

*A Continuation of the Discourse concerning Vitriol, begun in Numb. 103. shewing, That Vitriol is usually produced by Sulphur, acting on, and concoagulating with, a Metal; and then making out, that Allom is likewise the Result of the said Sulphur; as also evincing, that Vitriol, Sulphur, and Allom, do agree in the Saline Principle; and lastly, declaring the Nature of the Salt in Brimstone, and whence it is derived.*

THAT the Vitriolat Salt in *common Sulphur* differs little from the Salt in *Vitriol*, will appear evident to them, who will compare with the common Spirit, or Oyl of Vitriol, the Acidity of Sulphur afforded by Brimstone inflam'd under a Glafs-bell, which being rectified is not to be distinguish'd by any sensible property from the well-rectified Acidity, or Oyl of good Vitriol; and they may, I am confident, be safely substituted for each other, producing in Men and Metals the very same effects, being, in any apprehension, no less alike in their *internal* and secret, than in *external* sensible qualities.

The quantity indeed of Acidity, which is obtain'd in the ordinary ways of operation is very small, a pound of Brimstone not yielding above one Ounce, or ten Drachms, the far greater part being by the rapid Motion of the Flame sublim'd in the Form of *Flores*, which differ not from the common Flowers. I have been often assur'd by a Kinsman of that admirable Mechanist *Cornelius Drebbel*, that his Uncle did, by the means of conveniently shaped Vessels, ordinarily obtain out of a pound of good Brimstone eight, and, in a very moist Season, ten ounces of Acidity, and was confident he could, by improving the contrivance, recover the entire weight of the Sulphur; the moisture of the Air acquired making abundant recompence for the avolation of what is incoagulable. I have my self, by the means of several *Mensstrua*, reduced *common Brim stone* into the form of an highly Acid corrosive Liquor, and even *Spirit of Niter*, or *Aqua fortis*, well rectified, being digested on the Flowers of Brimstone, then distilled in Alhes, this repeated five or six times, after the last co-  
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hobation there will remain with the Flowers near their weight of an acid Spirit, like that made by a Bell; the Spirit of Niter being scarcely changed from what it was before the operation: And, I suppose, that being reiterated frequently, especially, if fresh Spirit be employed, the whole may be transmuted, abating some few earthly and metallick Particles; the sulphureous being capable of a fluid Form, and are copious in Oyl of Vitriol, *Aquafortis*, and many other acid *Menstrua*, especially if any imperfect sulphureous Minerals were employed with the other ingredients in their production.

I once made out of Vitriol, common Salt, and Antimony, a Liquor clear as any Fountain-water, yet the Smell intolerably sulphureous, continuing so many years: And true inflammable Sulphur may several ways be recovered out of Oyl of Vitriol, or Sulphur, many times rectified, and in appearance free from such mixture. We formerly mention'd its separation by means of vinous Spirits. Also, if mixt with Oyl of Turpentine, and distilled, at the latter end store of Brimstone will sublime: I suppose, none will ascribe this to the Vegetable Oyl, which is only the means of its separation, being an appropriate *Menstruum*, or dissolvent of sulphureous Bodies. This recalls into my mind what I have often observ'd, (and I suppose it always happens) in the preparation of *Balsom of Sulphur* with the said Oyl of Turpentine: After the Oyl is fatiated with Sulphur, it lets fall store of fair Crystals; an evident proof of its saline Nature: For, although these Crystals broken, within appear full of Sulphur, their outward parts or superficies seem perfect *Salt*, by vertue whereof they are disposed to crystallization. It may indeed be objected, that crystallization is not a sufficient proof of a saline Nature, the essential Oyls (as they are called) of Anniseeds, Fennel-seeds, and of many other substances being very prone to crystallize, where there is no suspicion of their abounding with Salt. But this Objection is so far from invalidating my assertion, that it rather confirms it, most essential Oyls abounding no less with Salt than common Sulphur, into which I have often converted them without additament, or suspicion of

Transmutation: Which, together with several other Experiments and Observations, induce me to embrace that lucky, or rather judicious, conjecture of the deservedly admired *Cartesius*, That Sulphur consists of Saline Particles inclosed in store of branched Oleaginous Matter, and may be predominant in some Substances, but is no where pure and separate from the other Principles; for then it would immediately vanish into Air, being always mixt with either Salt, or Earth, and then it appears in a dry Form; or with Water and Spirit, and then in a Fluid.

But to return whence we digressed: Nothing can more fully demonstrate any truth, than the consideration of the following Experiment doth the Affinity, I had almost said, Identity of the Saline Principle in Sulphur and Vitriol. Take thin plates of Copper, cement them carefully with common Brimstone, *stratum super stratum* (as Chymists love to speak) repeat the operation four or five times with fresh Sulphur; most of the Copper will be converted into Vitriol, which dissolved in Water, and most of that evaporated, it yields very beautiful Azure Crystals. The same may be effected with Iron; or take the Acidity of Sulphur (corruptly called its Oyl) moisten therewith filings of Copper, or Iron, then free them by Fire, or Air, from superfluous moisture, repeat this twice, or thrice, and afterwards with common Water, you may extract a fair Vitriol, which by the Chymists is called *Vitriolum Martis*, or *Veneris*, according as the one, or the other Metall was employed in order to its production; which same Mettals being dissolv'd in any acid *Menstrua*, and crystallized, are converted into Vitriol. This is signified unto us by the common name of Vitriol, vulgarly stiled *Cuperosum*, quasi *Cuprum erosum*; that being the Metall wherewith 'tis usually associated. Sulphur indeed is found mixt with most Mettals and Minerals, Gold and Silver not being excepted, the most expert Mineralists in *Peru*, accounting abundance of Sulphur an especial sign of rich

\* See c. 19. of the 1st Book of Mettals, declaring the manner of their Generation, written in Spanish by Alonso Barba, and translated into English Anno 1669.

Ore: And among the richest Ore of the mountain *Potosi* \* are such quantities of Brimstone, that the cavities and hollow places are presently filled with flame, if

a candle touch or come very near their sides. Yet they do not ordinarily find Vitriol in mines of gold and silver (unless mix'd with other mettals) because those bodies are somewhat too compact for the sulphureous spirit to dissolve assisted with a *small* degree of heat; whereas all ores, which touch on cooper or *Pyrites* abounding in Sulphur, do also afford Vitriol; copper being an open body, and more easily soluble than any other mettal: For, it will presently, though crude, dissolve *in*, and give a deep tincture *to*, common Volatil urinous spirits; which cannot be affirmed of any other mettal, howsoever prepared; and therefore no wonder if it be by the steam of sulphur so easily converted into Vitriol: And in the bowels of the Earth it is, I do conjecture, mostly produced after this manner.

An acid salino-sulphureous steam (such we have proved that of common sulphur to be) insinuating it self into a vein of copper, corrodes it, and uniting therewith becomes Vitriol. So it doth by mixture with iron, and other minerals; whence being washed by water, it produces *acidule* of divers kinds, according to the nature of the minerals, wherewith the acids is united. And that Vitriol and Vitriolate waters are thus produced, is hereby confirmed, that many ores and *Pyrites* being distilled *per descensum*, yield abundance of common sulphur; the remainder afterwards affords store of Vitriol, although before calcination it would have yielded none; the fire enabling the sulphur to corrode, and associate with, the metallick parts; that which is without mixture of mettal, or which hath thereof a very small proportion, continuing under the form of Brimstone.

This to me seems the reason, why Vitriol and Brimstone are usually found together, those minerals and pyrites that bound with one, being usually impregnated with the other; Vitriol not being a distinct principle, but the genuin off-spring of sulphur, its material cause, and fire and air the efficient causes of its production. I speak of Vitriol generated *in* the bowels of the earth; for it *may be*, and *is*, often produced *above* ground by the aerial salt united with mineral substances, copiously contained in marcasites, which it extricates, and concoagulating therewith becomes a Vitriol.

You will not, I suppose, be much startled at these words; *Aerial salt*, after the credit you have lately given a discourse concerning the *Volatil Salt of Vegetables*, which upon their Putrefaction or Arefaction expiring into the air, *that* must necessarily abound therewith, besides abundance of the same substance, which transpires from animals, and is sublimed by subterranean fires, whereof I may hereafter render you a more particular account. I shall at present only affirm, that this *Aerial Salt*, which I have many ways procured, whilst in the air, is altogether un-specificate, I mean, freed from all union with, or determination by, any seminal principle; (the primordials of all *species* in the universe being, in my opinion, spermatical;) but being once at the command of the architectonick power of any *species*, whatsoever *that* be, it is by it, with other matter, determined in order to the formation and augmentation of the *Individuum*, and propagation of the *species*, and, upon the dissolution of its dwelling, returns whence it descended. Besides this, there is also in the air and acidity, as is evident in iron-bars, whose superficies is thereby resolved into a subtle *crocus*; also in the tarnishing of polish'd mettals, where Pit-coals is much burnt, near unto and on the Sea, and where exposed to certain winds; truths so common and obvious, that I need not expatiate on, or much labour to confirm, them.

This acid spirit with the salt, last mention'd, are instruments by nature, employ'd in almost every operation; especially the salt, without which no perfect animal can subsist a minute, and all vegetables deprived thereof do immediately decay. I shall in this discourse have regard unto them only as they contribute towards the production of salts. Its well known, that several minerals and *Pyrites*, which are to the tast altogether insipid and elixivated, would yield not a grain of salt; being exposed unto the *Air* are resolved into a powder, and afford some, allom, others Vitriol copiously. Sometimes the minerals require previous Calcinations, which opens and relaxes the *compages* of the bodies, so that the air may have more easy ingress. And it is, I think, by most allow'd, that, after all the salt is extracted out of earth impregnated with  
 vitriol,

vitriol, allom or niter, the said earth being expos'd a sufficient time into the air, acquires fresh supplies, and that in such quantity, that many have concluded (which I can neither contradict or confirm) than in an hundred or some few more years the earth would yield more salt than its whole bulk amounted to in the beginning of the operation; a great, if not the greatest, portion whereof must be deriv'd from the air. And it is particularly remarkable in vitriol and allom, that their spirit being put into a commotion or fermentation by either heat or contrary-natur'd spirits, the glasses which contain them being well clos'd, although large and strong, will be crack'd or broken in pieces; which seems to proceed from the expansion of some of those prodigiously ætively springy particles, wherewith the air abounds, which together with the aerial salt were arrested by the vitriolifying principle, and set at liberty by the tumultuating liquor, the change of whose contexture might occasion their dismissal, the unbending of their springs, and the effects which thereupon ensue. But, whether the vitriolate *marcasites* are only magnets, to attract and specificat the aerial salt and spirit; or whether these are as well active, as passive, separating, comminuting, and after combining with the mineral particles, so that the result is different from what either of them were before such union, I leave unto farther enquiry: For, though I could say much on this occasion, yet I shall defer it, until some few more experiments have enabled me to make more perfect discovery of a truth, which is not so obvious as most may imagine.

I shall now proceed to demonstrate unto you the affinity between *allom* and *vitriol*; I mean, the *natural*, not common *factitious* allom; sea-salt, alcalies, and urine being usually employ'd in its production. Now, *vitriol* not only in *England*, but in several other parts of the world, is ordinarily found in the same vein, and sometimes in the same parcel that yields the allom: which may by several methods be separated from each other. The mineral of *allom*, if mature, elixivated yields it Salt presently; if less mature, it requires previous calcination; if very immature, it must not only be burnt, but

but long expos'd unto the air. The cause whereof seems the very same with that we lately mention'd in our account of the production of *vitriol*; the *allom*, as *that* is, being produc'd by the sulphurs acting *on*, corroding *of*, and concoagulating *with*, some mineral substance, which usually partakes more of terrene and stony, than metallick, nature; although yet mettal is often found to be contain'd in the *allom*, stone, or ore. And that the sulphur is the chief efficient and material cause of its production, appears from hence, that many *allom*-stones (as the *vitriolate*) distilled *per descensum*, yield good brimstone; and all *allom*, stones, or ore, during calcination, emit a sulphureous steam. An inquisitive naturalist of my acquaintance did gather from the very same rock, and that within a few inches of each other, *vitriol*, *allom*, and sulphur; all of them excellent and perfect in their kind. Indeed they are so nearly allied, that I can by some pretty artifices (too long to be here describ'd) convert *allom* into *vitriol*, or *vitriol* into *allom*, which shall be the same to all intents and purposes (as we commonly speak) with the natural.

*Allom* distill'd into an acid spirit with copper or iron, becomes good *vitriol*; and *vitriol* freed from its metallick parts becomes aluminous; and distill'd, yields a spirit scarcely to be distinguish'd not only by taste, but even by the most nice and accurate scrutiny, from that of *allom*. And (which doth in some measure illustrate this affinity) I have often observ'd rectified oyl of *vitriol* and spirit of sulphur to coagulate and become solid transparent concretions, exactly resembling *allom* crystallized, with which compar'd, I am confident, the most judicious eye, without the assistance of the palate, would find little difference.

Having analis'd *vitriol*, and shewed, that it is usually produc'd by sulphur acting *on*, and concoagulating with, a metal; and that *allom* is the result of the said sulphur, comprehended in, or united with, bodies less metallick and more terrene; and having, I think, fully evinced, that sulphur, *vitriol*, and *allom* do agree in the saline principle, which is in all originally the same, perhaps a little chang'd by the bodies  
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with which it is associated: it remains, that I should declare the nature of the salt in *Brimstone*, and whence it is deriv'd.

Brimstone consists of *mineral* sulphur, and an *acid* salt, which being united, it is no difficult matter to conceive, how it should become volatil, if we reflect on *cinnaber* and *sublimate*. In *one*, mercury is so disguised by a little sulphur, that it seems a mineral substance of another nature, and, abating the colour, not unlike antimony: In the *other*, salts very acid and fixt are rendered sufficiently volatil. Now, whence the brimstone should derive its sulphureous particles, will appear very obvious to them, who have observed, how much the bowels of the Earth abound with bituminous substances. What else feeds all the subterraneous fires? What an immense quantity thereof is lodged in the earth, will be attested by our large and numerous coal-mines, and by those eruptions of bituminous substances in many quarters of the world, among which that, called *Naphttha*, is so purely sulphureous, so free from mixture with any other materials, that upon the very approach of fire or flame it is immediately inflamed, and scarcely to be extinguish'd, until wholly consumed. As for the *saline* principle of sulphur, I conclude it to be *common salt*, which, together with the *aerial* salt before mentioned, is the foundation of all saline substances in the universe. How it comes to be so much diversified by strong and violent heat, or long and easie digestions, as also by its acting *on*, and combinations *with*, particles of different nature, I shall at your next summons endeavour to make manifest, it not being an ungrounded fancy, but a persuasion derived from many experiments and long observation. I shall at present only assure you, in reference to the present discourse, that I can with *common salt* make both *vitriol* and *allom*, hardly distinguishable from the natural.