and constant pain, and total blindness had resulted on that side from the closing of the iris. In the hospital all this justified more bleeding, and more of every thing which had already proved so injurious, while the disease persevered without alteration except for the worse during three months, when the gradually increasing fatuity became a mania, and the patient attempted to destroy himself by cutting his throat. The attempt was unsuccessful, and after the wound was healed he was sent home to be transferred to the lunatic asylum. During this interval I was enabled for a week or more to see him daily. He was then in a state of melancholy fatuity, rather than proper mania—the inflammation continued with occasional head ache, apparently of great severity, and still periodical, though the state of the intellect prevented any very accurate information. What was done in the lunatic hospital I could never discover, but in about two months he died, as I understood from his wife, with his eye still in the same condition.

It seems probable that the condition of the brain and nervous system from the effect of Malaria, induces an undue action, and a painful sensitiveness, upon the whole circulating system, which is fever, and which is in some degree analogous to the action of a diseased (neuralgia) nerve in producing the specific inflammation belonging to this class of diseases. Under this fundamental derangement of the master part of the machinery, to which all the others are inherently subordinate; any morbid condition of those parts is secondary though implicated with it; and whether coexistent with the febrile action, or supervening upon it, these secondary disorders become identical with the deranged or troubled state of the moving power. With the agitation or fever there is a loss of the nervous energy, and so interwoven and so mutually dependent are all the parts of the animated structure so harmoniously and curiously blended, that every part sympathizes with every other. If then the nervous power is diminished and a series of pains and agitations ensues, the pernicious effect of debilitating treatment is obvious; increasing the disorder it designs to cure; opening new avenues in the enfeebled system for the accession of other and greater derangements; not unfrequently terminating in those awful results appalling to the stoutest heart, and from which there is no escape but through the final agony of death.

The cause of the periodical phenomena has hitherto eluded the most inquisitive scrutiny. It seems to be a compliance on the part of the nervous system with a mysterious routine, regulated by an arithmetical ratio; but why twelve, or its multiples or submultiples should be the rule in preference to any other number, is a secret which the most sagacious enquirer has been unable to penetrate. The fact, that punctured and otherwise injured nerves are periodically affected when fever is not frequent, suggests the probability that the cause is to be sought for in some of the occult faculties of the nervous system.

The prosecution of this enquiry discloses a claim which society has upon landed proprietors to unite in the necessary exertions, to prevent as far as possible the origin of that pestilential agent which produces so many forms of mortal disease. It is unnecessary to repeat the methods for reclaiming wet lands, and rendering unhealthy districts salubrious, and motives need not be urged upon men, themselves exposed to the effects.

If there are in the medical faculty, any who have overlooked the causes and consequences of these forms of disease, or who have not suspected them, and who have had under other rules of practice, the unhappiness to find their best efforts unsuccessful; if they perceive the views and reasonings contained in the present work, shedding light upon a difficult department of their professsional duties; it is not too much to anticipate, that this terrific and wide spread class of evils may be alleviated, and cured by the aid of science and sound reasoning, and a sagacious practice of the healing art.

New York, June, 1830.

Art. XVII.—*Analysis of the Clinton Mineral Water, Cliff Street, City of New York; by* George Chilton.

A. One gallon of the water left by slow evaporation 166 grains, dried in a steam heat of 212° Fah. Of these, cold distilled water dissolved 86.5 grains, and left on the filter 79.5 grains, consisting of carbonates, &c.

B. The dry residue, left by evaporating the above watery solution, was treated with alcohol, which left 91.5 grains on the filter, consisting of salt, &c. soluble in water.

C. *a.* The matter taken up by the alcohol, after distillation to dryness, redissolved in cold water, with the exception of a little colored matter; this being separated, the solution was treated with carbonate of soda, and after boiling, filtering, &c. carbonate of magnesia was obtained, which was reduced by heat in a platinum capsule to .8 grains magnesia.

b. The remaining fluid, neutralized by nitric acid, and treated with nitrate of silver, gave 18 grains chloride, containing 4.43 grains of chlorine, of which only 1.44 grains belong to the magnesium in the above 8 grains of magnesia; the remaining 2.99 grains must have belonged to common salt taken up by the alcohol, as no other salt was present, and by adding to it its equivalent of sodium, 1.99

grains, we have 4.98 grains chloride of sodium, and 1.92 grains chloride of magnesium, with a little coloring matter as the constituent of the alcoholic solutions.

D. Examination of the carbonates, &c. Cold dilute muriatic acid was added to the 79.5 grains, (process A.) The whole was dissolved with effervescence except 2.25 grains of colored matter, which ignition reduced to .5 grains. This was further decomposed into 0.25 grains of sulphate of lime, 0.20 grains of silica, and 0.05 grains oxide of iron.

E. To the muriatic solution of the last process (D,) ammonia was added till a little oxide of iron with a very little magnesia fell; these being separated, carbonate of ammonia threw down 32 grains of carbonate of lime of a yellowish cast. They were redissolved in nitric acid, boiled, and treated with ammonia; oxide of iron with a little magnesia was precipitated; the remaining solution, with carbonate of soda, yielded carbonate of lime, 29.5 grains perfectly white.

The oxide of iron and magnesia which fell in this process were contaminated with a little extractive matter, which burned off during ignition; the remainder, 2 grains, consisted of ½ a grain magnesia, and 1½ oxide of iron.

F. The muriatic solution (of D and E,) from which the 32 grains of carbonate of lime were obtained, was treated with phosphate of soda. Phosphate of ammonia and magnesia subsided in small crystals, which, reduced by heat to the state of phosphate, gave 38.5 grains, equivalent to 33.7 grains of carbonate of magnesia.

Examination of the salts, &c. insoluble in alcohol, (B.)

G. Cold water added to the 91.5 grains, (left in process B,) produced a brownish solution, which left on the filter a little colored matter. It was evaporated to dryness; on redissolving and filtering, another colored portion was obtained. By repeating the evaporation, solution, &c. the fluid became nearly colorless, when it was divided into two equal parts by weight.

a. The first half of the solution was treated with acetate of baryta; the resulting sulphate, after being ignited, weighed 7 grains. The remaining fluid was reduced by evaporation to a dry mass, which, after ignition, was washed to separate soluble salts. The insoluble remainder was then digested in dilute sulphuric acid, which took up magnesia, and left 1 grain sulphate of baryta, (formed from the excess of acetate.) The sulphate of magnesia which crystallized from the solution and was rendered anhydrous by heat, weighed 3 grains, consisting of 2 grains of acid and 1 grain of magnesia. Now, the 7 grains of sulphate of baryta obtained as above, contain 2.38 grains of sulphuric acid, two of which belong to the one grain of magnesia, and the remaining 0.38 grains belong to its equivalent 2.35 grains of soda, forming 2.73 grains sulphate of soda. These quantities doubled, give sulphate of magnesia, 6 grains, and sulphate of soda, 5.46 grains.

b. The second half of the solution was neutralized with nitric acid, and treated with sulphate of silver; the resulting chloride heated to semi-fusion, weighed 64 grains, equivalent to 26.3 chloride of sodium, which doubled, gives 52.6 grains for the gallon of water.

Separation of carbonate of potassa.

H. The residuum from the evaporation of one gallon of the fresh water, was repeatedly washed with small portions of water. Tartaric acid threw down crystals of bi-tartrate of potassa, which, when reduced to the state of carbonate by heat, weighed 3 grains.

Separation of carbonate of ammonia.

I. A pint of the fresh water was submitted to distillation in a glass retort furnished with a large receiver; to the fluid that passed over, muriatic acid was added to saturation, the crystallized muriatic resulting, weighed .9 grains, nearly equivalent to about 5 grains of carbonate of ammonia for the gallon.

K. To obtain the gaseous matter, 14 oz. of the fresh water, filling a mattress with a small bent neck, were boiled till no more gas came over. 8 cubic inches were received over mercury, 7.6 of which were absorbed by caustic potassa, passed up into the receiver for the purpose. The remainder, exposed to the action of sulphuret of lime, was reduced one fifth. A similar residue, in another experiment, detonated strongly with hydrogen in a Volta's tube; leaving no doubt of its being atmospheric air.

Supposing the gallon to weigh 128 ounces, we have

14 : 128 : : 7.5 : 68.57 cub. inches of carbonic acid, and
14 : 128 : : .5 : 4.57 do. atmospheric air.

From these experiments we have, for the gallon of mineral water,

	Grains.
Carbonate of ammonia, - - -	5.00
Carbonate of lime, - - - -	29.50
Carbonate of magnesia, (F,) 33.7+1 gr. (E,)	34.70
Carbonate of potassa, - - - -	3.00
Chloride of magnesium, - - -	1.92
Chloride of sodium, (C, *b*,) 4.98 grs. +52.6 grs. (G, *b*,)	57.58
Sulphate of magnesia, - - - -	6.00
Sulphate of soda, - - - - -	5.46
Sulphate of lime, - - - -	0.25
Silica, - - - - - -	0.20
Oxide of Iron, (D,) (F,) - - -	1.55
Extractive matter, - - - - -	5.
	150.16

Gaseous matter.

	Cub. In.
Carbonic acid, - - - -	68.57
Atmospheric air, - - - -	4.57
	73.14

Art. XVIII.—*On* the Vegetation of the Ottawa and some of its Tributaries (L. Canada.); by* Prof. A. Benedict.

Although the vegetation of North America is as diversified as its soil and climate, yet perhaps no one of its subdivisions exhibits a

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Hyde Park, May 20, 1830.

* To the editor.—*Dear Sir,* I send you a short paper *on the vegetation of the Ottawa and some of its tributary waters,* which I hastily drew up and read before the Coll. of Nat. Hist. in the University of Vermont," from notes and memoranda made, whilst botanizing along its bank in the summer of 1827. Although in botany my collections embraced every thing I could find, with date of flowering, &c. yet as most of the indigenous plants of that district are also found in the United States, and many of those which are not, are carefully described and duly credited in the useful works of Prof. Eaton, and Torrey; I have therefore at present only noticed such genera and species of plants as will, perhaps, best illustrate the general features of the vegetation of the country, leaving a catalogue of all those I found there, to some future day, when leisure and opportunity will have enabled me, to settle the character of such as are to me, at present, doubtful.

greater variety of these, and other circumstances which affect the vegetable world, than the province of Lower Canada. Its climate seems to be but little else than a succession of anomalies in the extremes of heat and cold,* wet and dry; whilst every description of soil is found, from the best to the worst—in some situations covered with perennial snows; in others the noxious exhalations and vapors of the Atlantic are condensed upon its unfruitful surface, while yet other portions, more favorably situated, enjoy a milder climate comparatively secure from the blasting winds of its northern seas. Under the influence of these causes, the vegetable productions of the Province are in some districts rich and luxuriant while in others less favorably located, they are sickly and dwarfish. In its regions of perpetual frost, it is natural to conclude, that the vegetable kingdom is narrowed down to a few Lichens, hardy Ferns and stunted forest trees. Upon the Labrador coast and the broken land bordering on the Gulf of St. Lawrence, vegetation is only thinly scattered over the bleak and rugged hills, compared with which the western valleys of the St. Lawrence and Ottawa exhibit a vegetation of a new and interesting character, a change that is not confined to their cultivated lands, but is found also in the indigenous plants of their native forests.

How far the geological formations of the Ottawa region may affect its vegetation, whether considered as only furnishing a substratum for its soil, or in reference to its future disintegration it is doubtless impossible to determine,† but as by far the greatest portion of its extensive territory has never yet been reduced to a state of cultivation

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* According to Joseph Bouchette, in his geographical history of L. Canada, the range of Fahrenheit's thermometer in summer is between 81 and 102, and though in winter it sometimes sinks to — 31; yet this is unusual and the cold is generally indicated between — 20 and — 25.

† Almost the whole course of the Ottawa river seems to be through the transition and secondary formation which rest in the great basin of the primitive rocks, formed by the range that runs in the north eastern direction from this state into Canada crossing the St. Lawrence at the thousand islands, making an angle of 80° or 90° with the chain that stretches across the province in an eastern direction from the sources of the Ottawa, north of Lake Huron towards the coasts of Labrador, separating the northern lakes Mitissing, Abittibe, &c. whose waters flow into James's Bay, from the lakes and rivers that discharge themselves into the St. Lawrence through the St. Maurice and Saguenay. Besides the usual alluvial formations, that class of Detritus termed by Prof. Eaton in his geological nomenclature, ultimate diluvion frequently is seen, particularly in the high lands near "rivière de Lagrasse" and "Lac de la Chaudière."

or even robbed of its forests, it is not probable that the fertility of its soil has not even yet been much affected by the disintegration of its rocks, but is rather indebted to the adventitious circumstances, of the vegetable mould, which its forests have been depositing for ages, and the alluvial wash of its floods and tributary streams, which, when charged with sufficient moisture and subject to the warm temperature of the first summer months, is highly favorable to the germination and vegetation of plants, and so rapid is the transition from the cold and desolation of a Canadian winter to the mild, agreeable weather of May, that scarce any period may be called spring, that is unaccompanied by appearances of vegetation; for no sooner are the rains over, which, with the dissolving snow have swept the ice from the rivers, than signs of vegetation begin to appear; even in the last days of April, the beautiful plants *Hepatica* and *Sanguinaria*, which seem to have crept from the earth, are seen basking their delicate flowers in the sun, whilst the snow has scarcely disappeared from the bottom of the ravine. Vegetation may not however be said to have fairly commenced before the second or third week of May, when every tree, bush and plant seems pushing forward in the race of vegetable life, as if conscious of the short period allotted to the renovation of their existence. An ordinary share of exertion will discover to the botanist, that the valleys of the Ottawa are not less rich and luxuriant in vegetable beauty than those of the Mohawk, the Hudson, or other rivers of the eastern or middle states,—he will find himself surrounded by hundreds of plants with the same habit of soil and location, with which they are found in the Northern States.* Several species of the different genera *Corydalis*, *Convallaria*, *Uvularia* and *Trillium* are among the first in the flowering of May, the T. grandiflorum of the latter in its greatest perfection of character, whitening acres with its beautiful flower, while as the season

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* After my return from visiting the north eastern part of the province on the coast of Labrador, and the north western, in the direction of the Ottawa river, I was requested by the president of the Col. of Nat. Hist. U. C. to look over and give a general classification to the plants collected by the late Prof. Hall. His collection was the result of years of persevering industry, to which he added great minuteness in the descriptions of their habit, location and time of flowering. Although it embraced a vast mass of rubbish, and many of its most interesting things had not escaped the ravages of insects, yet it was still valuable, and I was surprised to observe so many families of plants found about lake Champlain, coinciding in appearance, habit and location with those I found about *Lac de deux montagnes*, and the high land south east of L. Chat.

advances the numerous families of herbaceous plants make their appearance in rapid succession. The species arietinum, pubescens, humile and spectabile of the admired *Cypripedium*, are found on the banks of the "Rivière du nord" and "R. de la petite nation," the Kalmia and Sarracenia in the swamps bordering upon "*Lac de la Chaudière*" and L. Chat. But as we go still farther west many of these more delicate plants are not found, the dark and thick forest of evergreens which stretch off towards Lake Nipissing, filled with the rubbish of decaying trees, which have been accumulating for ages, with the dense underbrush of hardy shrubs, afford but little chance for those plants accustomed to the light and heat of more open forests; yet still they are far from being destitute of interest, aside from their external characters; among the ancient forests of the north west, which remain untouched by the axe, and their solitudes undisturbed except by their native inhabitants, vegetation appears as it probably has appeared ever since the deluge; no straggling foreign plant or naturalized exotic is ever found vegetating there; different species of Betula, Xylosteum, Lonicera,* &c. are intermingled in the never ending forest of Norway pines, whilst a variety of Fungi, Ferns and Mosses are the more humble occupants of these gloomy shades.

Art. XIX.—*Notice of Piperin; by* T. G. Clemson, Member of the Royal School of Mines.

TO PROFESSOR SILLIMAN.

Paris, Jan. 12th, 1830.

Sir—Whilst occupied in Mr. Robiquet's Laboratory, I had occasion to prepare, for the demands of commerce, more than usually large quantities of Piperin:—I have frequently treated an hundred pounds of piper nigrum at a single digestion.—Thus I had an opportunity of examining the substance, and rectifying certain representations respecting its properties, and I think that the following additions cannot but be of utility to those persons who may have occasion to prepare the substance.

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* A specimen of the beautiful species of Lonicera found by the lamented Pursh near the Red river is now growing in the garden of Wm. Teasdel, Esq. of St. Andrews; it is a splendid plant. Mr. Teasdel botanized considerably with Pursh and towards the unhappy close of his life, rendered him all the comfort and assistance in his power. His useful collections are lost.

After the analysis given by Mr. Peletier piper nigrum, contains a crystallizable substance (piperin) an acrid concrete oil, a volatile balsamic oil, a gummy colored matter, an extractive principle, malic and tartaric acids, amidon, bassorine, lignin and incidental salts.

By following the methods of preparation heretofore given, I have never succeeded without great pains in separating that acrid resino-oleaginous compound so extremely embarrassing in the course of the purification.

It is evident from inspection that the greater part of the coloring matter exists in the outer pellicle of the grain ; all attempts to make the separation by mechanical or other means proved fruitless and recourse to pulverization was found necessary.

The pepper should be ground, and digested in alcohol at 37° or 40° (Baumé) at a smart distilling heat, an alembic with its water-bath is at once convenient and economical ; the whole should be agitated from time to time, and the fluid changed if necessary. I know of no better indication of the entire extraction of the Piperin, than the want of taste in the mark, or insoluble residue ; although acridity (as has been represented,) is by no means a property of piperin. The alcoholic solutions being united should be reduced over a water-bath. The distillation ended, there will be found in the bottom of the alembic, a deposit composed of a great deal of piperin, and a black acrid resino-oleaginous substance ; the separation of this latter compound from the piperin is difficult in the extreme, so much so that I have seldom or never seen the preparation free from acridity, which not only destroys, but produces a contrary effect to that desired when employed as a remedy. The greater part of this viscous oil may be separated by cold alcohol, piperin being much less soluble in this menstruum when cold, than when warm and much less than the oil.— The latter portion may be entirely separated by the addition of a little lime to the warm solution of piperin with the oil, and leaving it to crystallize in the same vase, which when cold may be separated at leisure, redissolving the crystals thus procured with addition of a little animal charcoal, and filtering when hot, which upon cooling will afford crystals of a canary white, regular and free from acridity.

Mr. Pontel has advised the use of caustic potash, and the effect is certainly very marked. The solution should be weak, for caustic Potash has a tendency to alter the nature of the substance, and instead of procuring piperin, I once found a compound that resembled very much that of soap, and all subsequent attempts to procure the substance in crystals failed; moreover I have always observed, that those crystals obtained by the aid of potassa had more or less of a reddish tinge, and were very brittle.

Piperin, when pure, crystallizes in right square prisms occasionally presenting an anomaly, the crystals, particularly those obtained through the means of potassa, being hollow, or containing and interior decrement, the four vertical sides being entire and shewing the form of the crystal. Insoluble in water, soluble in cold alcohol and more so when warm, insoluble in acetic or other acids. It has been employed latterly in Italy as a febrifuge.

If you think the above worthy of being made public, will you have the goodness to give it a place in the next number of your excellent Journal of Science and Arts.

Art. XX.—*An account of Depositions of Calcareous Tufa, at Chitteningo, Madison County, N. York; by* Edward Sanford, Professor of the Natural Sciences in the Polytechnic School at that place.

The fact of their being a petrified tree in the north east part of this village, has long been known to the public, as well as to scientific travellers; and it has also been noticed in some publications. But I believe the general impression among all who are not intimately acquainted with the Geology and Mineralogy of this district, is, that the calcareous matter took the place of the vegetable fibres, in the trunk of this tree, many years ago, and that since that time the depositions have been discontinued. The petrified trunk of this tree may have been in the first place, twelve or fifteen feet in length; but it has been so long resorted to, for the purpose of obtaining specimens, that it has nearly all been removed; and what now remains, is so situated, that good pieces can be separated only with much difficulty. For the purpose of correcting the impression, that there are no similar depositions in this immediate vicinity, and of pointing the mineralogist to the best places, for obtaining specimens, I make the following statements. The rock which constitutes the frame work of the hill, on the east side of this village on the sides and around the base of which, the petrifactions are found, is called calciferous slate, in Prof. Eaton's arrangement of the Canal rocks, and is composed principally of quartzose sand, lime, and clay slate. Most specimens of the rock will effervesce on the application of muriatic acid. This rock in the hill, is no where left exposed by nature, but is covered to a considerable depth, in most parts, with a diluvial deposit. On the west, and south west sides, are several small springs, the waters of which are highly charged with carbonate of lime, and on their arriving at the surface, this carbonate is deposited forming pseudomorphoses, as various as the vegetable substances, which lie in their vicinity. As fast as the wood, leaves, and moss, in contact with these waters decay, the place of the vegetable matter is supplied by the carbonate of lime, and the deposition is so constant, that the minutest veins of the leaves, are to be seen in the petrified mass. On these two sides of the hill, moss may be found in abundance, in all states, from the hard stony substitution, to the green fruit-bearing plant. All these varieties may be procured in pieces, not larger than ordinary hand specimens. Wood may be found, with some of the vegetable fibres flexible and elastic, and but slightly impregnated with calcareous matter; while the contiguous parts of the same piece presenting with perfect distinctness, the course and turnings of the cortical layers, are as hard as the rock of the hill. The petrified trunks of trees, are in an inclined position, on the sides of the hill, and generally near its base. The trunk which has been principally resorted to for specimens, is situated (as before stated) near the stage road north east of the villiage and immediately on the right bank of the Branch Canal. Round the hill to the south of this, many trunks are found in a similar state and presenting specimens equally perfect. At the base of the hill immediately east of the seminary, thirty rods distant, and about the same distance south east of Mr. Livingston's Stage House, are found vast quantities of tufa, embracing all the varieties before mentioned except the petrified leaves, which though found in small pieces here, are more perfectly petrified, at a small spring on the south west part of the hill, and about fifty rods distant, from the last mentioned place. On these, hitherto little visited parts of the hill, may be found an unlimited supply of vegetable petrifactions; and I trust it is only necessary to point out the places where they may be procured, to cause them to be resorted to, not only by the practical mineralogist, but, by the general traveller. The fact that depositions are daily taking place and the contiguity of the location to the stage house, must cause all those who are disposed to combine instruction with pleasure to pause a moment and view these curious and interesting changes. The siliceous carbonate of lime, from which hydraulic cement is extensively mannfactured in this village, is found in the calciferous slate, and a quarry is wrought one mile west, on the turnpike leading to Manlius square. On the same hill, and near the quarry, the indurated marl is found in considerable quantity; specimens of the lime rock from which the cement is manufactured can usually be obtained at the mill of the cement company in this village.

Chiteningo, N. Y. April 9, 1830.

MISCELLANIES.

(DOMESTIC AND FOREIGN.)

1. *Note on Cardamine rotundifolia, by Wm. Darlington, M. D.*

West-Chester, Penn. May 29, 1830.

In looking over Prof. Hooker's new and magnificent work, entitled "Flora Boreali-Americana, or the Botany of the Northern parts of British America," part 1, page 44, my attention was arrested by the following remark.—"*My valued friend Dr. Boot has ascertained that the Arabis rhomboidea of Persoon is the same as the Cardamine rotundifolia of Michaux.*"

I was the more impressed by the observation, coming, at this time of day, from such high authority as Professor Hooker, inasmuch as I thought *I* had "*ascertained,*" several years ago, that the said plants were decidedly and undoubtedly *distinct.* The Arabis rhomboidea, of Persoon, (which Professor De Candolle has very properly, I think, transferred to the *genus* Cardamine,) is quite a common plant, in this vicinity. I have been well acquainted with it for twenty five years. Until 1819, I was induced, by the doubts of Muhlenberg, Nuttall, and others, to suppose that it *might* be the Cardamine rotundifolia, of Michaux: But in that year, I detected, near the Brandywine, a few specimens of a plant so different, in habit, from the Arabis, and agreeing so exactly with Michaux's Cardamine rotundifolia, that I no longer hesitated in believing them to be distinct species. I submitted the evidences of my belief to an experienced botanical friend, who acknowledged the probable correctness of my conclusion; but who, nevertheless, *ex abundanti cautelâ,* as the lawyers say, declined giving a *decided* opinion.

I also sent a specimen to Professor De Candolle, at Geneva: who, in the second volume of his *Systema Naturale*, has unequivocally recognised it, as being *identical* with Michaux's Cardamine. I should observe, that I forwarded specimens of Persoon's Arabis, along with it, at the same time expressing my views, and soliciting a comparison. That learned and indefatigable Professor could scarcely be mistaken in the matter: because he had carefully examined Michaux's Herbarium, and had there seen the very plant in question.

In 1825, I was fortunate enough to come across a locality, (a cold, shaded, muddy spring,) where this Cardamine was quite abundant. Being under the impression that there were still doubts entertained by some of our Botanists, concerning the plant, I presented a few specimens to the Philadelphia Academy of Natural Sciences, accompanied by a note, stating that its character, as a distinct species, seemed to have been questioned by respectable authority: particularly by Muhlenberg, Nuttall, and Elliott; but that I believed we now had the means of removing all doubt and uncertainty. A committee was appointed on the subject,—who, in a report dated Aug. 20, 1825, (but not published,) say, they " find on due examination, that they (the specimens) do accord with Michaux's description and appear distinct from the Arabis bulbosa of Muhlenberg, the last identical with A. rhomboidea, Pursh."

After citing Michaux's description, they add, " The committee are not aware that the existence of the Cardamine rotundifolia of Michaux was ever denied. His description coming so near bulbosa, or rhomboidea, led Muhlenberg to his usual word *confer* (compare,) and Pursh to use the synonym with a question.* But Dr. Bigelow in the second edition of the Florula Bostoniensis has introduced Cardamine rotundifolia as found on the mountains of New Hampshire; and his description accords well with Michaux's. Still he offers it with a question; because without comparison with Michuax's specimens, which are in possession of M. des Fontaines at Paris, absolute certainty cannot be counted on."

On the foregoing extract I would remark, that I am not aware, myself, that *the existence* of C. rotundifolia was ever denied; but it is very palpable, I think, from the notes of doubt, and interrogation,

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* I do not find, by my copy of *Pursh*, that he does " use the synonym with a question." On the contrary, the two plants are given by him as being entirely distinct, and without any reference from one to the other.

used by Muhlenberg, Nuttall, Elliott, and Bigelow, that some of our most distinguished Botanists did question whether it was really *distinct* from Persoon's Arabis rhomboidea : and it was simply to determine the fact, conclusively, that my specimens were presented to the Academy.

I have already mentioned that Prof. De Candolle had satisfied himself, by an actual examination of Michaux's Herbarium : and I may add that his descriptions of the two plants, in his *Systema*, can scarcely be improved. Their distinct character has also been expressly recognised by my friend, Prof. Torrey, whose botanical acumen has rarely if ever been surpassed, in our country. Under these circumstances, I confess, I was surprised, when I saw so eminent and accomplised a Botanist as Professor Hooker, declaring, at this late day, that the aforesaid plants had been "ascertained" to be "*the same!*" It seems extraordinary, to me, that there should yet be so much confusion, and such conflicting opinions on a point so easily settled : and I can account for it only by supposing that those gentlemen who confound the two species together, have never, in fact, met with the *genuine* Cardamine rotundifolia, of Michaux.

I will conclude these remarks by presenting, in contrast, the prominent characteristics of the two plants, as I have observed them for several years past.

Arabis Rhomboidea, *Persoon*, *Cardamine rhomboidea.* DC.

Root *tuberous*, with comparatively few fibres,—warmly acrid.

Stem *erect;* mostly simple, except when wounded or broken off, in which case a branch or two will succeed the injury.

Leaves, the radical ones roundish, on long petioles, proceeding from the tuber ; lower stem-leaves rhomboid ovate, on short petioles ; upper leaves *sessile*, lance oblong, and somewhat *incisely* toothed.

Flowers, with *large* and conspicuous white corollas, fully equal in size to those of *Cardamine pratensis*, of Europe.

The plant, after maturing its fruit, speedily withers and disappears. After the first week in June, it is difficult to find a vestige of it.

Cardamine Rotundifolia, Mx.

Root constantly *fibrous*, fibres numerous,—sapor inconsiderable, bitterish.

Stem weak and soon becomes *procumbent*, sending out slender branches from the axils of the leaves, especially after flowering ; which branches are clothed with small, orbicular leaves.

Leaves *all petiolate*, suborbicular,* obsoletely or obtuse repand, dentate, and gradually diminishing in size, but preserving nearly the same form, to the ends of the branches.

Flowers *small;* the corollas not half the size of those of the rhomboidea, and comparatively inconspicuous.

The plant continues to extend its slender branches, fresh and green, nearly all summer. They usually lie prostrate on the mud, and often *strike root*, after the manner of creeping, or radicating stems; a circumstance, I venture to say, never observed in the other species. Sometimes a young shoot, or proliferous stem, starts from the end of the raceme of siliques, after the fruit is full grown.

The foregoing discriminating features of the plants in question will probably be deemed sufficient; and are submitted with considerable confidence in their accuracy. W. D.

To the Editor of the American Journal of Science.

2. *On Xanthite and its crystalline form, with a notice of Mineral Localities; by Lt. W. W. Mather, Assistant Prof. of Chem. and Min. U. S. M. A.*—Xanthite has been described as a new mineral species by Dr. Thomson, from its chemical and some of its physical characters.† I have now the pleasure to state, that it also differs in its crystallographical characters, from any mineral species hitherto described. Dr. Thomson describes it as a mineral of "a light grayish yellow color, consisting of a congeries of very small rounded grains, easily separable from each other, and not larger than small grains of sand. These grains are translucent, and some of them indeed transparent. The lustre of the transparent grains is splendent; that of the translucent grains shining. The lustre is inclining to resinous. The grains are rounded, but when examined with the microscope, they seem to consist of imperfect crystals. The texture before a powerful magnifier seems foliated; but the grains are so small, that it is not easy to make out its true texture with accuracy. Specific gravity, 3.201.

"Easily crushed to powder by the nail of the finger. It is therefore soft. It does not scratch calcareous spar. Infusible before the blowpipe per se. Nor did it fuse along with carbonate of soda."

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* I have occasionally noticed, at the base of the larger, lower leaves, a pair of *lobes*, exhibiting an effort as it were to form *pinnatifid* leaves.

† Ann. of the Lyc. of Nat. Hist. of New York, for April, 1828.

Dr. Thomson found the constitutents to be

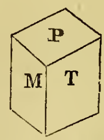
Silica, - - - - -	32.708
Lime, - - - - - -	36.308
Alumina, - - - - -	12.280
Peroxide of iron, - - - -	12.000
Protoxide of manganese, - -	3.680
Water, - - - - - -	0.600
	97.576

and he considers it as essentially composed of 2 atoms of silicate of lime, and 1 atom of silicate of alumina.

I have found the xanthite at Amity, Orange county, N. Y. in laminated masses in the same rock in which it is disseminated in grains. These masses are very frangible, crumbling readily into grains, some of which can be cleaved into prisms of perhaps $\frac{1}{20}$ of an inch in their lineal dimensions. The laminated masses when held to the light exhibit very plainly by reflection, the directions of the cleavage planes. It exhibits double refraction when a candle is viewed through a thin plate of it, by placing it over a fine hole pierced in a card. It can be fused in small particles on a fine slip of platinum foil by the common blowpipe. When in fusion it intumesces, and gives a greenish translucent bead, slightly attractable by the magnet. With borax it gives a glass, yellow when hot, but colorless when cold.

The cleavages are parallel to the sides of a doubly oblique prism, which is probably its primary form, as no other system of cleavage planes, could be obtained. The reflective goniometer gave for the angles

P on M - - - -	97° 30′
P on T - - - -	94 00
M on T - - - -	107 30



The planes M and T were not sufficiently brilliant to give the angles exactly; but it is presumed that the variation is not very great.

Localities of Minerals.

Westerly, R. I.—Iron sand on the beach, two miles S. E. of Stonington Point. Carnelian, jasper, a chlorite near the same place.

Sulphurets of iron (pyrites) in small but very perfect cubes, in the fine quarried graywacke at the quarries S. E. of Fort Adams. Jasper, very fine, at one of the quarries near Fort Adams.

Ashford, Conn.—Black tourmaline, abundant in the granite in Eastford. Cyanite in gneiss and detached masses, the bladed crystals sometimes a foot in length, in a part of Ashford called locally Pilfershire, on a cross road from Abington to Eastford.

Canterbury, Conn.—Precious garnets, more or less perfectly crystallized, in granite. Some of them are nearly an inch in diameter, and of a beautiful amethystine color. They are in loose blocks of granite that have been blasted from the road, about three miles from Canterbury village, on the road to Norwich.

Brooklyn, Conn.—Epidote, crystallized and compact in gneiss; chlorite, specular oxide of iron, associated with epidote in thin veins, in gneiss, common. Precious garnets, small, but very beautiful, in a fine white granite, three miles from the court house, on the road towards Windham. Staurotide in mica slate, about three miles from the last locality, on the road towards Windham, near Howard's Inn.

Plainfield.—Epidote, Iron pyrites in gneiss, found in considerable quantity, in digging the foundation of Harris' manufactory.

3. *Mode of adjusting lightning rods.*

TO THE EDITOR, FROM MR. P. B. WILCOX.

Columbus, (Ohio,) May 24th, 1830.

Sir—The Scioto valley in which this town is situated, is liable to heavy thunder storms. A contrariety of opinion and of practice prevails in attempting to secure houses by rods from the effects of lightning; and I have been requested by several gentlemen, to address you upon the subject, to ascertain the proper manner in which to put up rods, so as most effectually to protect buildings. Some of the difficulties are as follows:

1. *The depth to which the rod should be inserted in the ground.*—It has been remarked in this State and in Kentucky, both limestone countries, that very frequently rods furnish no protection to houses. In the summer season the earth becomes perfectly dry for several feet below the surface, and it is supposed by some, that there is not sufficient moisture at the termination of the rod in the ground.

2. Another difficulty is, *the proper height of the rod above the highest point of the building.*

3. Another very serious difficulty seems to be *the manner in which the rod should be attached to the building.*—The common practice here is to place the rod by the side of the house, and at proper dis-

tances, let the rod run through small pieces of iron, one end of which is driven into the house, the other end having an eye sufficiently large to admit the rod. Through this eye, and before the rod is inserted, the neck of a glass bottle, the end of a horn or some other non-conductor is placed, so that the building stands isolated. Serious doubts are entertained whether the practice is correct or not. Indeed, there is nobody here who knows *how* to put up a lightning rod and rest satisfied that he is correct. Will you be good enough to give us the necessary information. With your permission I would make public your views upon the subject, as I have no doubt it may save many lives and much property.

Answers given by Prof. Olmsted of Y. College, at the Editor's request.

1. The rod should be *closely joined together* throughout, either by securing one part within another, or by welding the several parts together; this will prevent the interruption occasioned to the passage of electricity through links or loose joints.

2. The points of the rod above should be *gilt*, since the conducting power of iron is impaired by oxidation.

3. The rod should descend into the ground far enough to be always in contact with *moist earth*. This depth will vary in different places. In some places five feet will be sufficient; in others, six or seven will be required; and in soils peculiarly dry it may be prudent in the season of thunder storms, to connect the bottom of the rod (by means of a chain or the rod continued,) with a well or vein of water. The chain or rod may be enclosed in some substance, or be painted with a thick coat of lampblack, to keep it from rusting. When the bottom of the rod terminates in the ground, it may branch off in several directions.

4. The height of the rod above the building should be regulated on this principle: that *a lightning rod will protect a space in every direction from it, of twice its length above the building*. Thus, if it rises fifteen feet above the roof, it will protect a space of thirty feet every way.

5. The rod should be fastened to the house by wooden, in preference to iron stays. For, although electricity takes the shortest route, yet in case the rod were imperfect, the passage of the fluid into the building would be favored by iron bolts.

6. The kitchen chimney, being that alone in which a fire is usually kept during the summer, requires to be especially protected.

7. Paint, made of lampblack is best suited to lightning rods, this substance being a better conductor than other kinds of paints.

With regard to the failure in lightning rods mentioned in the foregoing letter, it is probably owing chiefly to the *dryness of the soil;* and therefore, in that region, particular care will be required in fixing the bottom of the rod, so as to make it convey off the electricity in the best manner, and this is most effectually secured by a thorough metallic communication with moist earth, or better with permanent water.

In addition to the above remarks, drawn up by my request by Prof. Olmsted, it may be suggested, that, as the gold leaf on lightning rods is in a few years removed by the weather, it would be better to terminate the rods with solid silver, or better still with the platina points prepared by Mr. Lukens of Philadelphia.—*Ed.*

See the paper of Dr. Jer. Van Rensselaer on lightning rods. Vol. IX. p. 331 of this Journal.

4. *Practical penmanship, being a developement of the Carstairian system; by* B. F. Foster. *Illustrated by twenty four engravings.* Albany, Little and Cummings. pp. 112.

This is the title of a work recently published in this country, which is as is professed to be, a developement of the system of Carstairs for many years well known, and extensively popular in England and France. From an examination of the present publication, we find that this system has received the favorable notice of several scientific individuals in both those countries, and in the latter, it has received the attention of the Society for elementary instruction, and by a public ordinance has been adopted in all the colleges of the University. These are measures which are highly gratifying, and we trust the time is not far distant when it will be neither unfashionable nor scientific to write a fair and legible hand.

The system of Carstairs is the only one, within our knowledge, that presents any thing like a philosophical view of the art of writing. The defects in the old system appear to have attracted his attention about thirty years since, and after studying the manner in which accomplished penmen execute their tasks, he found that they use the fore arm and hand as much and as readily as the fingers. While on the other hand, according to the old method of teaching this art, the pupil is permitted or directed to rest the wrist, and generally also the third and fourth fingers, and to execute the writing with the fingers. Having ascertained the true nature of the defects in the old system, Carstairs recommended the following general plan for obviating them.

1. To teach the pupil to form the letters of the alphabet by the movement of the *arm* alone, without a separate movement of the fingers.

2. To teach the movement of the fore arm, the arm resting on the table near the elbow.

3. To teach the movement of the fingers.

4. The combination of the movements.

The treatise of Mr. Foster is devoted to explaining the manner in which these objects are effected. It also contains directions for the choice of quills, pen making, position of the body, hand and pen,—together with several well executed plates, illustrative of the peculiarities of the system.

The great advantages which this system possesses, and the success which has uniformly attended its introduction, both in Europe and America, are abundantly proved by numerous and highly respectable testimonials. Mr. Foster's account of it is clear and concise and is in many respects preferable to the original work of Carstairs. We hope ere long to see this work introduced and this system taught, not only in all our elementary schools, but also in our higher seminaries.*

5. *On a sesqui sulphate of mercury; by Lt. W. T. Hopkins, acting Prof. of Chemistry in the U. S. Mil. Acad. at West Point.*

TO THE EDITOR.

Sir—Not being aware that a sesqui per-sulphate of mercury has ever been described, I take the liberty of communicating, briefly, the following facts. Having had occasion, lately, to pour strong nitric acid on the yellow neutral per-sulphate of mercury, known as the "turpeth mineral," I observed that a portion of the salt disappeared, while the remainder was converted into a white powder. This substance was readily reconverted by water into the yellow salt. I succeeded, however, in edulcorating a portion of it without change; and upon boiling thirty grains of it with nitrate of baryta, digesting

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* The original work has passed through four Editions in England, and in France (if we are not misinformed) through eight; the last of which was got up, by Mr. Julien sub-librarian of the Institute.

afterward with nitric acid, (to remove a portion of peroxide of mercury which was deposited,) washing, drying and weighing, I obtained 19 grains sulphate of baryta. Now 19 grains sulphate of baryta contain 6.44 grs. sulphuric acid, and the white powder submitted to experiment consisted of sulphuric acid, 6. 44 grs. + peroxide of mercury, 23.56 grs. = 30 grs. We have, therefore, the proportion

$$23.56 : 6.44 :: 216 : 59.04$$

where 216 represents the atom of peroxide of mercury, and 59.04 the quantity of sulphuric acid that would combine with it to produce the compound under examination. If the numbers I obtained had been 6.48 and 23.52, the proportion would have been

$$23.52 : 6.48 :: 216 : 60$$

and the last term would precisely represent $1\frac{1}{2}$ atom of sulphuric acid. The hastiness of my experiment would account for a much greater discrepancy.

This sesqui sulphate has no very interesting properties. It appears to be insoluble, but is easily decomposed even by cold water.

It is usually said that the action of water upon the white bi-persulphate of mercury consists in the resolution of it into the yellow, insoluble, neutral sulphate, and a soluble super-sulphate. Yet, upon evaporating the liquid thus obtained, I observed the deposition of a white substance resembling, in its external characters, the bi-per-sulphate; while the supernatant liquid had those of free sulphuric acid.

I decomposed 37 grs. of the bi-sulphate by adding hot water to it; there resulted 29.75 grs. of turpeth mineral, whence 7.25 grs. (or about $\frac{1}{5}$ of the whole,) must have been dissolved. These 29.75 grs. of the yellow sulphate contain, acid, 4.65 + peroxide mercury 25.10; and since 37 grs. of bi-sulphate of mercury, consist of acid, 10 + peroxide of mercury 27, the solution must contain acid (10 − 4.65 =) 5.35 grs. + peroxide (27 − 25.10 =) 1.9 gr. Wherefore, if these bodies be united to form a super-sulphate of mercury, it must be the inconceivable one of $15\frac{1}{2}$ atoms of acid + 1 atom of base! That these theoretical quantities actually exist in the solution, I ascertained by experiment. Is it not probable, that when water acts on the bi-per-sulphate of mercury, a small portion of the salt is dissolved while the rest loses just half its acid?

6. *Meteorological Table.*

Extracted from a Journal of Observations, made at Fayetteville, (Vt.) from the 30th day of April, 1829, to the 1st day of May, 1830, in lat. 42° 58′ North, and long. 4° 20′ East from Washington; by Gen. MARTIN FIELD.

THERMOMETER.											WEATHER.				WINDS.								MISCELLANEOUS.					
				Maximum of temperature.			Minimum of temperature.				No. of days of diff. variation.																	
1829 and 1830. *Month*	Mean temp. at sun rise.	Mean temp. at 2 o'clock, P. M.	Mean temp. at 9 o'clock, P. M.	Aggreg. of mean temp. each month.	Day.	Hour.	Highest degree.	Day.	Hour.	Lowest degree.	Range of Therm'r.	Fair.	Cloudy.	Rainy.	Snow & hail.	N.	N. E.	E.	S. E.	S.	S. W.	W.	N. W.	Inches of water in rain, snow & hail in day time.	Inches of water in rain, snow & hail at night.	Aggregate of water each month.	Inches of snow and hail.	Lightning & thunder. No. of days.	Aurora Borealis.
May,	46.6	67.6	56.	56.4	28	2 P. M.	84°	13	4 A. M.	26°	58°	22	9	3	0	3	3	2	–	3	10	3	7	2.6	–.6	3.2	—	2	1
June,	55.	77.4	61.1	64.5	5	3 ..	86	26	.. ..	40	46	23	7	7	0	2	1	–	1	10	3	2	11	2.9	–.3	3.2	—	3	6
July,	55.5	75.5	63.	64.6	21	2 ..	88	25	4 ..	42	46	18	13	5	0	2	–	2	1	6	7	6	7	2.4	1.–	3.4	—	5	–
Aug.	55.	76.5	67.2	66.2	8	.. ..	87	27	5 ..	40	47	23	8	5	0	4	2	2	–	4	8	4	7	–.9	—	–.9	—	2	2
Sept.	42.8	62.6	51.2	52.2	2	3 ..	88	28	6 ..	28	60	24	6	5	0	2	1	–	–	5	6	3	13	–.7	1.–	1.7	—	1	4
Oct.	36.1	55.4	41.5	44.3	16	2 ..	66	22	.. ..	16	50	22	9	4	1	2	3	1	–	8	5	2	10	–.6	1.7	2.3	—	–	1
Nov.	30.9	38.9	31.3	33.6	18	.. ..	55	16	7 ..	10	45	14	16	7	4	1	1	3	–	5	10	3	7	–.7	3.8	4.5	8.–	–	1
Dec.	27.	36.8	29.2	31.3	25	.. ..	55	4	.. ..	7	48	17	14	5	3	3	1	–	2	8	6	7	4	1.–	2.3	3.3	7.–	–	2
Jan.	13.8	23.5	16.4	17.9	17	.. ..	48	31	.. ..	19	67	18	13	2	5	6	1	–	2	2	4	6	10	–.2	1.9	2.1	18.–	–	–
Feb.	13.2	24.6	18.	18.6	20	.. ..	54	7	.. ..	19	73	19	9	1	1	3	2	–	–	3	6	2	12	–.6	1.1	1.7	10.–	–	2
March,	27.2	40.1	31.8	33.3	22	3 ..	60	9	6 ..	10	50	20	11	3	3	1	5	–	1	4	6	2	12	2.2	4.7	6.9	18.–	1	6
April,	38.4	58.	47.1	47.5	22	.. ..	76	2	5 ..	25	51	20	10	4	1	–	8	5	1	1	3	2	10	–.9	2.–	2.9	3.–	1	3
Ag.tem	37.7	52.3	42.8	44.2	Recapitulation.							240	125	51	18	29	28	15	8	59	74	42	110	15.7	20.4	36.1	64.–	15	28

Remarks.—It appears from the foregoing table, that the mean temperature of the year was 44° 2′; and was precisely the same as that of the twelve months preceding.

The temperature of the summer months was - - - - - 65° 1′

" winter " - - - - - 22° 9′

Difference, - - 42° 2′

That August was about 2° warmer than the other summer months, and that the temperature of June and July was about the same. That the highest temperature within the year was 88°, and was the same on the 21st of July and the 2d of Sept.; that the lowest was 19° below zero, and was the same on the 31st of January and the 7th of February. But it fell below zero fourteen nights within the months of January and February. The range of the thermometer was much the greatest in the month of February, being 73°; and the least 45°, in the month of November. The range within the year was 107°. The whole quantity of water, which fell in rain, hail and snow, was 36.1 inches: snow, 64 inches: lightning and thunder, on fifteen days: Aurora Borealis, on twenty-eight evenings.

Although the temperature of the last twelve months was precisely the same, as that of the twelve months preceding,* yet from the following table it will be found, that those periods were very different in some other things.

TABLE.

1828 and 1829, and 1829 and 1830.	Mean temp. of summer months.	Mean temp. of winter months.	Highest temp'ure.	Lowest temp'ure.	Wind N. W.	Rainy Days.	Inches of rain in summer months.	Inches of snow.	Inches of water in rain, hail and snow.	Lightning and thunder. No. of days.	Aurora Borealis.
First 12 mo's.	67.8	19.9	90.	22.	94	67	20.8	100	73.3	45	10
Last 12 mo's.	65.1	22.9	88.	19.	110	51	7.5	64	36.1	15	28
Difference,	2.7	3.	2.	3.	16	16	13.3	36	37.2	30	18

The last twelve months have been unusually dry in Vermont. A severe drought commenced on the 19th of July, and from that day till the 25th of September, a period of sixty-eight days, there fell but 1.4 inch of rain. Within the same period in 1828, there fell 14.7 inches. The severe drought proved injurious to some of the later crops. But notwithstanding the summer was almost 3° colder, and we had but about one-third the quantity of rain which fell in the summer preceding, yet the aggregate of crops of the latter, was quite equal to that of the former. The autumn, and fore part of the winter, were unusually mild, and we had no frost to prevent our farmers from plowing their lands, till the 10th of January.

Vegetation is now very forward. Many of our apple-trees are in blossom; a circumstance which I have no recollection of witnessing

* See Journal of Science, &c. Vol. XVI, p. 288.

before on the first day of May, within the last thirty-two years, since I have resided in Vermont.

Fayetteville, (Vt.) May 1, 1830.

7. *Abstract of Meteorological Observations, made at Marietta, (Ohio,) in North Lat.* 39° 25′, *West Long.* 81° 30′, *in the year* 1829, *by S. P. Hildreth.*

MONTHS.	*Thermometer.* Mean temperature.	Maximum.	Minimum.	Range.	Warmest day.	Coldest day.	Fair days.	Cloudy days.	*Depth of Rain.* Inches.	Hundredths.	Prevailing Winds.
January,	33.21	62	6	56	5	28	16	15	2	75	W.S.W. & N.N.W.
February,	26.26	60	2	58	7	23	19	9	2	33	S.S.W. & N.N.W.
March,	37.59	73	18	55	28	1	16	15	2	04	S.S.W. & N.
April,	50.53	82	24	58	29	26	10	20	4	00	W.S.W. & N.
May,	65.45	94	32	62	29&30	10	26	5	1	08	S.S.E. & N.
June,	71.40	94	48	46	1&2	9	22	8	4	00	S.S.W. & N.N.W.
July,	71.56	90	47	43	15&18	1	19	12	2	12	W.S.W. & N.
August,	71.51	90	50	40	8	20	22	9	5	54	S.S.W. & N.N.E.
September,	62.40	87	42	45	1	19	16	14	4	00	S.S.W. & N.N.E.
October,	55.01	78	30	48	18	22	17	14	3	16	S.S.E. & N. & E.
November,	39.55	66	14	52	9	13	10	20	4	00	W.S.W. & N.N.W.
December,	44.07	70	20	50	7	16	15	16	4	50	S.S.W. & N.N.E.
Mean,	52.38						208	157	39	52	

Mean temperature for the year, 52° 38′, being almost three degrees less than the year 1828.

Rain, 39 inches and $\frac{52}{100}$, being ten inches less than in 1828.

Prevailing winds from the S. and S. W.; with more from the east than is usual for this climate.

Heat the greatest in July, and least in February.

Although less rain has fallen, we have had nearly a month more of cloudy weather than in the past year. The mild, pleasant weather, called "Indian summer," which usually continues for four or five weeks in October and November, failed wholly to visit us, and its place was supplied with long, cold, drizzling rains, so that it was with much extra labor the farmer gathered his crops of Indian corn and potatoes.

Fruits of all kinds, common to the country, were excellent and abundant.

OBSERVATIONS ON THE FLOWERING OF PLANTS, RIPENING OF FRUITS, &c. 1829.

January 1st, Honey bee quite active.—6, Floating ice in the Ohio river for three days past.—12th, Muskingum river frozen over, so as to afford good skating.—15th, ice broken up in the Muskingum last night.—Cold in Kingston, (Upper Canada,) 20° below zero, the 5th, 6th and 7th inst., and at Quebec, 27°.

February 17th, rivers full of floating ice; navigation ceased.—18th, the ground in exposed situations frozen 15 inches deep.

N. B. The whole of the month of February has been more uniformly cold than it has been for many years. The great snow storm which visited the Atlantic States on the 20th, commenced here on the evening of the 19th, with the wind at the S. E.; in the night it shifted to the N. W. and blew violently; the 20th was very cold and windy, snowing in the morning but not much by day: fell in all about six inches; rivers full of ice.

March 4th, ice broke up in the Ohio and Muskingum rivers, last night.—25th, blue bird seen.—28th, honey bee at work, loaded with farina.

April 7th, Hirundo urbica or Martin swallow, appears.—11th, Daffodill in bloom.—17th, Peach tree nearly in blow, some early ones open.—19th, Crown Imperial and Hyacinth in bloom.—20th, Acer Saccharinus putting forth: Flowering almond and Sanguinaria Canadensis.—21st, Service tree in bloom.—22d, Viola dens canis and wood anemone.—22d, Hirundo rustica seen.—23d, Peach tree in full bloom.—24th, Spice bush and Laurus Sassafras.—27th, Horse-chesnut opening its leaves, germ of bloom two inches in length.—28th, Birthwort, Harebell and Cherry.

May 1st, Pear tree in bloom; ox heart cherry and green gage plum.—2d, Indian corn planting, generally commenced.—3d, White narcissus.—4th, Apple tree in full bloom.—6th, Garden tulip opening.—7th, Cornus florida.—8th, Judas tree and purple mulberry.—9th, Chicasaw plum.—13th, Crab apple.—15th, Wild hyacinth,—17th, Coral honeysuckle.—20th, Blue sophora.—21st, Peony and snow ball.—22d, Tricolor, woodbine.—25th, Pseudo acacia and blackberry.—26th, Tradescanthia.—27th, Prunus virginianus.—29th, Rye in bloom.—30th, White rose.

June 1st, Liriodendron in bloom; peas fit for the table; red thorn.—3d, Dyosporas virg. or persimon.—5th, Wheat in head or bloom.—6th, Service berry ripe.—7th, Yellow celsia.—8th, Mulberry ripe.

—9th, Digitalis purpurea.—14th, White and orange lily.—18th, Catalpa tree.—19th, Red cherry ripe.—21st, Raspberry ripe.—22d, Early cucumbers fit for table.—26th, The water in a well sixty feet deep is at the temperature of 55°, open air 78°.—30th, Asclepias tuberosa in bloom.

July 1st, Wheat harvest commenced.—3d, Sambucus and Dat. stram. in bloom.—7th, Early apples beginning to ripen.—10th, White rosebay and purple althea.—13th, Asclepias syriaca.—17th, Acacia marylandica.—19th, Genista americana and purple flox.—20th, Ribes villosa ripe.—22d, Sugar pear ripe.—26th, Watermellons ripe.

8. *Wire gauze windows, a suggested protection against the effects of malaria and aërial poisons; by Robt. Cannon Bond, M. D.*—However much medical men may differ as to the origin and nature of malaria, all agree that it is inseparable from moisture. Such is the opinion of Prof. Chapman, as recently expressed in his very valuable treatise on epidemics; and a late writer, Dr. Ferguson of the British army, asserts, that however distinct they may be, "they are always found in company." Wherever vapors are most copiously produced, there miasmata are generated. When vapor is most abundant, as in the morning and evening, in the form of dew and fog, then malaria is most active. Is vapor dissipated by the sun and heat? so is malaria. Both are wafted by the winds, absorbed by water, and arrested by frost. Malaria is known to be intercepted by groves and walls, the moisture in the air being condensed. From these facts it has occurred to me, that wire gauze, similar to that of which Sir Humphry Davy's safety lamp is constructed, placed up at the windows at night, may answer a very useful purpose by condensing the moisture, and thus arresting the source of miasmatic diseases. It is now a settled law in meteorology, that vapor is most rapidly and copiously condensed on those substances which are good conductors;—more abundantly upon glass and metals than cloth, or the surface of the earth. I have little doubt that windows of this kind, by leaving at all times a free circulation of air, may be very usefully applied to hospitals, and crowded rooms for the sick, and to jails and manufactories, and thus afford a safe guard from disease. To keep the rooms of the sick well ventilated, and at the same time exclude the dampness of the air, has long been a desideratum among physicians. And even persons in health, during the hot and sultry nights of autumn are much incommoded by

the necessity of keeping the windows down. It may also be very conveniently applied to stage coaches travelling at night, and in the vicinity of marshes. To give additional security, the sash may be so constructed as to consist of two sheets of wire gauze, half an inch or more apart, or made in such manner as to be placed up at night and removed during the day. It is certainly well worth the attention of the scientific.

9. *On the Heating of Water; by* Dr. E. Emmons.

It is familiarly known, that the upper surface of heating water is hotter than the bottom, and that even *ice* may remain at the bottom, while the water near the surface would be quite uncomfortable to the hand. Now the experiments of Peron prove the water of the ocean to be in the same condition as water heating in a furnace; viz. with the bottom the coldest and the upper surface the warmest, while circumstances are known to depend on the ascent of heated particles of water to the surface, and the sinking of the colder to the bottom. Now, until it is shown that a different effect would follow, from heating the ocean at the bottom, than what takes place in our culinary operations, I shall consider the experiment of Peron as misapplied in the article I have noticed. Fearing that I may be mistaken in my views, I will respectfully request Mr. T. to consider the subject farther and give his opinion on the heating of water at vast depths and under great pressure; and show, if possible, that the heated particles of water would not tend to the surface, but be confined to the bottom, forming there a stratum of hot water more dense than marble. If however the heating of the ocean at the bottom would be attended with the same circumstances as the heating of a kettle in a furnace, then the experiments of Peron instead of going to disprove the theory of Cordier, would in the view of some, furnish arguments in favor of it, for it is known that the ocean continually gives off caloric to the surrounding medium, and what source for a continual supply of it can be found, nearer at hand, than the interior heat of the earth?

10. *On the Carbonization of Lignite.*—The prevailing theories on the formation of Lignite are two, 1st, that which ascribes its formation to fire, 2d, that which gives to water the agency of effecting this change on vegetable matter. The latter was suggested by Dr. MacCulloch, and has been adopted by Conybeare and Phillips in the

Geology of England and Wales, pp. 331–2. During a visit last fall to the tertiary and secondary region of N. Jersey, principally in Monmouth County, I was led from facts, which presented themselves, to adopt a different theory from either of the above. I would not now attempt to make a general application of it; though I see no reason why it may not be *extensively* applied. The theory in question is as follows, *that the beds of lignite in the plastic clay of N. J. have been carbonized through the agency of sulphuric acid.* The following are facts which go to support me in this opinion. 1st. The charring of the wood and vegetable matter seems to be of recent occurrence and to be even now going on.—2d. If the charring was produced by water after a long submergence, the effect ought to be nearly equal throughout the beds, but some logs have suffered no change; in others, the change is confined to the bark or surface, other pieces of wood are perfect charcoal, the different effects evidently owing to an unequal exposure to the agent which produces the carbonization. 3d, Free sulphuric acid may be detected in the small streams flowing down the banks which unquestionably is produced by the decomposition of iron pyrites so abundantly diffused through the bed. 4th, The charring is most perfect where pyrites abound the most, and where this mineral is wholly wanting, no carbonization is perceptible.

Whether others will, on visiting this region, come to the same conclusion that I have, I am unable to tell, but it is certain that the region is worthy of a visit, and no geologist would grudge the expense of a tour to the plastic clay near Middletown Point and the adjacent secondary formation, termed the *marle beds*, as they abound in organic relics of a most interesting character, and approach nearer to those of the chalk formation of Europe than any our country affords.

11. *On the inflammation of phosphorus in a partial Vacuum; by* A. D. Bache, M. D. Prof. of Nat. Phil. and Chem. Col. Depart. Univ. Pennsylvania.

Philadelphia, May 18, 1830.

Dear Sir.—In the last number of the American Journal of Science and Arts, (page 147) I observed an extract from one of the foreign journals, in relation to the experiment of Van Bemmelen, with phosphorus in the rarefied air of the receiver of an air pump. The article from which that extract is taken reached us in the Bulletin des Sciences Physiques, &c. about the same time with the first Vol. of the

French translation of Berzelius' Treatise on Chemistry, of which the article in the Bulletin is a notice. Having referred to the account of Van Bemmelen's Experiments, given by Berzelius, it appears that the cause assigned by their author to explain his results, was objected to and that an explanation was still wanting : in search of this I engaged in a series of experiments still in progress. For the present I would call your attention to a portion of the facts exhibited by these experiments, which seem to me, interesting.

Van Bemmelen found that a stick of phosphorus powdered with resin or with sulphur and placed on cotton under the receiver of an air-pump, or exhausting the receiver was inflamed ; and that the same effect was produced by wrapping a stick of phosphorus in cotton ; then placing it under the receiver and exhausting the latter.

Its inflammation occurs when phosphorus alone is placed under the receiver and the air within is rarefied. These experiments I have repeated many times. The inflammation produced by rosin is remarkably different from that which takes place when sulphur is used.

In addition to the substances just mentioned as producing the inflammation of phosphorus under the partially exhausted receiver of an air-pump, I find that the same effect is produced by powdering with finely divided,

Charcoal.		
Spongy Platinum.	Hydrate of Potassa.	Carbonate of Lime.
Antimony.	Lime.	Nitrate of Potassa.
Arsenic.	Magnesia.	Nitrate of Lead.
	Hydrate of Baryta.	Sil. Fluate of Lime (Fluor Spar.)
Per Sulphuret of Mercury.		
Sulphuret of Antimony.	Silica.	Muriate of Platinum and Ammonia.
Per-oxide of Mercury.	Chloride of Sodium.	Boracic Acid.
Per-oxide of Lead.	Muriate of Ammonia.	
Per-oxide of Manganese.	Chloride of Lime.	

The temperature being about 60°, Fah. or above that point.

Proceeding to an extension of the experiments to air of the natural density at different temperatures, I found that at about 60° F., *Carbon*, in the form of animal charcoal or of lampblack, *causes the inflammation of a stick of phosphorus powdered with it:* this takes place either in the open air or in a close receiver of a moderate size. The fusion of phosphorus is produced at about the same temperature by, (among other substances,) finely divided Platinum sponge, Antimony, Potassa, Lime, Silica, Carbonate of Lime, &c. These actions are, as was to be expected, aided by an elevation of temperature above 60° F.

These results I am led to believe from a partial trial, will find useful application in Eudiometry by means of Phosphorus.

12. *On the use of black mica, as a substitute for colored glasses in spectacles;* by Dr. William Meade, in a letter to the Editor, dated Newburgh, March 19, 1830.

Dear Sir—While my eyes were weak, during the last winter, I suffered great inconvenience in consequence of the glare of the snow on the mountains and the river, and I found a substitute for glass spectacles which answered beyond my expectations, and gave me the greatest relief. It is far better than green glass; it gives a most agreeable sombre light and is peculiarly pleasant for tender eyes; not however to read with, but merely to defend the eyes from the influence of the light of the sun or snow. As I find it equally useful and agreeable at candle light or when looking at a fire, it occurred to me that great convenience would be attached to the use of spectacles in which these shades may be inserted instead of glass, when making chemical or galvanic experiments, particularly when the large galvanic apparatus is used, which produces such intense light that few eyes can bear it. On these occasions I have always seen Dr. Hare wear glasses; but these are liable to several objections. First, great danger attends breaking; they also are distressing when they get warm, and the glare is never so effectually counteracted as in the black mica which I send you, and which may be made of any shade most agreeable to the sight in proportion to the thickness of the lamina; nor will this mica become heated and disagreeable to the eyes in the summer. I have now had several weeks' trial of them and am quite satisfied with their superiority over glass. I have given them to others, who also acknowledge their superiority, particularly a young lady who lives near me, and who has such tender eyes that she never can venture out without colored spectacles, but from the moment she has adopted my plan she has found such benefit that she has quite given up the green glasses.

I have enclosed you in this letter two or three thin plates of this black mica, which I have never found any where but in the town of Munro, in the state of New York, but it is now rare; it is found crystallized in rhomboidal tables or plates, sometimes ten or twelve inches by four; the laminæ or planes can be separated very easily. The crystals assume a great variety of forms and are very well defined; fifty plates may be split with a knife from a crystal half an inch thick, and these may be cut with a scissors and shaped to fit the frame of any spectacles, and of any thickness, to suit the sight or the object of the wearer; for instance, if to screen the eyes from the intense light produced by the galvanic deflagrator, the plates must be thicker than when used in the day time to shade the eyes from the usual light of the sun or the snow.

Remark.—The mica transmitted by Dr. Meade produces a most agreeable effect; the light transmitted to my eyes is yellowish green. —Editor.

13. *Geological Facts, by David Thomas:* communicated through Prof. Eaton.

The rocky strata of this region have a general dip to the south.

The new channel of the Seneca River near Jack's Reef, made for the purpose of draining the Cayuga marshes, is nearly in a north or south direction. The rock excavated is a soft or slaty limestone, repeatedly alternating with marl; and nothing can be more obvious, in the sides of this cut, than the dip of these strata to the south.

In a cove on the east shore of the Cayuga Lake, five miles to the south of East Cayuga village, a valuable quarry of water lime has been wrought for building stone; but at Cook's quarries, two miles above, and at Long Point, we find the geodiferous limerock. The latter in all cases overlie the former; and as these quarries occur at the surface of the lake, the dip of the strata to the south is evident.

A mile further up, the pyritiferous slate, which overlies the geodiferous limestone, first appears on the shore, and also demonstrates the dip to the south. From this point upwards, the slate abounds on both shores, to the head of the lake; but the prospect of some inclined strata, from the ferry-boat near Kidder's, is very interesting.

In going up the canal from Lockport, the dip of the strata is very apparent; and though the course of the canal varies, in about two miles the whole mass of rock disappears. It is true, some rocks occurred further south, but these were super-imposed strata, and in a short distance in that direction, sunk below the canal.

In 1821, I requested my assistant, Davis Hurd,* to measure the dip in the strata at Black Rock. I can speak only from memory, and at a considerable distance of time, but I think it was three feet in twenty-four rods. This dip was also to the south.

In regard to these appearances on the south-east shore of Lake Erie, permit me to copy from a former publication: "This mineral is confined to one stratum, which is three feet above the lake, and declines south-westerly till it disappears in the waves. The angle with the plane of the horizon is nearly one-third of a degree; and the other strata along shore dip in the same direction."

I omit many observations on the intermediate region, and close with the remark that *inclined limestone probably forms the dams of all our parallel lakes, as it does that of Lake Erie*, (that is, ascending towards their outlets) *and also underlies them.*

Greatfield, (Cayuga Co.) 2d mo. 20, 1830.

The views of Mr. Thomas are corroborated by those of Professor Eaton, particularly as exhibited on a profile, in a map communicated to us some time since; and it is stated that there has been no communication between Mr. Eaton and Mr. Thomas on the subject.

Direction and extent of Primitive ranges: Prof. Eaton.—1. The Primitive rocks of Lake George, &c. cross the St. Lawrence at Ogdensburg, and run along the north-east side of Lakes Huron, Superior, &c.; and they are at least one thousand miles long. In this State, they are separated into two or three ridges, however, as you see on our map. From Little Falls on the Erie canal, the gneiss range is unbroken as far north-west as the extreme termination of the great chain of lakes. I have received specimens from Dr. Zina Pitcher,† of the U. S. army, making an unbroken chain throughout.

There is certainly genuine upper secondary oolite in large quantity in Franklin, Bergen county, New Jersey. Dr. Horton, of Goshen, Orange county, collected specimens there in place.

14. *Cannel Coal in Ohio.*—That elegant species of coal, found abundantly in Lancashire in England, and called cannel‡ coal, has

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* Late principal engineer of the Farmington Canal, in Ct.

† Brother of Governor Pitcher, of the State of New York.

‡ Which in the local dialect means candle coal, as it is, or was used, as a substitute for candles, on account of its burning with so much brilliancy.

not hitherto been announced as a production of this country. We embrace the earliest opportunity to state that an unquestionable specimen has been just received from Hon. Judge Tappan of Steubenville, and the following notice is from his letter, dated May 15, 1830.

"I make the spec. grav. of this combustible* 1.6. One and a half miles west of Cambridge, Guernsey county, Ohio, near Grummon's tavern, a bed of the mineral was found cropping out (not long since); it has been penetrated about two feet vertically, but the depth or thickness of the bed is not yet ascertained. It appears to extend, like our other coal beds, into the hill horizontally: it is so compact and hard, as to be more difficult to quarry than our common coal; it makes in the grate a very clear light, and leaves less residuum than our common coal. I hope to be able to give you a correct analysis of it before long."

We would suggest to our respected correspondent, that the specimen forwarded (which is sufficiently large to exhibit the characters) corresponds, strikingly, with the cannel coal of England: like that, it is black, has a conchoidal fracture, and a resinous lustre: it is compact, with only a slight tendency to the slaty structure, and it is highly inflammable, burning by mere contact of the blowpipe flame, with a brilliant light.

Its high specific gravity (1.6) is remarkable; the cannel coal of England being only 1.2 or 1.3, and even the anthracites of Pennsylvania being but 1.55.

From the fact that there is, according to the observations of Judge Tappan, but little residuum, it is probable that the high gravity (which is very obvious even in a hand specimen,) is owing to the greater condensation of the carbon, which of course gives a superiority to this coal. The discovery is very interesting, and we shall hope to receive a fuller account before the appearance of our next number.

15. *Plumbago of Sturbridge, Mass.*—Numerous localities of this valuable mineral are known in the United States; and we are gratified to observe that it is obtained in large quantities and of an excellent quality, at Sturbridge, in Massachusetts. A large mass now lies before us, which is very pure, soft and sub-crystalline in its structure. The saw cuts it easily into any form, and it admits of a high polish.

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* Judge Tappan regards it as resembling both jet and cannel coal, but as being not exactly like either.

We are indebted for it to Mr. Frederic Tudor, and also for a quantity of the melting pots and crucibles manufactured from it. Their appearance is excellent, and such a manufacture is an acquisition to the arts of this country; we wish it entire success.

We understand that forty tons of plumbago, of the same quality as that named above, were taken from the mine during the late year.

A small specimen from the same place, more recently received from Mr. Tudor, is very fine, and it would seem is good enough for the manufacture of pencils. An eminent pencil maker in England has written that it is inferior only to that of Borrowdale, and the appearance fully justifies this recommendation.

16. *Notice of the circumstances attending the fall of the Tennessee Meteorites*,* May 9, 1827.—This account although published at the time in the Nashville Banner, has but recently been placed in our hands. As all such notices that are authentic ought to be preserved, it is now inserted in this journal. It is on the authority of the Rev. Hugh Kirkpatrick, who is spoken of as worthy of entire confidence.

On Wednesday the 9th inst. about 4 o'clock P. M. the day being as clear as usual, my son and servants were planting corn in the field, they heard a report similar to that of a cannon, which was continued in the air resembling the firing of cannon or muskets by platoons, and the beating of drums as in a battle. Some small clouds with a trail of black smoke, made a terrific appearance, and from them, without doubt, came a number of stones with a loud whizzing noise, which struck the earth with a sound like that of a ponderous body. One of these stones my son heard fall about fifty yards from where he was. In its descent to the ground it struck a paupau tree of the size of a small hand spike, and tore it to pieces as lightning would have done; guided by the tree, he immediately found the spot, and there he found the stone about eight or ten inches under the ground; this stone weighed five pounds and a quarter. Mr. James Dugge was also present. They stated that the stone was cold but had the scent of sulphur.

On the same day, and about the same time, my son-in-law Mr. Peter Ketsing was in a field with his laborers, about one mile dis-

* For the analysis, see Vol. 17, p. 326 of this Journal, and for a description this Vol. p. 200.

tant, when a stone fell which weighed eleven pounds and a half. This took place near him, his wife and three other women. A number of respectable men were present when it was found and taken up; it was twelve inches under ground. I have seen one that fell at Mr. David Garrett's, and part of one that fell at Mr. John Bones', I have also heard of one more that has been found. These stones are perfectly similar, glazed with a thin black crust and bear the marks of having been through a body of fire and black smoke. Many gentlemen, who have been excited within a few days to come to my house to see them, say they never saw such before.

Drake's Creek, Sumner Co., May 16, 1827—18 miles from Nashville.

The Editor of the paper says the noise was heard 10 or 12 miles or more.

I have nothing to add to the descriptions of this stone already published, except that the innumerable metallic points which are visible through the light grey (almost white) surface of the mass are nearly as brilliant as silver, although they have obviously been rounded by heat. They are attended by an immense number of brilliant black vitreous globules, which have every appearance of perfect fusion and the entire mass has that harsh acrid feel which belongs to lavas and trachytic rocks.

The black crust has evidently been in a state of, at least, pasty fusion; its roughnesses are rounded and on drawing a file over any of its prominent points bright metallic iron is immediately uncovered.

There is no account of a fire ball attending these meteorites, but as it was full day light and probably sun shine, we cannot conclude that there was no fire ball. It is most probable, that there was one. —*Editor.*

17. *Fountains of fresh and salt water.*

Marietta, Ohio, March 11, 1830.

TO PROFESSOR SILLIMAN.

Sir—In the last number of the Journal of Science, I was pleased to observe the remarks of Mr. G. W. Long, upon the spontaneous flow of springs or water from the bowels of the earth. He says, "springs that flow spontaneously, are generally found on the sides of hills, or in the neighborhood of them; and often in such situations as not to be easily accounted for, and to be, at the same time, objects of great curiosity. The flow of water from the bowels of the earth by boring, excites still more wonder, as the cause appears more hidden from our comprehension. In all these cases the hydrostatic principle which causes the discharge of the water, must be the same; that is, the pressure of a column of water superior to the pressure of the water raised; and in the absence of any other active force to cause this pressure, *it follows that it must arise from a superior fountain head.*" If this be correct on philosophical principles, can a sound reason be given, why a more copious fountain of water should be found by boring at the brow of the hills, from four to nine hundred feet deep, perpendicular, than can be found by boring the same depth one hundred and sixty rods, or three hundred rods, back from the hill on the plain? For such is the fact; *salt licks* on the surface are found all through this western country, and generally at the edge of rising ground. Some of the largest of the *licks* are at the foot of the lowest hills; salt wells were sunk at these places to a great depth, and some in valleys, where strong licks were found, two hundred rods from the hills, which were not *high*, but without success. The wells were abandoned.

The citizens of this country have laid it down as an axiom, founded on experience of some ten or twelve years in the boring of the earth for salt water, to sink their wells at the brow of the highest hills, commencing on a rock, at the surface, if possible. No matter whether there is any appearance of *licks*, or of brackish water, within miles of the place. At the depth of from one hundred and seventy to eight hundred feet they obtain strong salt water, which gushes forth spontaneously, from some wells, six and ten feet above the surface, without being exhausted. In all cases the wells of the greatest depth, and at the brow of the highest hills, have discharged water with the greatest force. The hills are from sixty to two hundred feet high. When we take into consideration the depth of the wells, upon what principle of hydraulics shall we solve this problem?

There are now a great many salt wells, thirty or forty miles from this place, on the Muskingum River, near to Zanesville; and on Leading Creek, in the county of Meigs, several wells have been in operation for years, and make very beautiful salt, which sells at fifty cents per bushel. I am, respectfully, your obedient humble servant,

NAHUM WARD.

18. *Suggestions as to a union of effort to obtain a correct account of the variation of the magnetic needle;* in a letter to the Editor, dated Wilmington, Del. Feb. 28, 1830, from *Daniel Byrnes.*—In

the year 1808, at Baltimore, I commenced a series of observations in the mornings and evenings to ascertain the variations of the magnetic needle, as the surveyors found a considerable difference in the curves of lines which had been run many years before, although they knew not what it then was or had been before. I found after many observations, taken at different places, (to avoid local attraction,) by using a nautical almanac and continuing the declinations up to the time of observation; by using a magnifying glass to take the sun's bearing more correctly, and afterwards by rejecting a number of my first observations, I believed that I could place reliance on the result, which was, that there was not more than ten or fifteen minutes of a degree west variation at that time. Now I will suggest that, in my view, it is due from this generation to succeeding ones, to leave them the knowledge of what the variation is in our time. If there was an observer at Washington, at Baltimore, at Wilmington, at Philadelphia, at Princeton, at New York, and so on easterly, and also south of Washington city, and if each of these observers would take an observation of the sun, with amplitude or azimuth, on the fifth, fifteenth and twenty fifth day of each month, and transmit a copy thereof to the president of this *magnetic association*, (who, to give credit to the association, ought to be some scientific man, and known to the public as such.) I am convinced that from an annual publication of the result of this labor, both advantage and satisfaction would be derived. As this could hardly be accomplished without some public aid, each observer should be furnished by the government with a good compass that would do for either azimuth or amplitude observations, to which might be added a telescope and sextant, all to be kept and used by each observer while he shall faithfully and correctly do his duty and no longer.

If more attention was paid to this neglected branch of science, succeeding generations would be rewarded thereby, and perhaps they might then be able to assign some reasonable cause for the magnetic variation more rational than any hitherto. Thy friend,

Daniel Byrnes.

The suggestions of Mr. Byrnes are both reasonable and interesting, and they could be easily put in practice: nothing is easier for the government of this country than to do every thing for science, and to enable science to do every thing for the country.

19. *Premiums for useful inventions.*

Philadelphia, December 17, 1824.

John Scott, late of Edinburgh, in 1816, bequeathed *four thousand dollars*, to the Corporation of the city of Philadelphia, to the intent "that the interests and dividends to become receivable thereon, should be laid out in premiums to be distributed among ingenious men and women, who make useful inventions, but no such premiums to exceed twenty dollars: and that therewith shall be given a copper medal with this inscription—" To THE MOST DESERVING."—The select and Common Councils of the city of Philadelphia, having entrusted "the Philadelphia Society for promoting Agriculture," with the distribution of the aforesaid premiums and medals, and a committee of that Society having been appointed to attend thereto, they will receive applications for the same.

Certificates of the originality and utility of the inventions, must accompany the applications, which may be directed "to the Committee of the Philadelphia Society for promoting Agriculture, on Scott's legacy," and forwarded free of expense.

A description of the invention, must be given in clear language, and correctly written, accompanied by drawings in perspective and detail, where necessary to illustrate it. Where the invention is a composition of matter, sufficient in quantity for the purpose of experiment, and to preserve in the Cabinet of the Society, will be expected.

In 1822, there were thirteen premiums—in 1824, fourteen premiums, twelve for $20 each, and nine of them, with the addition of the medal.

In 1825, there were two premiums, one for $20 and the medal.

In 1827, eight premiums which appear all to have been for $20 each and the medal.

In 1828, there were two premiums of $20 and the medal.

In 1829, three of the same amount and the medal.

In 1830, two do. do.

This Institution under the patronage of Drs. Mease, Hare, and other eminent and patriotic gentlemen, can hardly fail of doing good.

20. *Manufacture of Silk in America.—Report to Congress.—Homergues' Essays.*—An important report on this subject was made in the Congress of the United States, March 12, 1830. It appears,

1. That American silk is superior to any other; and that eight pounds of American coccoons will produce one of raw silk, while twelve pounds of Italian or French coccoons are necessary for the same purpose.

2. That although silk has been long manufactured in some parts of the United States, and particularly in Connecticut, it has not been done in the most profitable manner; for the sewing silk of Connecticut is made from the best silk, while that of France and Italy is made from the refuse silk, and still is of a superior quality.

3. That the proper reeling of the silk is indispensable to its being duly manufactured into the finer fabrics.

4. That the climate of the United States is in every part of the country adapted to the culture of silk, as the hatching of the eggs is accelerated or retarded by the variations of temperature, so as to suit the putting forth of the leaves of the mulberry, which is easily cultivated from the seed, and grows in almost every soil.

5. That the United States, in the year ending Sept. 30, 1828, imported silk to the amount of $8,463,563, of which $1,274,461 were exported, and that the export of the materials for bread in the same period amounted to only $5,414,665.

6. That silk may in a few years become an important article of export from this country; for even France, although she raises much silk, annually imports to the amount of $20,000,000.

The report of the committee is sustained by an interesting letter from Peter S. Du Ponceau, Esq., a gentleman equally eminent for his talents and learning, for his private excellence and for his patriotic views towards this, his long since adopted country.

Mr. Du Ponceau strongly recommends the establishment of a course of instruction in the filature or reeling of the silk; and to this end he proposes that the government should afford the necessary patronage to a young man who is represented as every way qualified for the undertaking—namely, M. D'Homergue, who has already appeared advantageously before the public in his Essays on the culture of silk, in which he has been aided by Mr. Du Ponceau. These essays are highly interesting and instructive; and granting that the facts are as stated, (of which we cannot entertain a doubt,) they establish a very strong case in favor of the culture of silk in the United States. It is proposed that the course of instruction shall be given at Philadelphia. It will require two years from July 1 to Nov. 30; and sixty young men can be instructed, and may begin on the 1st of July, 1830.

In the mean time it is proposed to instruct twenty women, who shall be able to exhibit the filature in actual operation, when the young men shall assemble in the following year.

As there can be no filature without coccoons, it is proposed that Mr. Homergue should travel variously in the United States to obtain them, and to promote as much as possible the culture of the mulberry tree and the raising of silk worms.

It is proposed to encourage by suitable bounties the planting of the white Italian mulberry tree, as silk worms and coccoons will naturally follow where this is done.

To this important and patriotic effort we wish all possible success; and it cannot be in better hands than those of the gentlemen who have undertaken to promote it in the United States.

Dr. Pascalis has made great efforts and sacrifices on this subject. Mr. Duponceau is giving the weight of his character to the same object, and it is fortunate for this country that eminent natives of France, so long distinguished for the manufacture of silk, are bringing their knowledge and early partialities to bear on this subject, which is evidently of the greatest national importance.

21. *Porcelain of Philadelphia.*—This fine product of our domestic arts was mentioned in Vol. XIV. pa. 198 of this Journal. There is little to add to what was then (we have great pleasure in saying *truly*) stated, relative to the beauty and excellence of the porcelain of Philadelphia; but a recent visit to the manufactory, places it in our power to say, that it is going on with vigor and success. It is now under the entire management of Mr. Tucker, and there is exhibited in his premises sufficient evidence of skill, good judgment, perseverance and efficiency, to justify the belief that the establishment will be permanent, and will admit of due extension as the demand shall increase.

Mr. Tucker is very fortunate in the possession of the best materials, which are obtained in the greatest abundance, in the southern parts of Penn. and in Delaware. Besides the proper porcelain clay, he uses also feldspar and quartz. The feldspar is from a huge vein in Delaware; the most common pieces that are used in the manufactory are beautiful, and many of them sufficiently so to form ornaments of cabinets, being little inferior to the adularia of the Alps: white quartz is also used: both are calcined to aid the pulverization, which is effected by proper mills; the powders are then mingled in water, and form an excellent basis.

If we possessed all the facts, and it were proper to publish them, we are not now disposed to enter into the details of the manufacture; and it is mentioned again, that we may say, from personal inspection, and a very full and obliging exhibition of the manufacture, by the proprietor, that we entertain the fullest conviction of its entire success. The porcelain is excellent and very beautiful, and as the public afford Mr. Tucker encouragement, by purchasing, liberally, his fine productions, he will be able to add all the embellishments in the merely ornamental part of the manufacture, which fancy and taste may require.

In surveying, with some attention, the great improvements which the lapse of a few years has introduced into Philadelphia and its environs, nothing impressed us more agreeably, *even in this city of institutions, science and arts*, than this unostentatious, but perfectly successful manufacture of porcelain. The patriotism of this country will make no sacrifice by affording Mr. Tucker all the encouragement which he can desire, and which he so richly deserves.

22. *Improved Scale of Chemical Equivalents.*—In a former volume of this Journal, we mentioned the improved edition of Dr. Wollaston's beautiful instrument by Messrs. Beck & Henry. A second edition was published by them in 1828, and this improved scale, strongly recommended by the adoption of hydrogen as unity, is also executed with great neatness, and we are happy to see it thus brought within the reach of all students of chemistry in this country.

It is justly observed that it is founded on the most important fact in the science, namely, that all bodies unite, chemically, in weights, or multiples of weights, that have the same constant ratio to each other.

23. *Report to the Regents of the University of New York.—Feb.* 1830.—This is an interesting and instructive document; its plan is excellent, as it unites copiousness, condensation and perspicuity; indeed it is so difficult to make an analysis of what is almost entirely elementary, that we can do little more than speak of it in general terms. It presents a view of all the colleges and incorporated academies, in this great state; the places in which they are—the number of students, the value of the buildings and apparatus, the amount of funds, the number and compensation of instructors, and the courses of studies. The academies are between fifty and sixty in number, besides four colleges, and three medical schools, one of which is not however

acknowledged by the Regents; there are also in the state two theological seminaries. The common school system of the state is also, on an extensive plan; one hundred thousand dollars are paid annually from the treasury for this purpose, besides more than an equal sum raised by taxes, and other modes, and half a million of children, being more than all, that there are between the ages of five and sixteen and about one third of the entire population, are instructed in the primary schools.

By a very wise provision of the Legislature of New York, passed in 1825, all the chartered institutions are required to keep meteorological registers, of which an annual return is made and an abstract published. This is a very interesting part of the public document on education, and the information has been ably digestedby Messrs. T. R. Beck, and J. Henry, under the direction of the chancellor, Simeon DeWitt. The latitude, longitude, location, elevation above the sea and topographical peculiarities for each place, are given. The average temperature of the first and last half of each month is stated in separate columns, and in other columns the highest and the lowest degree of temperature, and the entire range for the month; also, the number of days in which the wind prevailed for eight points of the compass—quarters and half quarters; and the prevailing weather, stated in number of days under the heads of clear, cloudy, rain, snow, and snow and rain. The last column gives the contents of the rain gage. Five general recapitulatory tables are given, containing the average results for the year; No. 1 is for the temperature; No. 2 is for winds; No. 3 is for weather including rain; No. 4 is a comparison of extreme heat and cold for each month; No. 5 is a comparison of the range in each month; and there are two tables or catalogues of miscellaneous observations, the first of which relates to remarkable occurrences in the weather, in the progress of vegetation, and of the appearance and economy of birds and animals, as connected with weather, and particularly with temperature.

The last table contains notices of the aurora borealis, halos, meteors, storms, rain and snow, winds, temperature of wells, the opening of the spring navigation of the great river and other waters, &c.

We should be glad to see a table added for the barometer, and for the range of variation of the magnetic needle. Where so much is done and so ably done, it would seem eminently desirable, that those two important topics should not be forgotton.

It would perhaps not be so easy to make and register, hygrometric observations, although in themselves desirable; and perhaps the most valuable results in this head are embraced by the rain gage. For want of room, we must omit the citations which we intended to make of particular facts contained in these important results. The state of New York, has set an example worthy of general imitation through all the States, and the information thus obtained will lay the sure foundation of general conclusions of great importance.

24. *A history of the county of Berkshire, Mass. in two parts, the first being a general view of the whole county, and the second an account of the several towns; by gentlemen of the county, clergymen and laymen.*—This is a neat volume of 468 pages, large duodecimo, illustrated by a map geographical and geological, and by several wood cuts. It appears to be executed with all requisite fidelity and good judgment; it is an effort creditable to the county and to the several gentlemen engaged in the work, and is worthy of general imitation. Among the authors, the Rev. David D. Field, Prof. Kellogg and Prof. Dewey are conspicuous. The general account, including the scientific part, is from the pen of the latter gentlemen, whose labors have often aided the cause of science in this Journal.*

25. *History of Wyoming, by the late Isaac A. Chapman, Esq.*—This interesting little volume is a valuable addition to our local histories, and an excellent guide to the traveller in the valley of Wyoming. The first settlement of that country, by people from Connecticut; the severe civil conflict, in relation to the right of soil and the right of jurisdiction; and the privations, sufferings and heroic acts of its inhabitants, as well during that conflict as the revolutionary struggle, are the principal subjects of this work.

The facts which it contains have been collected with care—arranged and digested with skill and ability, and are narrated in a neat and perspicuous style.

There is an appendix, containing a statistical account of the valley and adjacent region, and of its mineral riches, present situation, &c.

* The other historians of particular towns, are Rev. James Bradford, Rev. Gardner Hayden, Rev. Silvester Burt, Edwin Brewer, A. M., Rev. Harley Goodwin, Rev. Levi White, Rev. Jonathan Lee, Rev. Edwin W. Dwight, Rev. Samuel Shepard, Rev. Caleb Knight, Rev. Alvan Hyde, Henry R. Strong, M. D., Rev. Eber Jennings, Rev. Henry B. Hooker, Rodman Hazard, Esq., Rev. John Yeomans, Rev. Joseph M. Brewster, Rev. William A. Hawley and Rev. Gordon Dorrance.

From recent familiarity with this country, we are happy to add our testimony to its general accuracy, as far as it relates to the actual state of things, and its correspondence, in relation to historical facts, with the recollections of such of the aged inhabitants as were witnesses or actors in the scenes described. A fuller account of *the tragedies* of Wyoming seems to be called for, and from the older inhabitants it could now be easily obtained; but the opportunity will soon be irretrievably lost.

26. *Georgia Meteor and Ærolite.*—Having recently received from Dr. Boykin, specimens of the meteoric stone which fell in Forsyth, in Georgia, in May, 1829, we are induced to republish an extract from an original statement of the facts, as it appeared in the newspapers at the time.

"Between three and four o'clock, on the 8th instant, on that day, a small black cloud appeared south from Forsyth, from which two distinct explosions were heard, following in immediate succession, succeeded by a tremendous rumbling or whizzing noise, passing through the air, which lasted from the best account, from two to four minutes.

"This extraordinary noise was, on the same evening, accounted for, by Mr. Sparks and Captain Postian, who happened to be near some negroes working in a field, one mile south of this place, who discovered a large stone descending through the air, weighing, as was afterwards ascertained, thirty six pounds.

"The stone was, in the course of the evening, or very early the next morning, recovered from the spot where it fell. It had penetrated the earth two feet and a half. The outside wore the appearance, as if it had been in a furnace : it was covered about the thickness of a common knife blade, with a black substance somewhat like lava that had been melted. On breaking the stone, it had a strong sulphureous smell, and exhibited a metallic substance resembling silver.

"The stone however, when broken, had a white appearance on the inside, with veins. By the application of steel, it would produce fire.

"The facts as related, can be supported by many individuals who heard the explosion and rumbling noise, and saw the stone.

Elias Beall."

The following notice, forwarded to the Editor by Dr. Boykin, of Georgia, under date of June 2, 1830, corresponds substantially with the above.

"No one can tell from what direction the meteor came.—The first thing noticed was the report, like that of a large piece of ordnance; some say the principal explosion was succeeded by a number of lesser ones in quick succession, similar to the explosions of a cracker: one has told me the secondary noise was only a reverberation. Very soon after the explosion, some black people heard a whizzing noise, and on looking saw a faint '*smoke*' descend to the ground; at which time they heard the noise produced by the fall of the stone: they ran to the spot, for they saw where it fell, and discovered the hole it had made in the ground, being more than two feet in a hard clay soil: the negroes, and others who went early to the spot, say they perceived a sulphureous smell. The stone weighed thirty-six pounds: it fell at a small angle with the horizon."

Remarks.—Having received the specimens, just as this number of the Journal is about being finished, I can add only the following notice: The color of the interior of the stone is a light ash-gray, and very uniform, except that it is sprinkled throughout with thousands of brilliant points of metallic iron, having very nearly the color and lustre of polished silver. The iron is rarely in points larger than a small pin's head, but the points are so numerous that nearly the whole of the powder of the stone is taken up by the magnet, even when it is in fine dust, and by a magnifier the little points of iron can even then be seen standing out from the magnet. It greatly resembles the Tennessee meteorite.

It has the usual black crust on certain parts, and this, although resembling a semi-fused substance, exhibits bright metallic points when a file is drawn across it. A similar black crust is seen pervading the stone in some places, through its interior, and forming where it is seen in a cross fracture, black lines or veins. The stone is full of semi-fused black points and ridges similar to the crust, and its entire mass seems half vitrified in points, so as to resemble an imperfect glass. The specific gravity as ascertained by Mr. Shepard, is 3.37.

27. *Dr. Comstock's Natural History of Birds.*—This entertaining little work, of two hundred and sixteen pages, large duodecimo, is pleasingly illustrated by a quarto atlas of colored figures, designed with all requisite skill, and proportioned to the life size. This is the second volume of a series which the author designs to execute for the use of children, and of which the first was devoted to quadrupeds. The books are so attractive that they cannot fail of being read, and

if read they must prove both interesting and useful to the rising generation.

28. Obituary.—Science has sustained a great loss in the death of Mr. Stephen Elliott, of Charleston, S. C. Mr. Elliott's distinguished talents; his extensive acquirements in science; his exalted private and public virtues; his great love of liberal knowledge and liberal purposes, and the prevailing and happy influence which he had acquired, made him an object of the greatest respect and admiration, and will cause him to be long regretted by the nation as well as by his own state. He received his education in Yale College, of which institution he was a graduate in 1791. We look for a full account of his life, labors and character, from some one of his eminent friends and associates in Charleston.

29. Correction.—On page 143, Vol. XVII, an obvious error was committed in giving the inclination of *k* on P. The accompanying measurements show that this angle cannot be 90°, as there stated. Unfortunately, the manuscript not having been preserved, and the author being unprovided with specimens for obtaining it anew, it is impossible to give it, at present, from actual measurement.

30. *Collections of New England Rocks with their imbedded minerals, for sale.*—Collections of the different series of New England rocks, can be furnished in parcels of from one hundred and fifty to three hundred pieces, according to the views of purchasers;—the specimens being intended to illustrate the geology and mineralogy of this section of the United States. They will be of a large size, neatly trimmed, and accompanied with the requisite information concerning their localities. The Editor of this Journal, may be the medium of communications.

FOREIGN.

31. *Transactions of the Society of Arts, Manufactures and Commerce, London, Vol. XLVII.*—This volume, the latest of this most useful and respectable work, has been received; and by the good will of the Society towards the cause of useful knowledge in this country, we have been favored with a complete set of these transactions which, in substantial utility, are probably not equalled by any similar work. The volumes are illustrated and adorned by numerous beautiful plates, and every useful thing, from a pin to a ship

of the line, is within its plan. We have no room to mention even the contents of Vol. 47, but will cite the following interesting fact.

The vessels employed in the New Foundland fishery, which export salt, and return salted fish *in bulk*, are known to be exempt from destruction by rot. This fact induced Mr. Carey, in 1786, when building in the Gulf of Canso, a schooner, of timber green from the woods, to fill the spaces between the timbers with a mixture of salt, fish oil and pounded charcoal, with stops of wood inserted here and there, to keep the composition in place. Thirty years after, this schooner was in perfect preservation, since which her history has been lost; but it is not impossible that she may be still safe and sound. Mr. Carey received a prize medal from the society.

32. *Minerals not yet described in the common systems of Mineralogy.*

(Communicated by Dr. Lewis Feuchtwanger, late of Germany, now of Philadelphia.)

1. *Bi-seleniuret of zinc, with proto and deuto-sulphuret of mercury*, according to Prof. del Rio, has been found in the variegated sandstone at Culebras, in Mexico; is of a red and gray color: the specific gravity of the red is 5.66, of the gray 5.56: it consists of 49.0 selenium, 24.0 zinc, 19.0 mercury, 1.5 sulphur.

2. *Seleniuret of lead*, from the Harz, has the metallic lustre, lead gray color passing into blue, soft, specific gravity 6.8 to 7.69; it consists of 72.2 lead and 27.8 selenium.

3. *Seleniuret of lead and mercury*, from the Harz; lustre metallic, color lead gray, steel gray and black, soft; sp. gr. 7.3; it consists of 24.97 selenium, 55.84 lead and 16.94 mercury.

4. *Carbonate of bismuth*, from Cornwall, in gray and brown masses; it consists of 28.8 oxide of bismuth, 51.3 carbonic acid, 2.1 oxide of iron, 7.5 alumina, 6.7 silica, 3.6 water.

5. *Kakoxene*, from Bohemia; soft concentric fibres and small soft crystals of an ochrey yellow color; it consists of 8.9 silica, 17.86 phosphoric acid, 10.01 alumine, 36.32 oxide of iron, 0.15 lime, 25.09 loss, water and fluoric acid.

6. *Kerolite*, from Zoblitz, in Saxony and in Silesia; occurs drusy, lamellar and compact; has a conchoidal fracture; lustre vitreous but greasy; color white and green, and is transparent or translucent; specific gravity 2.0 to 2.2.

7. *Tephroite*, from Sparta; compact, uneven fracture; adamantine lustre; color gray; specific gravity 4.1.

8. *Turnerite*, from Dauphinée; lustre, adamantine; color, yellow and brown, transparent and translucent.

9. *Bustamite*, from Mexico; drusy, of a bladed structure; color gray, greenish and reddish; is almost opake, and scratches felspar; specific gravity 3.1 to 3.3; it consists of 48.90 silica, 36.06 oxide of manganese, 14.57 lime, 0.81 protoxide of iron. It will take its place near the silicate of manganese.

10. *Stilpnomelan*, from Silesia. It occurs in fibrous, radiated and compact masses; colors black and green; lustre greasy; is opake; specific gravity 3.

11. *Brookite*, from Dauphinée and Wales, with Anatase. The crystals are rhombic prisms, with the angle of 100°; lustre metallic adamantine; color brown, orange yellow, reddish; translucent to opake; hardness 5.5 to 6.0.

12. *Polymignite*, from Norway, in zircon sienite. The crystals are rhombic prisms; conchoidal fracture; metallic lustre; black color; is opake; sp. gr. 4.8; it consists, according to Berzelius, of 46.30 titanic acid, 14.14 zirconia, 12.20 oxide of iron, 4.20 lime, 2.70 oxide of manganese, 5.00 oxide of cerium, 11.50 yttria.

13. *Pyrochlor*, from Norway, in zircon sienite. It occurs in octahedrons; conchoidal fracture; smooth surface; lustre vitreous and greasy; color brown; is opake; sp. gr. 4.2; it consists, according to Wöhler, of 62.75 titanic acid, 12.85 lime, 5.18 protoxide of uranium, 6.80 impure oxide of cerium, 2.75 oxide of manganese, 2.16 oxide of iron, 0.61 oxide of tin, 4.20 water.

14. *Pyrophyllite*, from the Ural. This mineral has been known to mineralogists under the name of radiated talc, (steatite,) but its behavior before the blowpipe is very peculiar. Heated by itself, it swells up in leaves and increases into a volume twenty times greater than its original bulk, and the dispersed mass is infusible; heated in a retort, water is condensed in the upper part, which does not injure the glass, and does not leave silex by evaporating. Soda dissolves the mineral with effervescence; heated with a solution of cobalt, it becomes of a blue color. It is therefore distinguished from steatite, by its relation to solution of cobalt, the water which it contains, and by its division in separated leaves. According to R. Hermañ, of Moscow, it consists of 5.62 water, 59.79 silex, 29.46 alumine, 4.00 magnesia, 1.80 oxide of iron, some oxide of silver, and has the formula $M'g^3S'''i^3 + 3A'''l^3S'''i^6 + 10H$.

33. *Notice of an irised Aurora Borealis, by Dr. Lewis Feuchtwanger.*—After having had on Sunday, the 13th of September, 1829, the most majestic prospect of an eclipse of three-fourths of the moon in 42° 40′ N. lat. and 57° 56′ W. lon. from the South-East, which lasted one hour and fifty minutes, I was surprised to see at nine o'clock in the evening of Friday, the 18th of September, in 40° 35′ N. lat. and 64° 18′ W. long. in the horizon in the North-East, the most splendid *aurora borealis* which I ever beheld: large bundles of rays appeared in parallel form, beginning from the north, and went over to the North-East, from the horizon to the zenith, I observed from eight to twelve parallel bundles, which by continual changes of the colors, (but only from the different variations of the red to those of the blue) remained in a constant motion to each other, so that if one bundle of rays seemed to go beyond the zenith,* the other bundle appeared likewise to go lower down. The colors of the light, as well as the complete constant motion of the parallels, lasted, according to my observation on the watch, *one* hour; after this time I saw the number of the bundles becoming more concentrated; so that in the first five minutes I observed but four bundles, and they totally disappeared in the last ten minutes.

On Saturday evening, at nine o'clock, of the 19th of September, I saw in the same direction of the horizon, an *Aurora*, consisting of a very few bundles of radii, with a very weak lustre of light, and lasting but half an hour.

Extract of a letter from Dr. Buckland to Prof. Hitchcock of Amherst, dated February 1, 1830.

34. *Reliquiae Diluvianæ.*—I wish it were in my power to announce a speedy prospect of my second volume, but I dare not hope to have leisure to get it ready during the present year; although I have materials sufficient for two volumes, if I could find time to put them together.

35. *Antediluvian human remains.*—With respect to the recent discovery of human bones in the caves of the South of France, I believe there is much that deserves serious attention. The human bones in the cave of Bize, are admitted to be of modern origin; but the

*The word zenith may perhaps not be in the right place, since I did not see the whole spectacle over my head, but I cannot be so minute in describing the height of the radii in degrees.

two other caves described by Mr. Christol, seem, from his account, to contain bones of the human species, mixed with those of Hyaenas, in caves to which it seems there can have been no *Post-diluvian* approach; as they were entirely filled with gravel, so that no one could ever have gone in to bury them: and I place much reliance on the observations of Mr. Christol; as he is aware of the difficulties of an examination of the contents of a cave, and as I know his skill, from having been myself engaged with him in examining the bones in the cave of Zunel.

36. *Opinion of Prof. Buckland as to the Heidelberg collections of Geological specimens, noticed in the last Vol. of this Journal.*—I should recommend you to apply to Professor Leonhard of Heidelberg, who has an establishment there for making general European Collections in Geology, to be sold at a very moderate price. One of his pupils has been lately in England, and I believe has made collections from many of our English strata, to form part of his European series, which I believe will be very good, and very cheap.

Notices, translated and Extracted by Prof. J. Griscom.

37. *Cements for iron water pipes.*—M. Gueymard, in an interesting statement of the introduction of water into the city of Grenoble, says that the mastic which he has employed to connect the pipes has been known for some years, by the name of *Aquin.* Most of the recipes vary, and those which he had obtained directly from Vienna, Lyons, Paris, and by correspondence from London, do not answer his purpose. For this reason he commenced a series of experiments, and found the following composition, acquired the hardness and compactness of good cast iron.

I mingle ninety eight parts of cast iron filings (pounded turnings) passed through a coarse seive, and not oxidized, with one part of flowers of sulphur. When intimately mixed, I take one part of sal-ammoniæ, and dissolve it in boiling water; and pour this solution on the preceding mixture and agitate it thoroughly. The quantity of water ought to be such as to reduce the whole to the consistency of common mortar.

This cement disengages a great quantity of heat and ammonia, and should be immediately used. It is pressed forcibly into the joints, and after drying two or three days in the open air in summer, and from seven to eight days in winter, the pipes may be covered, with an assurance of their solidity.

In all the basins or reservoirs of the city, he used only this cement, and the joints prove to be as tight as if cast iron had been melted and poured into them, or as if the cisterns were made of glass. They stand in no need of repairs.

He recommends this cement in all cases of hewn stone and other solid works exposed to the weather, as in bridges, aqueducts, conduits, &c.—*Annales des Mines, Tom.* V. *3d liv.* 1829.

38. *Potatoe Cheese.*—In Thuringia and part of Saxony, a kind of potatoe cheese is made which is very much sought after. The following is the recipe: select good white potatoes, boil them, and when cold, peel and reduce them to a pulp with a rasp or mortar; to five pounds of this pulp which must be very uniform and homogeneous, add a pint of sour milk and the requisite portion of salt;—knead the whole well, cover it, and let it remain three or four days, according to the season;—then knead it afresh, and place the cheeses in small baskets, when they will part with their superfluous moisture;—dry them in the shade, and place them in layers in large pots or kegs, where they may remain a fortnight. The older they are the finer they become.

This cheese has the advantage of never engendering worms, and of being preserved fresh for many years, provided it is kept in a dry place, and in well closed vessels.

Other proportions of pulp and curdled milk are used, but the above is preferred.—*Bull. d'Encour. Sept.* 1829.

39. *On the supposed influence of magnetism in the phenomena of Chemical combinations and crystallizations; by* Prof. Erdmann.—From the discordant statements of Chemists with regard to the effects of magnetism, on the oxidation of metals, crystallization of salts, changes of color in vegetable tinctures, &c. Prof. Erdmann was induced to examine the question with renewed care. He was persuaded that in the midst of so many disturbing causes, the question could not be fairly decided by one or two experiments, which appeared to have been the extent of the trials of those who had pronounced a decision upon it.

His magnetic apparatus appears to have been selected with much care, and to have possessed a very adequate force. The greater part of the experiments were made in a south west chamber, in which the light was distributed upon the apparatus equally from all sides. It was in no case exposed to the direct rays of the sun.

His first experiments related to the oxidation of pure iron by terrestrial magnetism. It was found necessary to use extreme precaution in choosing the iron on account of the great inequality observable in its texture. The best chosen wires are far from being homogeneous. Among ten pieces, a few inches long, cut from the same wire, and which appeared identical, not one was found, which, in an acid, was attached equally in all its points. In some of his first trials, the northern end appeared more oxidized, but he recollected, that he had handled them with naked hands, and remarked that the light fell upon them unequally. After using every precaution, the result of thirteen experiments is

I. On oxidation.

1st. That the oxidation of iron placed under water is not influenced by terrestrial magnetism. There is no point in the horizon toward which it is placed, which produces either a stronger or a more prompt effect.

2nd. The oxidation which proceeds from the unequal texture of the iron, always begins at the points in which the iron is in contact with some other body, not only metallic, but with wax or earthern ware.

3rd. Diffused light, or weak solar rays neither hasten nor retard oxidation, when the heat accompanying it is insensible, as is the case in a warm room in winter.

II. Eleven experiments were made to ascertain whether magnetic needles would be acted on in water or in acids differently from needles unmagnetized, and the result presents nothing whatever favorable to the opinion of there being any difference in the oxidability of the two poles of a magnet. They confirm what had been observed with regard to the contact of foreign bodies.

III. Fifteen experiments were cautiously made to determine whether terrestrial magnetism had any influence in the crystallization of nitrate of silver or formation of the Arbor Dianæ by means of mercury in a syphon tube; and others, with respect to the precipitation by Zinc, of acetate of Lead. In none of these cases was it found that terrestrial magnetism had any effect whatever. Neither the position of the tube, nor even diffused light, appeared to hasten or retard the crystallization.

IV. Similar experiments were made by attaching the poles of a strong artificial magnet to the two branches of a syphon by means of wax. The magnet produced no effect, neither had a compound horse-shoe magnet any influence on the formation of crystals on a flat bottomed porcelain cup standing upon its poles.

V. Mr. E. had no better success in repeating the experiments, which indicated an influence of the poles over vegetable colors. He was convinced that those persons were by some means mistaken who thought they had witnessed a certain effect, and that too with instruments more feeble than his own.—*Bib. Univ. Oct.* 1829.

40. *Animal Putrefaction.*—It is remarked by Chas. Matteucci, that the decomposition of animal matter during the putrefactive fermentation, depends chiefly on the agency and affinities of atmospheric oxygen. This element, by uniting with those contained in animal substances, gives rise to the production of carbonic acid, water, carbonate of ammonia and acetic acid, which are the principal results of animal fermentation. Hence he conceived that if this affinity were counteracted by rendering animal substance electro-negative, or in other words, if they were put into the same electric state as oxygen, putrefactive decomposition would be retarded. With this view he placed some pieces of muscle on plates of zinc; others on plates of copper, and others were left to themselves. It was soon perceived that the metals, and especially the zinc, retarded putrefaction, and also that the products of the decomposition were different, and always in relation to the electric state or affinity, determined by the contact. Thus the muscle in contact with the zinc, afforded carburetted hydrogen and ammoniacal products; and that in contact with copper, much acid and acetate of copper. The former, therefore, having become electro-negative, could not unite with oxygen, but yielded at length to the weak affinity of hydrogen and azote, whilst on the contrary the muscular fibre on the copper resolved itself chiefly into acid products. Effects still more decided have been obtained by connecting muscular fibre as a conductor to one of the poles of a pile. It is perhaps in this way that antiseptics operate. These bodies, it is true, do not all act alike. Some depend on their attraction for water, others form real imputrescible combinations; but others, in the opinion of the author, are effective by determining a particular electrical state. It is well ascertained, for example, that if vegetable charcoal be put upon

purulent sores or putrescent wounds, it soon deprives them of their bad odor, and prevents the ulterior developement of fetid matter. These effects cannot be ascribed altogether to porosity, or it would cease by prolonged contact; but regarding the action as electro-motive, it establishes in these wounds, electric states, which destroy the affinities that give rise to putrefactive or purulent compounds.—*Annales de Chimie, Nov.* 1829.

41. *On the dark precipitate of Platina of Ed. Davy, and on the property of spongy Platina, by* M. Liebig.—The black precipitate of Davy is obtained by heating the sulphate of the oxide of platina with alcohol. This substance when dried emits an ethereal odor, and possesses the remarkable property of becoming red hot when moistened with spirit of wine, and continuing so as long as the alcohol remains. Acetic acid is formed during the ignition.

M. Doebereiner ascertained that this substance absorbs all the combustible gases, but does not absorb either oxygen or carbonic acid. Saturated with hydrogen and placed in contact with oxygen, it effects their combination, and becomes incandescent. Presuming that finely divided platina might possess the same property, he tried it, and thus discovered the remarkable inflammation of hydrogen by spongy platina.

The best mode (according to the author) of obtaining the black precipitate, is to procure the *chloruret* (chlorure) of platina, by heating strongly, and for a long time, the *chloride* of the same metal, and to treat this chloruret, which has a greenish yellow color, with a concentrated solution of potash. It forms with heat a perfect solution, dark and thick, into which alcohol is to be poured by slow degrees, shaking it well. In a short time it effervesces strongly, discharges much carbonic acid, and a very heavy velvet-black powder subsides, which must be boiled successively with a little alcohol, hydrochloric acid and potash, and lastly four or five times with water, and then washed and dried in a porcelain capsule, without coming in contact with a filter or any organic substance.

This dark powder is granular and hard, and loses no weight by being strongly calcined in the air. It dissolves in aqua regia, and gives a limpid solution, which contains only chloride of platina. Moistened with spirits of wine, it quickly ignites, and produces acetic acid; placed in a receiver filled with oxygen, over mercury, and moistened with alcohol, the mercury soon rises, acetic acid is formed without the least trace of carbonic, and in a week or a fortnight the oxygen is completely absorbed.

In the air, it instantly inflames hydrogen. Its specific gravity is about 16. It is therefore nothing more or less than metallic platina extremely divided, acting like spongy platina, only in a more intense degree.

Metallic platina precipitated by zinc, from its acid solution possesses the same properties.

The platina black (to avoid periphrasis) possesses in the highest degree the property of absorbing and retaining a multitude of gases.

If it is not boiled well in water, or if, before drying it, it is moistened with spirit of wine, the latter cannot be expelled entirely even under the air pump. If, in this condition, it is heated to the temperature of boiling water, it begins to ignite, and burns the paper on which it is placed. Even though entirely deprived of alcohol, and after being dried in an exhausted receiver aided by the presence of sulphuric acid, if brought suddenly into contact with air, it becomes occasionally so heated by the absorption as to ignite and burn the paper.

The solution of chloruret of platina in potash, being mingled with a notable quantity of nitrate of copper forms by boiling in spirits of wine, a precipitate which though it contains at least twice as much oxide of copper as platina, retains the property of igniting with alcohol.

According to Mr. Doebereiner, one hundred grains of platina black absorb twenty cubic inches of hydrogen gas. This reduced to comparative volumes gives one to seven hundred and forty five, which sufficiently accounts for the great elevation of temperature and ignition with hydrogen or alcohol.

Even iron, possesses an analogous property. If obtained by the reduction of its oxides by means of hydrogen; it is in such a state of extreme division as to combine with oxygen, so rapidly as to inflame at the common temperature.

Both the black and the spongy platina lose the property of inflaming by continued use, owing to their becoming more dense or less porous, or from having their pores obstructed by foreign matter; or from the air which they contain losing its oxygen. The method of restoring the property is to boil it in nitric acid, which has no other object than to expel and replace this air. Boiling the sponge in water answers the same purpose.

The absorbing power of finely divided platina appears to be analogous to that of some other substances except that it acts so much more powerfully on inflammable gases. Charcoal absorbs very little hydrogen, not so much even as dry wood. The effect in each case doubtless depends in a great measure on the relative dimensions or figure of the molecules of the gas and of the imbibing substance. Hydrogen contained over mercury in a receiver, which has a crack in its upper part, will gradually escape and the mercury will rise, in opposition to its gravity. No other gas possesses this property.

It would appear reasonable to ascribe the ignition of the spongy platina in part to the extermination of latent heat, arising from the affinity of oxygen and hydrogen, or in other words, to electrical action. But charcoal absorbs both ammoniacal and muriatic acid gases in equal proportions, when the electrical states are directly opposite. Affinity therefore cannot be the cause of the absorption, nor is it more probable that it is so in the case of platina and hydrogen.* —*Idem.*

42. *Reduction of nitrate of Silver.*—Some fine crystals of this salt were wrapped in unsized paper and put carelessly into a pasteboard box. Having been found a few years after, the paper had acquired as usual a deep violet color, but to the surprise of the manufacturer, the crystals, without losing their form, had become converted into metallic silver, which was very malleable.—*Idem.*

43. *Flesh of young calves.*—By a municipal law in Paris, it is forbidden to expose for sale the meat of calves less than six weeks old. The great profit arising from the sale of milk furnishes an inducement to the violation of this law. Many thousands of cows are kept and fed in cellars, within the walls of Paris for the sale of the milk, and unless a cow yields a calf about once a year, she is less profitable.

The prohibition of the sale of very young calves, is deemed of great importance to public health. At less than a month old, the

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*Has the experiment been tried of causing dry powdered fresh charcoal to absorb a portion of ammonial gas, and then to place it over mercury in a receiver filled with muriatic acid gas? would ignition ensue? J. G.

flesh of the calf is not even gelatine, but a viscid and glutinous juice, containing very little fibrine, (which is an animal substance essentially nutritious) still less ozmazome, a principle exciting to the digestive organs. Hence there are few stomachs capable of supporting such food; and were it digestible, it would strengthen and nourish the body very badly. More frequently it resists the digestive powers, becomes a foreign and inert substance, which excites the secretion of no fluid, traverses rapidly the intestinal canal, and thus creates obstinate diarrhæas, frequently accompanied with cholic. If such is the effect of one or two meals of this kind of aliment what must be the result of a habitual use of it? To what extent does not the public health suffer by such an injurious diet?—*Annales d'Hygiene publique, Jan.* 1830.

44. *Cloth of Amianthus.*—The method of preparing Amianthus for the purpose of making incombustible cloth, is thus stated in an Italian Journal.

The Amianthus is exposed to the action of steam, in a vessel made for the purpose, and which will hold more than 3000 pounds of the mineral, and so that all parts of it may be acted on by the steam. The fibres, by this action, become loosened and require so much flexibility that they are easily separated so as to obtain thread as fine as silk, and of several decimeters (about four inches) in length.—*Idem.*

45. *Charlatanism.*—Under this head, the council of salubrity of Paris in their last reports to the Prefects of police remark as follows:

"The council has already been in the practice of pointing out to the administration the danger of a particular kind of charlatanism, which consists in selling chemical or pharmaceutical preparations, and even raw materials under false denominations. Thus, in the market, soda is sold for potash; sulphate of soda for sulphate of magnesia, under the name of Epsom salts; impure potash, bleached, for salt of tartar; cream of tartar for salt of sorrel; minium for cinnabar, &c. &c."

In the sale of medicaments great abuses also exist.

Every day, there are announced in handbills or newspaper advertisements, by a great number of apothecaries, particular medicines, for the preparing of which they say, they alone have the recipe; while at the same time, these pretended secret remedies, when examined by the professors whose duty it is to visit their shops, are found to be nothing more than preparations described in the formularies of Paris, London, Edinburgh, Vienna, Berlin, &c. which they have thus appropriated to themselves and sell under names of their own invention.

Such deception, which has all the characters of fraud, produces serious inconvenience, and must be attended with unhappy consequences. To suppress it, one of the most effectual means would be, to order that all simple or compound substances, used either in the arts or medicine, should be sold only under the name, or one of the names, by which they are generally known, so that the purchasers, by consulting the works which treat of these substances, may always ascertain their nature, quality and use. The counterfeiters, brought before the proper tribunals, would then become subject to the penalties against fraud.—*Idem.*

46. *Chemico-Magnetism.*—M. Zantedeschi, of Pavia, in a communication to the Bib. Univ. of Geneva, states, that he had perceived a more decided chemical action in needles suspended from a horse-shoe magnet, than in those unconnected with magnetism, and also a stronger action at the north pole than at the south. His experiments are in direct opposition to those of Professor Erdmann, and therefore need confirmation. But he further states, that having taken a horse-shoe magnet, of about one pound in weight, and capable of supporting from four to five pounds, he bound a very fine copper wire round each of its poles, each wire extending fifteen or sixteen feet beyond the magnet. In connecting the ends of these wires with those of a multiplier of two needles, he observed a deviation of 8° to 10° sometimes in one direction and sometimes in the other, according to the position of the poles of the magnet. This phenomenon, he observes, could not be attributed to the electromotive faculty of the metals. Since each side was symmetrical, and precautions were taken to prevent any effect from temperature. It appears, therefore, that the north pole of a magnet acts like the zinc pole of a voltaic battery. Prof. Z. wishes that other experimenters may repeat the trial with more sensitive instruments.—*Bib. Univ. Jan.* 1830.

47. *Analyses of Pollen*, by Macaire-Prinsep.—The only dust of the stamina of plants which has been subjected to analysis, is that of the date tree (*Phœnix dactylifera*) brought from Egypt by Delille. Fourcroy and Vauquelin found it disagreeable to the taste, and they

discovered in it malic acid, phosphates of magnesia and lime, a soluble animal matter, and a portion of insoluble animal matter, between gluten and albumen. They concluded that probably the pollen of all plants contained azote.

The pollen of the cedar having been analysed by the author by means of the oxide of copper, he obtained only 40. of carbon, 48.3 of oxygen, and 11.7 of hydrogen, without an atom of azote. By treating it in the cold it gave water, a reddish oily liquid, thick, strongly reddening turnsol and giving no ammoniacal odor with pure potash. It appears then certain, that the pollen of the cedar differs from that of the date, in containing no animal matter. This induced the author to examine it more minutely, and from the most careful trial it appeared to contain—Acidulous malate of Potash, Sugar, Sulphate of Potash, Silica, Gum, Yellow Resin, Phosphate of Lime, and a vegetable substance constituting its greater portion, somewhat like starch, though differing in its sensible characters.

Lycopodium (perhaps the pollen of L. Lavatum) gave analogous results, although by analysis it yields 10 per cent more carbon, which explains the comparative splendor of its flame.

Carbon,	-	-	50.2
Oxygen,	-	-	39.2
Hydrogen,	-	-	8.6

Bib. Univ. Jan. 1830.

48. *On metallic decompositions by phosphuretted hydrogen gas*, by H. Rose.—The two phosphuretted hydrogen gases act differently on metallic solutions from sulphuretted hydrogen. Water is formed; but instead of a metallic phosphuret, phosphoric acid is produced and the metal is reduced. It is however only those metals whose affinity for oxygen is very weak, that are thus reduced. The precipitate formed by the two phosphuretted hydrogen gases, in a solution of gold consists of the reduced metal. All the solutions of silver are decomposed, and a brown precipitate, which becomes a greyish metallic white, is formed, which consists of silver only, without a trace of phosphorus. Phosphoric acid is formed.

Sulphate of copper, decomposed by per-phosphuretted hydrogen, gives a black powder, which is reduced; copper and the liquid contains a corresponding quantity of phosphoric acid. But although, according to Rose, no phosphurets are formed during the decomposition of metallic solutions by phosphuretted hydrogen, it is remarked by M. Buff, that immediately after the precipitation of sulphate of copper by phosphuretted hydrogen, there was no phosphoric acid in solution, and that none could be obtained until after the precipitate was treated with aqua Regia.—*Idem.*

49. *On the treatment of siliceous minerals by carburetted alkalies.*—The easy fusion which Berthier has observed in a great number of salts mixed in atomic proportions, may be applied to the treatment of siliceous minerals by carbonate of potash or soda over a spirit of wine lamp. If 5 parts of carb. of potash, and 4 of carb. of soda, be mixed together, the mass will melt so easily, that 15 grammes of it (235 grains) may be perfectly melted over a double current lamp. If sand be added to the mixture, as strong an effervescence is produced, as if an acid were added. This occasions a spirting of the materials, and by a too free addition of the siliceous mineral, the mass becomes too difficult to fuse. It requires also to be in fine powder and intimately mixed; and on this account it is necessary to begin with the mixture of the two carbonates. In this way, several grammes of feldspar may be promptly decomposed by the alcoholic lamp.—*Idem.*

50. *Change of color in the wood of certain trees.*—M. Marcet ascertained by a great number of experiments, that the wood of the alder, which, when exposed to the air, acquires a red color, does not undergo any change of color, if at the moment when the branch is cut transversely, it is placed in a perfect vacuum, or in a gas containing no oxygen; and on the contrary, that the red color becomes deeper in oxygen gas than in atmospheric air. If the wood, after being cut, is plunged in water, it always reddens, though immediately introduced into a vacuum or gas containing no oxygen. Alder wood which had acquired a yellow color, gave it out by degrees to water, and the water being evaporated, yielded a coloring matter which had all the chemical characters of pure *tannin.* Hence the discoloration of the wood is ascribed to oxygenation at the moment when it is exposed to the atmosphere. In these experiments the branch must be cut transversely, for if the bark only be taken off, the change of color is much less decided.—*Bib. Univ. Feb.* 1830.

Copious extracts, on other subjects, furnished by Prof. Griscom, will appear in the next number, there not being room in this.

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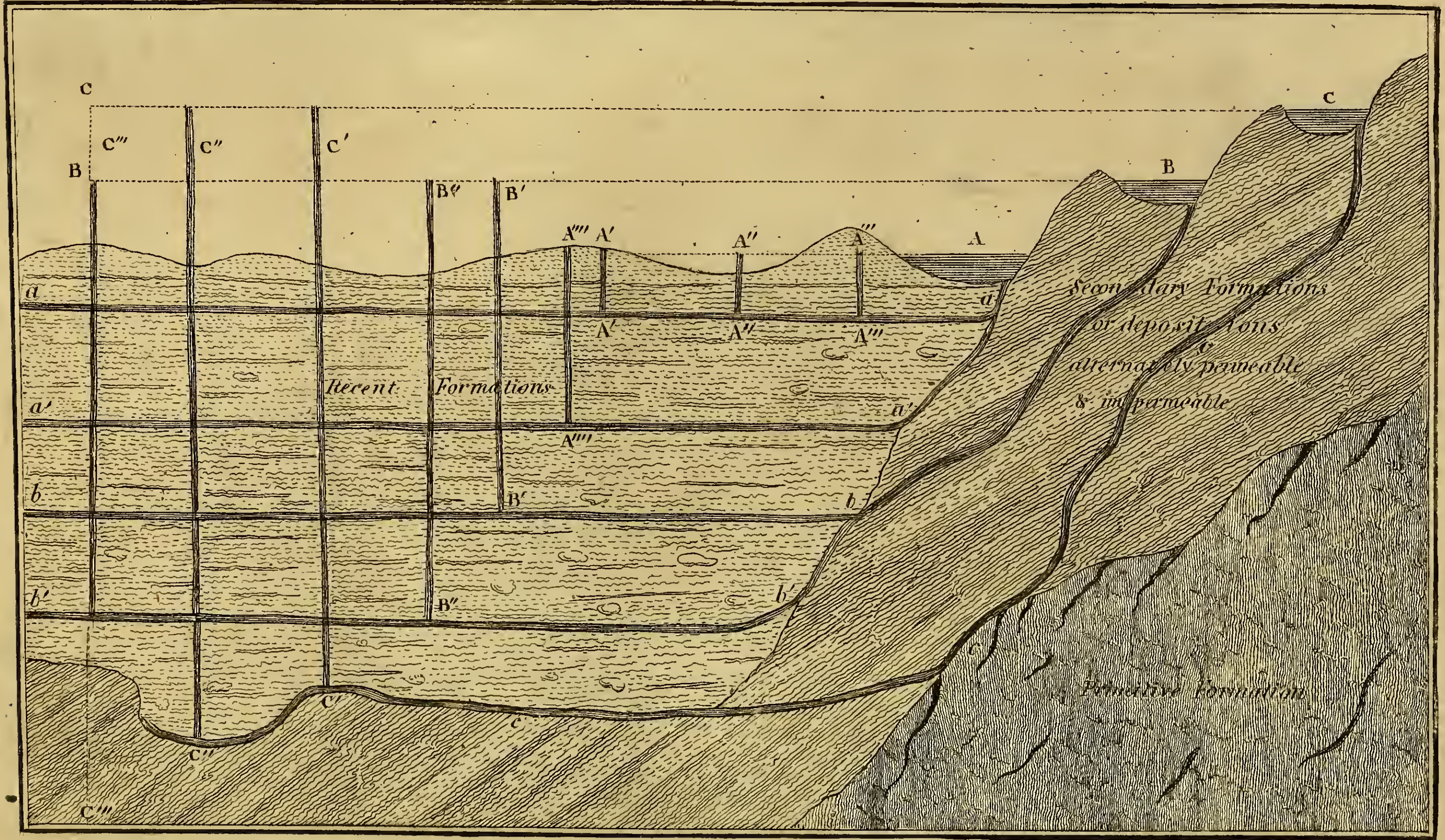

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Theory of Springs & Fountains. Plate II.

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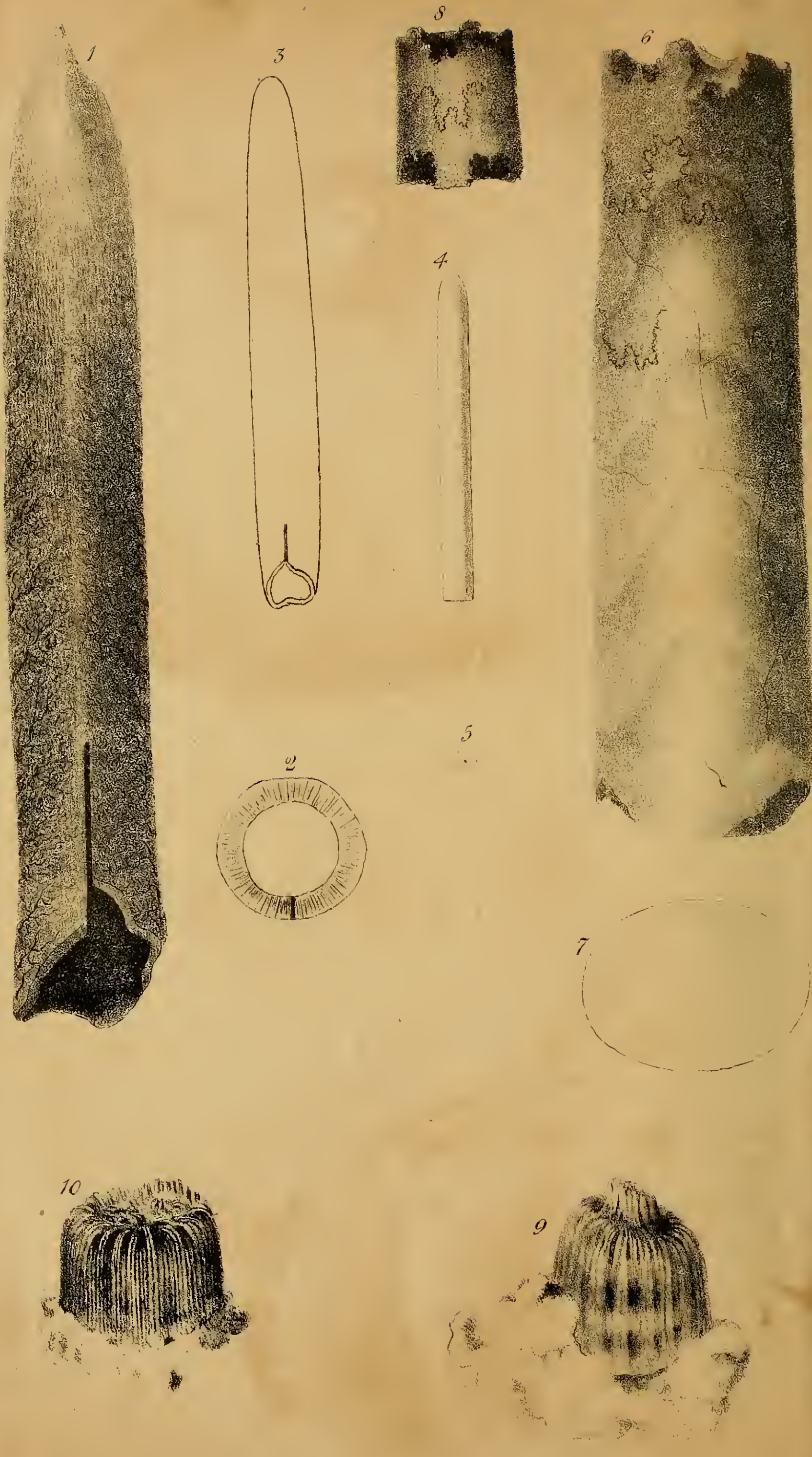

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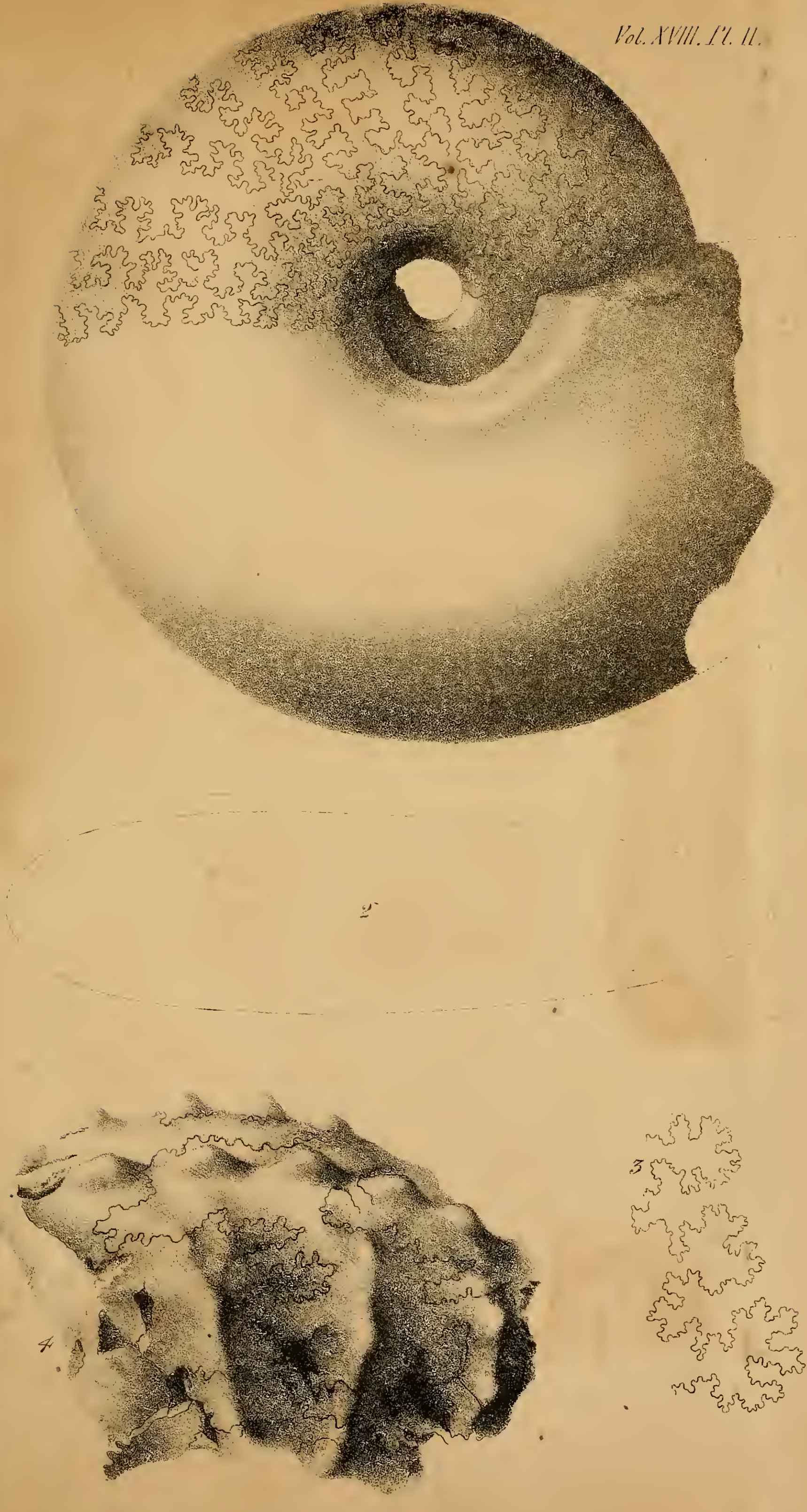

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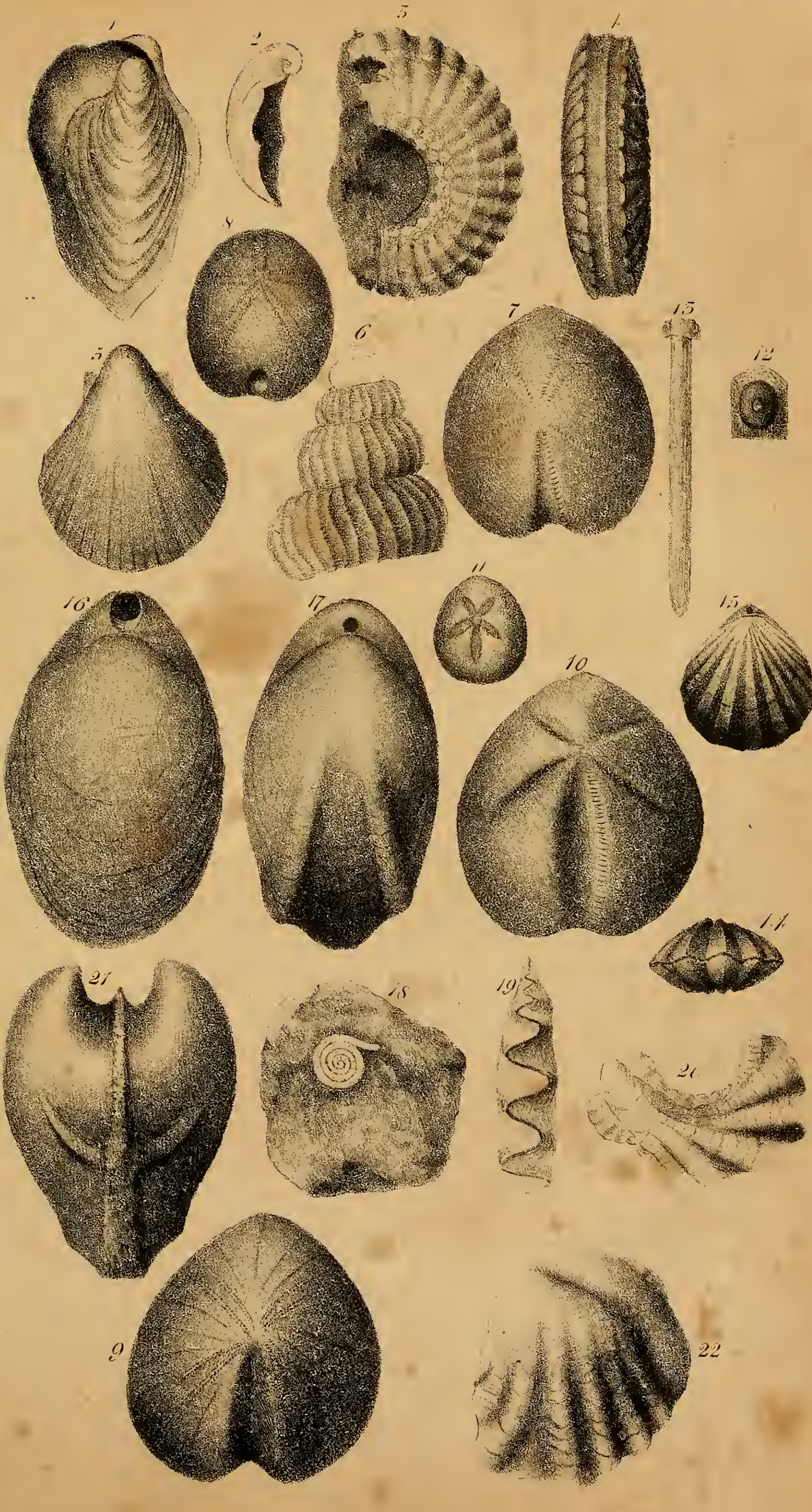
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