



LXVI. On the identity of silex and oxygen

Mr. Hume

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LXVI. *On the Identity of Silex and Oxygen.* By
Mr. HUME, of Long-Acre, London.

[Continued from p. 280.]

To Mr. Tilloch.

SIR,

AMONG these promiscuous observations, it would be unpardonable to omit *iron*, which is one of the more constant associates of *silex*. These two ingredients seem to be almost inseparable companions, especially in every thing of a primeval nature; for, in all original districts, mountains, rocks, and soils, and in every native compound of any consequence and extent, whatever the aspect, situation and contents may be, these two elementary bodies are sure to present themselves, and, I may add, are always united; for, though the *silex* may be elicited from the mineral in its simple form, the metal, on the contrary, is always *oxidized*.

So universally is this metal dispersed through the works of nature, that very few instances occur in which it is totally absent; its ubiquity is truly proverbial, and is exceeded by nothing, if we except *silex* or *oxygen*; indeed it pervades almost every solid substance, and even animal and vegetable bodies are seldom exempt from its influence, but often exhibit iron evidently as a constituent in their system. Hence, the history of iron becomes a most interesting subject to the physiologist, and, if we add its wonderful property of magnetism, it seems to be one of the most fertile for the imagination of every philosopher. As this metal is never discovered in the pure state, but is more frequently conjoined with *oxygen* than any other body; and as this process seems to have been effected in the immediate vicinity of *silex*, I see no particular or unreasonable objection, if, in all such instances, we assign the genuine cause of the oxidizement of iron, solely to this prototype of *oxygen*. I feel less difficulty in admitting this conclusion, when it is considered, that the more cogent examples are deducible from *originally formed* matter, from the real primordial rock, coeval with the globe itself, and made tangible, probably,
soon

soon after, or even at that very period when, the "Earth was without form and void."

The intimacy between silica and iron, and the consecutive oxidization of the latter, need not be further urged; it occurs in such numberless cases, that whoever is at all conversant in mineralogy, and will take the trouble to search with candour, can be at no loss for evidence, sufficient to establish this singular concomitance. Thus, let us take, as an instance, that substance, familiarly known by the name of emery. Here, the iron is truly united to the silica in a very close manner, and not as a mere mixture, for the metal is oxidized and imbedded in this surplus of oxygen. "This," says M. Haüy, speaking of emery, "is a *true combination* of quartz and iron, in which the two substances contract a stronger adherence than a mere interposition of their molecules."

Though iron is considered as a pure metal and a simple substance, that is, when divested, by the usual methods, of the common impurities, to which it has a habitual affinity, particularly of these, viz. carbon, phosphorus, and silica; still, there is strong reason to believe that it has never been totally exempt from one or other of these substances. Indeed, it appears that some of these very impurities are required to render the metal more perfect, to add to its splendour, ductility, and other properties, which the arts demand. Thus, to make good steel there must be an addition of carbon as well as silica; and, if brilliancy, hardness, and a susceptibility of higher polish are to be considered as improvements, the carbon and the silica, in this case, seem to render the metal still more metallic, if such a term may be allowed.

In an analysis of four different specimens of steel, by M. Vauquelin, the result was this, taking it on an average to avoid fractions: that one hundred thousand parts of these samples of metal consist of 9817 of iron, 723 of carbon, 870 of phosphorus, and rather more than 288 of silica. That it is very difficult to deprive iron of all foreign matters, may be readily conjectured from this philosopher's labours, and the following observation confirms this truth, that iron is never pure. "The analysis of the varieties of steel," says this very accurate chemist, "is one of those parts of the

science the least advanced and the most difficult, especially when our object of research is the *exact* estimation of the principles which they contain :—it is thus, for example, that, in dissolving steel in dilute sulphuric acid, the hydrogen which is evolved, dissolves and *carries off* a part of the carbon, the quantity of which varies according to a multitude of circumstances.”

From this and other authorities, and from a prejudice, which, I acknowledge, I have long been disposed to cherish, it may be inferred, that whatever emits smell cannot be considered as a *simple* body, and hence, the purity of hydrogen as an element must be doubted ; that species, however, which we obtain from the decomposition of water by the metals, is certainly very objectionable, if there be any truth in this observation ; for the gas is never free from a very perceptible odour, whether it has been procured by means of zinc or iron.

It is certainly not always prudent to generalize too freely upon these subjects, yet it is difficult on some occasions to avoid it entirely. The hydrogen gas, alluded to by M. Vauquelin, in these analyses, was undoubtedly impure, as it contained a certain portion of carbon from the metal, though not the whole ; for, finding this mode of operating inconclusive, he at last had recourse to the sulphurous acid, with which he apparently succeeded in separating the whole.

Fluoric acid, from its peculiar effects upon the siliceous compounds, deserves a particular notice in the present inquiry, especially as its whole history remains still clouded with inconsistency and ambiguity ; for, either the tables of affinity respecting its habitudes are erroneous, or the acid itself must be considered as a monstrous anomaly in the doctrine of chemical attractions. These tables begin with lime, and go on progressively with some of the earths and alkalies to silix, the very last in the enumeration, with which, by the way, it has never yet been united so as to produce a true salt. From Bergman's experiment, we learn, that he dissolved silix in fluoric acid, and that after the solution had remained undisturbed for two years, a number of crystals had formed at the bottom of the liquor in the vessel.

vessel. But, what were these crystals? They were pure silix, and had deserted this very acid, which, in all other cases, would have seized on it and dragged it into even aëriform existence. The native fluato of lime is so very generally contaminated with silix, if this expression may be allowed, that it is probable no fluoric acid exists without some of this ingredient; it may indeed owe its origin to this body, so uniformly are they associated.

But, that singular influence of fluoric acid upon silix, the corrosion of glass, is what has been chiefly noticed by most authors, for it does not appear that a direct application to the mere silix has yet been attempted, at least, with that precision which might have obtained a satisfactory result. That this acid should prefer the silix to the alkali, and in a case of single elective attraction too, is contrary to every table that has yet been published, and hence, in this example at least, it forms an exception to the general rule. But if, in similar experiments, the acid selects the silix from *lime*, a substance which is placed at the top of the list, in all arrangements, how much further does this error extend? Though in making experiments with this very curious liquid I have employed various species of glass, principally with a view to improve this method of etching, I have generally preferred *plate-glass*, on account of its form, convenience, and greater capability to endure the necessary pressure, so as to secure a number of perfect impressions. This glass is always, without exception, composed of lime, silix, alkali, and, occasionally, some other ingredients of less consequence in the present question.

It is astonishing, that in all the accounts of the decomposition of glass by fluoric acid, and even by other means of still greater energy, by electricity, little notice has been taken of the oxide of lead, and the subsequent disposition of the *whole* of the ingredients. I make no doubt, that *flint-glass* has been more frequently employed than any other, but I do not find that silix has ever put on that peculiar character of an *earth*, an alkali, or a salifiable base, and attached itself to the negative pole. On this subject, I confess, I feel extremely solicitous, as, in the late very

splendid discoveries, which now, and probably will ever continue to, engross the attention of the scientific world, the decomposition of glass and consequent disposal of all its ingredients, form a question, to me at least, of the utmost interest; since, as far as I can judge of the phenomena, which have already been described, there appear circumstances more likely to confirm, than invalidate, my opinion of the nature of silex.

There is a remarkable similitude in the effects of oxygen and silex on the metals, particularly in that process called *vitriification*, which is, in every meaning of the word, a complete saturation. By means of these, particularly the silex, all the metals, perhaps, with no exception, from being the most opaque bodies in the universe, may be rendered quite pellucid, affording an endless variety of the most charming tints, as useful as they are elegant, since it is chiefly from metals and metallic substances that the most durable and valuable colours are obtained for staining glass and making artificial gems. The best opaque colours, such as are most suitable for enamel, water, oil, crayon, and all other descriptions of painting, are derived also from the metals, combined with one or both of these substances; and though alumine and other bodies are occasionally present, they are as often absent. Even the precious stones and the less valuable pebbles, spars, and an infinite list of fossil productions, seem to derive their intrinsic value, beauty and other excellencies, entirely from the power of silex on the metals. Thus, the dull opacity of lead is as effectually changed by the *sand*, used in the composition of flint-glass, and the whole compound appears not less diaphanous, than the very same metal is, when, by means of *oxygen*, it is dissolved in nitric acid, properly diluted with water; such, however, is the inference I would draw from these premises.

The near connection between *potash* and silex, is not less manifest than in the other associations which have been already noticed; indeed, seeing with what avidity the base of potash (according to the late discoveries) clings to oxygen, I am furnished with this plea, that its original and necessary quantity had been obtained from silex; for all the
potash

potash of commerce contains silex, and retains it with some degree of force, not as an adventitious ingredient, but rather as the superabundance of that primitive store, from whence it had derived that portion which is essential to its existence as potash. Now, that the constitution of potash no longer remains in doubt, and that oxygen has been proved to be as essential to the formation of potash as it is to that of sulphuric acid, I see no explanation more congenial and satisfactory than what I have here ventured to suggest, especially when it is proved that the primitive seat of potash is in *rocks* and *stones*, and in the very centre of such bodies, where the atmosphere can have had no influence; for, as far as regards its vegetable and animal existence, all is merely secondary, and, consequently, does not apply so forcibly in this theory, though, even here also, we need be at no loss for proofs.

The power which silex exercises over potash, soda, and a variety of other substances which enter into the composition of glass, is a notorious instance of its neutralizing efficacy; for no acid more completely obtunds the acrimony of alkaline bodies and disarms them of their corrosive character. The effervescence, which results when silex and the alkali enter into fusion, and form this insipid compound, is not observable till the materials are on the point of perfect combination: hence, as something is apparently evolved, neither oxygen nor any other æriform fluid can be supposed to enter; so that the acidity, if the term may be applied, to coerce the alkaline matter, is alone due to the sand which is usually employed in the making of this beautiful and useful compound. Indeed, vitrification, in all instances, seems to be accomplished by silex or by oxygen; and the glass of lead, of antimony, of phosphorus, borax, or of any other body, is due to one, as much as the glass in common use, is to the other of these oxygenating agents.

In many very trite and familiar experiments, upon bodies containing either silex, an acid, or oxygen in some condition or other, the phenomena which succeed may be traced to the same cause. Thus, scintillation of hard bodies on collision against each other, as flint against steel; that of two siliceous stones, which emit not only light but the peculiar

culiar quartz or rather sulphurous smell, already noticed ; the effects produced by various species of phosphori ; friction of two pieces of borax ; the electric nature of glass ; that of amber, tourmaline, and of resinous bodies ; the light evolved by friction and collision of bonnet-cane and other vegetables which contain silix ; and, in short, all other analogous examples may be adduced as additional illustrations on this subject.

If I were to select a case, in which silix seems to be deposited as it were, and deprived of the caloric which had suspended it in the state of gaseous oxygen, it would be that of a natural *hot-spring*, such as the Bath-waters, which are confessedly impregnated with sand or silix, not merely in suspension as an accidental material, but perfectly dissolved so as to be imperceptible to our sight. Besides these waters, all other hot springs contain silix in solution ; that of Carlsbad ; the Geyser, and Rykum, in Iceland ; and many others, which, it is said, issue, for the most part, from granitic and other siliceous rocks. If these waters were cold the argument might fail, but while the temperature of the ambient medium can be taken into the account, I should not be willing to retract this opinion, as far as it concerns the nature of all hot-springs. It is stated from good authority, that in the kingdom of Portugal alone, there are upwards of 200 of these springs, the greater number of which, and the hottest, originate where silix is most abundant.

The presence of nitrogen in the Bath-waters, and, probably, in all other hot-springs, is a curious occurrence, and furnishes a proper theme for speculation. Whether it be the remainder of decomposed atmospheric air, which has been bereft of its oxygen, and that this is disposed of in the water, in the way I have supposed, is a question I shall not urge. The late Doctor Black analysed the hot-springs of Iceland, but the analysis, I believe, was not performed upon the spot, and, consequently, no notice could be taken of nitrogen gas. In the gallon of Geyser water, he found upwards of 31 grains of silix ; and in the other, that of the Rykum spring, the proportion was 22 grains of the same ingredient in the English gallon.

The

The effect of silex in various cases is the same as an acid, and in some situations, where an acid or acid properties really exist, no other cause is present. All acids we know are not *sour*, some on the contrary, are insipid, and, therefore, it would be too much to expect silex to possess this property. It is, however, a strong support to this question to see my idea of its general acid quality corroborated by others, for it has lately been observed, (*Journal des Mines*, tome xx. p. 245.) that “*in the analysis of ores, silex acts very sensibly as an acid.*”

[To be continued.]

LXVII. *Report of Surgical Cases in the City and Finsbury Dispensaries, for November 1807; containing a Dissection of a Case of Hydrocephalus internus. By JOHN TAUNTON, Esq.*

IN the month of November there were admitted on the books of the City and Finsbury Dispensaries 257 surgical patients.

Cured or relieved	—	229
Died	—	3
Under cure	—	25
		<hr/>
		257
		<hr/>

Since which time there have been admitted 1007.

Some time since I was requested to examine by dissection, the head of J. W. ætat. about 9 years. It was remarked at the birth of this child, by a very intelligent surgeon, that the head was large, and that it was probable there was water contained in the brain. The child grew, and enjoyed good health till the 17th month after birth; but the head continued large. He was then seized with the whooping-cough, which was very violent, and he lost his sight for some time. It was now pronounced decidedly, to be a case of *hydrocephalus internus*.

On his recovering from the whooping-cough he regained his sight and *strength*, so as to enable him to walk with the hand of his nurse, or in a go-cart: his appetite was good,
and