X. Extract from the report respecting experiments made at the Polytechnic School in the years V. and VI. on the combustion of the diamond

C. Guyton

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bibed by, or communicated to, any body whose power of receiving and retaining heat is much less.

The capacity of water to receive and retain heat, or what has been called its specific quantity of latent heat, has been found to be to that of gold as 1000 to 50, or as 20 to 1; consequently, the heat which any given quantity of water loses upon being frozen, were it to be communicated to an equal weight of gold at the temperature of freezing, the gold, instead of being heated 162 degrees, would be heated $140 \times 20 = 2800$ degrees, or would be raised to a *bright red heat*.

It appears therefore to be clearly proved, by my experiments, that a quantity of heat equal to that which 4214 grains (or about $9\frac{1}{4}$ oz.) of gold would require to heat it from the temperature of freezing water to be *red hot*, has no sensible effect upon a balance capable of indicating so small a variation of weight as that of $\frac{1}{1000000}$ part of the body in question; and if the weight of gold is neither augmented nor lessened by *one millionth part*, upon being heated from the point of *freezing water* to that of a *bright red heat*, I think we may very safely conclude, that ALL ATTEMPTS TO DISCOVER ANY EFFECT OF HEAT UPON THE APPARENT WEIGHTS OF BODIES WILL BE FRUITLESS.

X. *Extract from the Report respecting Experiments made at the Polytechnic School in the Years V. and VI. on the Combustion of the Diamond.* By C. GUYTON.

[Concluded from Page 61.]

Repetition of the Experiment in Fruclidor, Year VI.

AFTER examining what means were most proper for preventing the vessels from cracking by the inequality of their dilatation, it was found that there were none more certain than to employ, instead of a glass bell, a well-chosen globe of a moderate thickness, and of such a size that its surface might be at a sufficient distance from the point of the luminous cone.

The

The globe which we judged best for answering these conditions was 28·63 centimetres in diameter: its content was 123·25 decilitres, or 12,325 cubic centimetres, comprehending that portion of the neck which it was thought proper to retain, and which was 159 millimetres. That we might the more easily observe the rising and falling of the mercury in the inside, and thence determine the volumes of gas, we cemented on the outside slips of paper, on which we traced, by means of measured vessels, scales indicating decilitres, or or 100 cubic centimetres.

It may be readily conceived, that it was not possible to fill so frail a vessel with mercury in order to displace it afterwards by oxygen gas. In transferring the gas by means of water, we should have been obliged to leave a portion of that liquid on the interior side of the vessel. We determined, therefore, to convey the gas, at the moment when it was disengaged from the oxygenated muriat of pot-ash, by means of a tube adapted to the distilling apparatus, and made to descend to the bottom of the globe in such a manner that the common air should be forced to issue from the globe by another pipe fixed in the stopper of the orifice, and communicating with the pneumatic tub.

This process is exactly the inverse of that which I proposed in my work on *aërostats**, to fill a balloon of inflexible matter with hydrogen gas. It was founded on the same principle—the difference of the specific gravity of the two fluids. Here it had the advantage of leaving the vessel perfectly clean; an important condition, and which it is so difficult to obtain when air is expelled by mercury.

It was readily foreseen that the first portions of the oxygen gas would become mixed with the atmospheric air, and that it would be necessary to displace this mixture several times by new quantities of oxygen gas, that no more azotic gas might remain in it, or, at least, that the remaining quantity should be so small as to be incapable of having a sensible effect on the results of the experiment. We had even contrived means to determine it, by receiving under the pneumatic bell the

* Description de l'aërostat de Dijon, &c.

last portions displaced, that we might subject them to a eudiometric proof.

With this view we employed 18 decagrammes (about six ounces) of the oxygenated muriat of pot-ash, which were put into a retort, at once to furnish, at one operation, the whole quantity of the gas necessary for this renewal.

Those who have not tried themselves this method of substituting one æriform fluid for another, might entertain some doubt respecting the purity of that employed in our experiment; but it will be easy for me to remove it. This was an article of so much importance that we could not neglect attempting to collect proofs of it.

We know with what success M. Humboldt applied to the improvement of eudiometry. The interest which he took in our experiment induced me to invite him to come and determine himself with those instruments, and by those processes, which were familiar to him, the purity of the oxygen gas in which the combustion was to take place. He readily accepted my invitation, as I had reason to expect, from his well known zeal for the progress of science; and this article of our report is the production of his pen. I had likewise the satisfaction of seeing him apply eudiometric instruments to the examination of the residuum of the gas after the combustion. The following is the result of the proofs to which he subjected that introduced into the apparatus to serve for the combustion:—

Nitrous gas, disengaged, by means of copper, from weak nitric acid, was tried with sulphat of iron and oxygenated muriatic acid, which shewed in it from 0.09 to 0.10 of azot. One hundred parts of oxygen gas received, towards the middle of the operation, as it issued from the globe, in which we had proposed to displace, in succession, common air by oxygen gas, were mixed with 300 parts of this nitrous gas: there was an æriform residuum of 0.66: making allowance for 0.27 or 0.30 of azot, pre-existing in the nitrous gas, we judged that, in 100 parts of gas tried, there were still 36 of azotic gas.

We then continued to introduce into the globe fresh oxygen gas. We collected towards the end a portion which was
subjected

subjected to the same proof, in the same proportions, with the same nitrous gas. The residuum this time was only 30 parts; and as the 300 of nitrous gas employed contained nine or ten parts for $\frac{9}{10}$ of azot, we concluded that this oxygen gas was quite pure.—These are the words of M. Humboldt.

When this first condition was fulfilled, the question then was to place, in the centre of this globe, the diamond destined for the experiment. We had previously formed a small cup of the lower portion of a furnace-pipe, the tube of which, five centimetres in length, was fixed to an iron stalk, and this stalk was stuck into a cylinder of cork destined to be inserted in the neck of the balloon. This cork was dipped in mastic to shut its pores, and a small glass tube passed through it to establish a communication between the inside of the balloon and the mercurial tub. (See fig. 2. Plate II.)

We then placed the diamond on the cup, where we left it, having put it there by means of a ribbon, which we drew from under it in an instant, as soon as the balloon had been inverted, and its neck immersed in the mercury. The balloon in this position was made fast in a kind of collet, which rested on the edges of an iron mortar that served as a hydrargyro-pneumatic tub. We then exhausted, by suction, a portion of the oxygen gas sufficient to make the mercury rise to 12 centimetres above the orifice of the balloon.

The diamond was the same that had been already exposed to the action of the solar fire towards the end of the experiment of the preceding year, and which had lost only two deci-milligrammes, and consequently weighed 199.9 milligrammes (3.766 grains), or one carat wanting $\frac{1}{3}$.*

On the 5th Fructidor last year, at one in the afternoon, we began to throw upon the diamond the focus of the large lens of the National Institute. The thermometer, exposed to the sun under a bell-glass, indicated 29.75: the mercury in the barometer stood at 75.89 centimetres, (28 inches 0.5 lines.) The volume of air, inclosed by means of the mercury in the tub, brought to the pressure of 757.7 millime-

* It is well known that the carat of the jewellers is only 205.72 milligrammes.

Fig. 2.

Fig. 1.

Fig. 5.

Fig. 3.

Fig. 4.

tres (28 inches), and to the mean temperature of 12.5 degrees of the decimal thermometer, according to the experiments of Cit. Pneier, and the tables of Cit. Prony*, was then found to be 11,470 cubic centimetres.

Having taken the necessary precautions to heat gradually the balloon, the point of the luminous cone being almost in the centre, we were obliged to cover with a glass plate the wooden supporter, which was already on fire. The diamond first exhibited a black point at the angle immediately struck by the sun. We afterwards saw it entirely black, and as it were charred: we distinctly perceived, a moment after, brilliant points in a state of ebullition, as it were, on the black ground. The solar rays, having been for a moment intercepted, it appeared transparently red. The sun becoming obscured by a cloud, we saw it of a much purer white than it had been at the commencement of the operation.

The sun having emerged from the cloud, the surface of the diamond assumed the appearance of metallic splendour: it was then sensibly diminished, and there remained no more than a quarter, of a lengthened form, without angles or perceptible edges, but still very white, and of a beautiful transparency. We observed a slight fissure at the bottom of the pipe which supported it, but without any separation of the parts. I must not forget, that at the commencement of the combustion we thought we observed a purpureous cone arising from the support in the pencil of the solar rays; but this phenomenon was only an optical effect, which depended on the position of the observer.

The whole apparatus was left in the same state, only defended by an inverted box placed over it, until the 7th, when we again began, at one hour twenty minutes, to present the diamond to the focus. We soon observed the same phenomena as on the 5th, the black surface, the brilliant points in ebullition, which vanished and re-appeared according to the intensity of the focus: we saw also a brilliant metallic appearance, or rather leaden-colour. This is the expression which the assistants employed to characterise this phenomenon. At one hour forty minutes the diamond was entirely

* Journal Polytechnique, Part II, p. 65.

consumed. We at first suspected that there still remained a brilliant particle; but we soon judged that it was a vitrified point of the support, which was confirmed on inspecting the pipe when drawn from the globe. The question now was to collect the products of the combustion. No means seemed likely to be attended with more certainty than to introduce water of barytes into the apparatus, taking care to adhere, as nearly as possible, to the proportions indicated for the saturation of the carbonic acid, which we supposed must have been formed to prevent the uncertainty which the excess of this re-agent might occasion in the results. The whole apparatus being removed into the shade, we began on the 9th to draw out the pipe which served as a support, and observed on it two slight fissures occasioned by the contraction, and a spot of four or five millimetres in diameter, the centre of which had a vitreous appearance, and its edges a reddish hue. On examining it with a magnifying glass, we observed at the lowest point a space of two or three millimetres diameter, the surface of which was really vitrified, but of a tarnished and unequal colour. We distinguished a particle of white glass, pure and brilliant, formed into a globule some smaller portions of the same nature, and two small globules of a vitreous substance, which had a greenish red colour.

On one side we observed on the edges several other very small globules interspersed in a yellowish ground, and on the opposite a slight tinge of very bright red with very small reddish points. A particle of white earthy matter was at first taken for a fragment detached from the edges of the pipe, but it was found friable, and ascertained, by the stain it left on gold, to be oxyd of mercury. This examination being finished, we introduced into the globe five measures of saturated water of barytes, each of 46.5 cubic centimetres. The liquor immediately assumed a milky appearance, and there was a diminution in the volume of gas, which, calculated by means of the attached paper scale, amounted nearly to 300 cubic centimetres. Thus we might stop here and consider the experiment as terminated, and by making some allowance for the errors unavoidable in such manipulations, and make the result tally with the amount, determined before by the noble experiment of Lavoisier and Laplace, of the re-

spective quantities of carbon and oxygen which form the carbonic acid. Mr. Tennant seems to have done the same thing lately after the combustion of the diamond by nitre. But we should only have confirmed what was before known, or supposed to be known. Our object was not only to observe, with more attention, what took place during the act of combustion, but to ascertain, as accurately as possible, the nature and quantity of the product, and the reader will find that the labour undertaken on this subject has not been fruitless.

The liquor was agitated in the globe to mix the white matter which had been deposited. We drew out $4\frac{3}{4}$ measures of the five we had introduced by making use of the same inverted bottle filled with mercury, and which we raised on the inside by means of an iron stalk composed of several pieces, which could be adjusted by screws. (See fig. 6. Plate II.)

We introduced into the balloon three new measures, each containing the same quantity of distilled water, which was shaken in the inside to detach and collect what adhered to the sides. These united liquors, being immediately filtered in an open filtre, left 192 centigrammes ($36\cdot142$ grains) of carbonate of barytes dried in the heat of boiling water.

It may be readily judged what was our astonishment when proceeding to examine the liquor, instead of finding in it a slight excess of uncombined barytes, we observed that it changed neither the colour of turmeric nor that of logwood, and that, on the contrary, it acted on an infusion of turnsole as water charged with the carbonic acid. The presence of this acid unequivocally manifested itself, when we poured upon it a few drops more of barytes water, which immediately rendered it turbid. It was necessary to add even $4\cdot65$ centimetres of this water to saturate and precipitate the remaining acid gas. Being informed by this phenomenon that the production of the gas had been more considerable than we expected, and that some of it still remained mixed in the æriform fluid in the balloon, we took every measure necessary to determine the quantity. This we were luckily enabled to do by the divisions which had been marked on the scales, the orifice of the globe having never been yet taken out of the mercury.

When the barytes water was taken out, the apparent volume

lume was found to be exactly 122 decilitres, the internal column of the mercury above the level of the tub was 47 millimetres; the barometer being at 759.96 millimetres, (Fruëtidor 19, year VI.) the centegrade thermometer at 21.25, the real volume, at a mean pressure and temperature, was 112.426 decilitres, or 11242.66 cubic centimetres.

I still invited M. Humboldt to co-operate with us in examining the nature of this residuum of gas. It was transferred in his presence into a pneumatic tub prepared on purpose with distilled water, and received into four large flasks. The trial was made by the same instruments, and with the same nitrous gas, which had served for the oxygen gas before the combustion, and consequently containing from 0.09 to 0.10 of azotic gas. The trials made on portions extracted from different flasks varied from 31 to 34 in the quantity of the residuum of gas, in a mixture of 100 parts of gas examined with 300 parts of nitrous gas.

I shall not even take the mean term, I shall stop at the weakest, which indicates four hundredth parts of carbonic acid gas, which, I think, I can assert to be rather below than above the truth; since a portion of this same gas, brought into contact with ammonia, under a receiver, experienced a diminution of 4.5 *per cent*.

Let us now estimate the carbonic acid gas which entered into the composition of the 192 centigrammes of carbonat of barytes. According to Pelletier, whose accuracy is well known in researches of this kind, 100 of this earthy salt contain 22 of acid gas *, which gives 42.24 for 192; and as the cubic centimetre of gas weighs 1.847 milligrammes, it follows that the 42.24 centigrammes represent 228.621 cubic centimetres. If we now add, on the one hand, the 449 cubic centimetres, found in the residuum of the gas after combustion, and which, as we saw, formed the four hundredth parts; and deduct, on the other, the same quantity from the æriform fluid in which the combustion was effected, it results, that in 11470 cubic centimetres of oxygen gas contained in the balloon, there remained, after the combustion, only 10793; that 677 were consumed; that these 677 cubic centimetres of

* *Annales de Chimie*, Vol. XXI. p, 135.

oxygen gas, in the ratio of 1·3577 milligrammes each, produced, with the 199·9 milligrammes of the diamond, 1117·96 milligrammes of carbonic acid.

In the last place, that, instead of the proportions 0·28 of combustible substance, and 0·72 of acidifying principle, observed in the combustion of carbon, the proportion was, for the combustion of the diamond,

17·88 of carbon.

82·12 of oxygen.

100·00

Though it was not possible for me to doubt facts deduced from calculation, I at first hesitated to admit differences so considerable in the manner in which the same combustible united itself to oxygen in the quantities it could take up, and the products of its combustion; in a word, a carbonaceous combustible more abundant in real combustible matter than charcoal itself, and which at the same time differed so much from it in the degree of temperature necessary to determine the action of its affinity. But I soon began to reflect, 1st, That this would not be the only instance of the first degree of the oxydation of an acidifiable base having been operated with great difficulty, while the acidification was afterwards completed with the utmost facility: 2d, That several substances of the same kind presented to us also these two characters; a greater abundance in real carbon, and greater resistance to inflammation; so that they naturally placed themselves in an intermediary rank between the diamond and charcoal. These two considerations, still strengthened by the similarity of the phenomena observed during the course of our two experiments in the passage of the diamond to the state of carbonic acid, appeared to me to throw a ray of light on this subject hitherto so obscure.

In regard to the first consideration it will be sufficient for me to call to mind with what difficulty the commencement of a composition of azot and oxygen is formed by the direct way, and the high degree of temperature which it requires, while nitrous gas cannot be in contact with oxygen without passing immediately to the acid state. Charcoal will then be to the carbonic acid what nitrous gas is to the nitric, and the

the diamond will be to charcoal what azot is to nitrous gas. There will, therefore, be no longer occasion of wonder that more oxygen is necessary to that substance, which as yet has none of it, than to that which has already been united with the quantity necessary for arriving at the first point of saturation.

The second consideration rests on facts no less conclusive. Plumbago is a carbonaceous combustible, which does not burn but at a very high temperature, or in nitre in fusion; which produces by its combustion carbonic acid; which, as well as the diamond, is more abundant in combustible matter than carbon itself. We are indebted to the illustrious Scheele for the first observation of this fact. One part of carbon calcifies only five parts of nitre; one part of plumbago can calcify ten. The operation performed in a retort on 80 centigrammes of plumbago, gave him 357 cubic centimetres of carbonic acid gas*. This agreement will not be contested by those who, having been witnesses of our experiment, so unanimously declared, that the surface of the diamond assumed instantaneously a leaden colour.

This mineral is not the only body which presents these striking characters of a substance almost incombustible, and yet very abundant, in combustible matter. I described, sixteen years ago, in the Memoirs of the Academy of Dijon, a fossil found in a mass in the coal-pits of the Rive-de-Gier, which was sent to me under the name of *incombustible coal*, and which I then considered as real coal which had passed to the state of plumbago. I characterised it in that manner.

Our brother Dolomieu has described a fossil of the same kind, which he calls *carbure of alumine*, which is the *anthracolite* of Werner. I had already suspected that it was neither the presence of four or five centiemes of alumine, nor that of a still smaller quantity of iron, that rendered it incombustible, but the little advanced state of the oxydation of the carbon. I subjected it to two experiments, by which this was fully confirmed.

The object of the first was to determine if the alumine present was in a state of combination sufficiently intimate to

* Mem. de Scheele, French edit. Vol. II. p. 27 and 29.

refit the action of pot-ash by the humid way: 100 parts, put in digestion in that solvent, left in it 4.6 of alumine.

The second was, to ascertain whether this combustible, which possessed so little inflammability, had also the power to alcalese more nitre than carbon, consequently to take up more oxygen. Three successive trials gave for a mean result the alcalisation of 7.87 parts of nitre by one part of that mineral; and the same coally matter, digested for four or five days in oxygenated muriatic acid, burnt completely with 6.5 of nitre.

M. Klaproth, the celebrated chemist of Berlin, had before submitted to trials of the same kind a fossil described by M. Widenmann under the name of *incombustible coal*, and found that 100 parts left, after combustion at a very strong heat, only seven of a cineritious residuum; that treated in a crucible with eight parts of nitre, and the mass dissolved in water, acids occasioned no precipitate. Kirwan, in his experiments on coal, remarks, that that which he calls *Kilkenny coal*, and which has a metallic brilliancy, which does not burn but when carried to incandescence, and which then consumes slowly without emitting flame, can decompose 9.6 of nitre.

After this I do not see how there can remain any doubt that these supposed incombustible substances are real oxydes of carbon, which, like coal or charcoal, have the property of conducting the electric fluid; of cementing iron; of taking the oxygen from some acidifiable bases; but which are not at that degree of oxydation necessary for exercising this separating affinity at a weak temperature.

I must not omit this opportunity of making some application of this principle, which may become useful to the arts. It has not yet been sufficiently explained, why some animal and vegetable matters produce carbon so difficult to be incinerated; why charred pit-coal, known under the name of coke, or cinders, and which has been half burnt in the preparation, is, however, so powerful a combustible; why peat, or turf, the weakest of combustibles, acquires; by being properly charred, the property of welding large pieces of iron better than charcoal; and why, in the last place, charcoal, when exposed to a very strong heat in vessels impenetrable

to air, becomes there, in a certain degree, incombustible, as is proved in the experiment made by Mr. Tennant, which I have mentioned in the article Air in the *Dictionnaire de Chemie Encyclopedique*, Vol. I. p. 714.

The answer to all these questions may be found in the theory I have laid down: they are charcoals in the first degree of oxydation. Thus some of them have not yet acquired that which constitutes charcoal properly so called; others, after possessing all the qualities of vegetable and mineral carbon, have returned to the first degree by a real (*debrulement*) unburning of the remaining carbon; so that by losing their inflammability they become capable of fixing a greater quantity of oxygen, and consequently of setting at liberty a greater quantity of caloric when they find themselves at a temperature sufficiently high to determine and complete their acidification.

Some practical consequences will doubtless hence be deduced in regard to processes for the reduction of metals; for the cementation of steel, which it is probable takes up only oxyd of carbon, since it is separated from it in that state; for the incineration of the carbonaceous residuums of our analyses; for the carbonisation of wood, pit-coal, and turf: in a word, we may perhaps thence conclude the possibility of rendering useful those masses of pit-coal, said to be incombustible, found at Rive-de-Gier, by mixing it with more inflammable matters, to maintain the temperature which determines its combustion. Its position, texture, and all its exterior characters announce, as already said, that it consists of beds of coal changed by a subterranean fire; and this is confirmed by tradition, which preserved to that mountain, for three centuries, the name of the *Mountain of Fire*. (*Montagne de Feu*.) We can now pronounce that it is coke too far advanced, but so much the more susceptible of producing a great heat under favourable circumstances.

RECAPITULATION.

I shall here enumerate the consequences, or rather the facts, which result from the phenomena observed in the two

combustions of the diamond by the solar fire, and the experiments which followed:—

1. It is not only by the colour, weight, hardness, transparency, and other sensible characters, that the diamond *differs* from charcoal, as seems hitherto to have been believed;

2. Nor is it by the state alone of the aggregation of the matter that constitutes diamond:

3. Neither is it on account of the 200th part of the cineritious residuum left by carbon, or the small quantity of hydrogen which it contains.

4. It is more essentially by its chemical properties that it differs.

5. The diamond is the pure combustible substance of this genus.

6. The product of its combustion, or of its combination with oxygen to saturation, is carbonic acid without residue.

7. Carbon burns at a temperature estimated at 188° of the centigrade thermometer; the diamond does not inflame but at about 30 pyrometric degrees, which, according to Wedgwood's scale, makes a difference of 188 to 2765.

8. Charcoal, when kindled, maintains of itself, in oxygen gas, the temperature necessary for its combustion. The combustion of the diamond stops when you cease to maintain it by a furnace-heat, or the union of the solar rays.

9. The diamond, for its complete combustion, requires a much greater quantity of oxygen than charcoal does, and produces also more carbonic acid. One part of charcoal absorbs in this operation 2.527 of oxygen, and produces 3.575 of carbonic acid. One of diamond absorbs a little more than four of oxygen, and really produces five of carbonic acid.

10. There are substances which are in a state of intermediary composition between the diamond and charcoal. These are plumbago, or native carburet of iron; incombustible fossil coal; the carburet of alumine of Dolomieu; the anthracolite of Werner; the black matter united to iron in the state of cast iron and steel; carbonaceous residuums difficult to be incinerated; and carbon itself unburnt, (*dibrule*), by the action of a strong heat without the contact of air.

11 These substances mixed, or weakly combined with three or four hundredths of their weight of iron, or alumine, give by their combustion carbonic acid, like charcoal and the diamond.

They approach to carbon by their colour, their lightness, their opacity; by their serving, like it, to decompose water, to cement iron, to deoxydate metals, to deoxygenate sulphur, phosphorus, and arsenic; and by conducting, like it, the electric fluid. They approach the diamond by containing more combustible matter than charcoal; by absorbing also more oxygen, and producing more carbonic acid; by decomposing more nitrous acid; by burning only at a much higher temperature, even in nitre in fusion; and by their combustion being stopped when this temperature is lowered. They seem to differ from each other by the property of producing with zinc galvanic irritation, as well as silver does: which can be effected neither by the diamond nor charcoal.

12. Thus the diamond is pure carbon, the pure acidifiable base of the carbonic acid. Its combustion is effected in three periods, which require three different temperatures. At the first, which is the highest, the diamond assumes a black leaden colour. It is an oxydation in the first degree, the state of plumbago and anthracolite. At the second temperature, which may be estimated at 18 or 20 pyrometric degrees, there is a second slow and successive combination of oxygen. It is a progress of oxydation which constitutes the habitual state of charcoal, or rather that in which it is found after the action of a strong heat in close vessels has disengaged a part of its oxygen.

Thus plumbago is an oxyd of the first degree, charcoal an oxyd in the second, and the carbonic acid the product of the complete oxygenation of the carbon.

Supposing, then, that we operate with sufficient precision to take away from the surface of the diamond the black matter in proportion as it is formed, by suddenly withdrawing from it each time the action of the solar fire, we should doubtless be able to convert it into charcoal, or at least plumbago, if the too rapid passage of the last degree of oxydation to oxygenation did not prevent us from surprising it in that state.

13. In the last place, several consequences, of importance to chemistry and the arts, arise from these principles.

After this conclusion it will be asked, no doubt, how it happens that the simple matter, pure carbon, the diamond, is so rare while its compounds in different states are so abundantly diffused? To put an end to the astonishment of those who might entertain any mistrust, I shall observe, that aluminous earth is also one of the most common matters, and that adamantine spar, as rare as the diamond, is however only alumine; that iron every where exists, under all forms, except in the state of purity: the existence of native iron is still doubtful. The wonder exists only in the opposition of facts to our opinions, and will disappear in proportion as we discover, and appropriate to ourselves, the means employed by nature in producing the same effects.

Those who have never turned their attention to the physical sciences, to estimate at least their influence on public felicity, are disposed to treat as vain curiosity labours which are not immediately directed towards a near object of new enjoyment. What would have been their astonishment had they been told, that researches on the nature of the diamond would one day produce truths which might give rise to happy changes in the practice of the most familiar arts; in the preparation, and in the employment of the coarsest combustibles! Such, however, are the consequences that may arise from the best known properties of the essential principle carbon in its different states.

XI. *A Letter to the Editor, containing some Objections to the Mitchillian Theory of Pestilential Fluids.*

SIR,

I OBSERVE, in the 15th Number of your useful Magazine, a communication from Dr. Mitchill, of New-York, shewing the utility of constructing the houses, and paving the streets of cities, with *calcareous* in preference to *siliceous* and *argillaceous* materials. This communication is contained in a letter from Mr. Da Costa to the Doctor, in which it