Spring 1743

The Rise & Ascent of Vapours.

Various have been ye opinions of Philosophers respecting the cause of that very common phaenomenon, the ascent of vapours from ye earth, their suspension in the air, forming clouds, & rain.

The Cartesians contended that the particles of water were formed into hollow spherules, or little baloons by the solar heat; these being filled wth subtile matter become lighter yn air, and are easily ~~by~~ buoyed up in it. Dr Nieuwentyt, and several others, in order to account for the ascent of water in air, a fluid so much lighter yn itself, imagined that particles of fire, seperated from the rays of the Sun, and adhering to the particles of water, make together little bodies lighter yn an equal bulk of air, wc must therefore rise therein, till they arrive at such an height as to meet with air of the same specific gravity wth themselves, forming there a thin cloud. They supposed that rain was produced by the separation of those particles of fire from ye water, whereupon the water coalesce, and descend

Water is the heavy kind of air. (Priestley)

according

according to their own gravity, in drops of rain, or dew.

The most generally received opinion is, that of Dr. Halleys, viz. that by the action of the solar heat on the surface of the water, the aqueous particles are formed into globules filled wth a flatus, or warm air. They are thus rendered specifically lighter ythn common air, and must rise therein, till they meet with such as is of equal specific gravity wth themselves. But tis doubtful whether there can be a flatus within these globules, warmer or more rarefied ythn the air that surrounds them, as the action of the Sun is equal in strength on every part of the surface; and if they could be formed, their existence wd be only momentary, as we see in the bubbles of soaped water, when blown up by the waters of the Lungs; Nay soaped-water (soap suds) is much more tenacious ythn common water, and must constantly keep the air longer inclosed.

The rise & ascent of Vapours is owing to the power of the air as a menstruum, capable of dissolving, suspending, and intimately mixing the particles of water with itself. – Water e.g. will take up, or dissolve so much salt & no more; in like

manner the Air, or atmosphere, wch is the most powerful solvent, or menstruum in nature (for it will take all ~~all~~ the metals except gold in perfect solution) will take up so much water & no more, when completely full of water, or what is called "saturated," the water floats about in form of clouds, but when super saturated, it lets go the heavier body, as a super saturated solution of salt does ~~does~~ wch precipitates the salt to the bottom of the vessel, and the water descends in the form of rain.

The power & effect of all solvents is encreased, by heat, agitation, and the greater extension of the surface of the matter acted upon. Hence the efficacy of the Sun's rays & of the winds in promoting the ascent we speak of. — See Hunter's Geology

Let us next see what this atmosphere is, wch ~~operates~~ draws fresh water from the salt ocean wch descending again in ye form of dews, or rain give rise to those mighty rivers, wch while they seem to desgoir the world are actually the means of bending all mankind together. We may say of the Air we breath, as we did of the water we drink, that it is very different from that pure elementary body wch the experimental philosophers speak of. — Here consult Watson Vol 1. on atmosphere & then Todrysike from marble book

(1) In calm serene weather, the air has weight enough to sup-
-port a column of Q. Silver 31 inches high. In tempestous weather
not above 28 inches. Water will rise in a tube 32 feet, and there it
has always rested, & never ascended higher. From this we learn
that ye weight of ye air, wc presses up the water is equal to a
piller, or column of water wc is 32 feet high, wc it can raise so
high, & no higher. The surface of our Globe, is every where
covered wth a weight of air equivalent to a covering of 32 feet
deep of water, or to a weight of 29½ inches of Q. Silver (Hurg.

The experimental Lectures teach you, the weight, pressure, and
the elasticity of the air, and the effects thence arising. But
in giving the history of the Atmosphere, we must not consider
the air as a pure element, but as a heterogeneous mass,
containing the attenuated particles of all terrestial things.
By the air, we understand that fluid, wc surrounds and
rests every where on our globe. It is scarcely to be per-
-ceived by our senses, and only manifests itself by its resistance
to bodies moved in it. The air is the grand, efficacious, &
necessary ~~element~~ instrument, wc universal nature prin-
-cipally makes use of, in almost all the operations she
is engaged in. It is in all the parts of our bodies, & by a counter
pressure, wc we feel not, preserves them from being crushed. It is many
ways absolutely necessary to Vegetation. It is the Vehicle by wc Dews
and refreshing showers, are conveyed to the otherwise barren & thirsty
mould, and with all this, it is the very spirit of fire & flame.

The Waters

The waters do not cover the beds of the Ocean so entirely as this fluid does our Earth. It penetrates every where & every thing. There is scarcely any liquid that has not air mixed with it, nor any solid out of which air may not be extracted. Whatever the chemical art performs, it executes in the air without a single exception. (1.)

So necessary is this Universal fluid to the the existence of not only animals, but vegetables, that no eggs of animals, no seeds of plants be they ever so pregnant, ripe & the best of their kind, and cherished with ever so kindly a warmth, will ever bring forth the Embryoes contained in them, but will remain inactive, if they are entirely deprived of air, or closed up in stagnating air, in glasses hermetically sealed.

The air we breathe is very diff.t from that pure elementary body w.c Experimental Philosophers speak of - We should consider it as a Chaos of all things intermixed & compounded together: For in it float the subtile particles of all terrestrial bodies whatever. All the corporeal matter, that has ever entered into the composition of the bodies of living creatures, is carried up into the air. If the bodies are burnt, their solution in air, is brought about immediately; If left to rot it is more slowly; still longer if buried in the earth; but even then, they exhale away. What wonder therefore, if from the air, there should return again, a matter of the same nature with the food of former animals

capable

capable of affording nourishment to those bodies, that are by this means to spring up afterwards? — or at other times re:-plete w.th the latent seeds of death, plagues, & other destructive diseases.

Fossil substances, even metals themselves are scattered up and down in the air. Even ☉ the most ponderous of metals is in the air. If you take common sublimate of mercury, and rub it w.th gold filings, and then distill it in a w.th reg. of antimony, the very body of the ☉ will ascend in form of red oil, & become perfectly volatile.

This great solution, or mixture of all things, is continually operating on itself, w.ch is perhaps the cause of it's unceasing motion. The different seasons of the year, produce a remarkable variation in the State of the Atmosphere. — And here, we cannot ~~keep~~ but admire the wisdom of Providence, who hath set such exact bounds, & so nicely limited the changes of the air, if we consider it only in regard to heat & cold. A degree or two hotter & we and every thing else would be destroyed; — a degree or two colder & we should perish likewise. It is observable that our extremes of heat & cold do not last many hours. The alternate vicissitudes of heat & cold, produce a continual motion, & agitation in all the bodies in the atmosphere.

& we

If we, carefully attend to the order of nature, we shall find nothing more cautiously guarded against yn that the same degree of heat & cold should reign for a con-siderable time. We see that the Earth, is so dis-posed with regard to the Sun, that at one time, it may receive its rays in a more oblique direction, at another, in a more perpendicular one; nor does the earth ever remain for any period of time in the same aspect; nor is there a much less va-riation produced by the alternate succession of day and night. The Sun, again, has no sooner parched up the Earth, with its scorching heat, & filled the at-mosphere wth vapours & exhalations, but soon follows, Clouds, (i.e collections of water), Lightening, thunder, hail & rain, wc presently clear the air and produces an agreeable coolness —

Besides fire, wc is always & every where contained in the air; there is also a large quantity of water in the form of clouds wc are often near the surface of the Earth. These are the regions of meteors, & of those suspen-dious phenomena occasioned by Electricity —

Now this, great mixture, solution, or menstruum the Atmosphere, is continually operating on itself, that is dissolving & resolving every thing within —

There has been several hypotheses advanced to explain the original formation of the earth's atmosphere. The most rational is this: — Let us suppose that this terraqueous globe was not surrounded with any atmosphere, and that by an approach to the Sun, or an increase of the sub-terraneous fires, it should become exposed to a heat four times greater yn the medium heat of our summer (80 deg.); then w. an atmosphere be quickly formed around it. all the waters on its surface, most of the juices of Plants & animals, and a great variety of mineral particles w. be raised up in vapours, & exhalations, and whilst the heat continued w. be kept suspended in an elastic state, and constitute an atmosphere analagous to the chaotic state of our present atmosphere; only differing from it in this, that it w. require a greater degree of heat in order to keep the particles of matter from coalescing into one heterogenous mass — Again in the present state of the atmosphere suppose a very great degree of cold should continue unabated for any length of time; all the water up on the surface of the earth w. be changed into a solid transparent stone, w.c might be dug out of its quarry, & employed in building as well as marble,

or any

any other species of stone; all the particles of air wd be brought closer together; some of them, wc were the least elastic, wd be re-united; and if we imagine the cold to be indefinitely increased, what reason can there be against supposing that the whole atmosphere wd be reduced to a solid state, forming an heterogeneous crust upon the surface of the earth; the thickness of this crust, supposing it to be as dense as marble, wd be, (it is estimated) about four yards thick? — Upon this hypothesis, water, air, & earth, are but variations of the same element, or primary matter, introduced & modified by heat.

Watson

We find in the most unexceptionable accounts of the creation, that the atmosphere (or as it is called the "firmament") immediately succeeded the formation of light; Now, if the effect of that light was heat, then, wd such particles of the shapeless chaos, as were capable of being ~~elevated~~ evaporated wth that degree of heat, be elevated in an elastic state, and a division, or seperation wd be made in the midst of the great abyss, between the waters wc ~~could not be evaporated~~ were of a nature subtile enough to be converted by that degree of heat, into an elastic fluid, constituting the atmosphere, and the waters wc

could not be evaporated in that degree of heat, but which still remained covering the surface of the globe, and w.c was soon afterwards collected into one place, that the dry land might appear. The great S.r Isaac Newton favoured this hypothesis, (he says) "I conceive the con-fused mass of vapours, air, & exhalations, w.c we call the "Atmosphere", to be nothing else, but the particles of all sorts of bodies of w.c the earth consists, seperated from one another, and kept at a distance by a principle of repulsion!" — Watson's Ess. p. 107. Vol. 1.

{So much for the Atmosphere in gen.l Let us recur once more to the agent of vapours & descent of rain (see paper transcribed by J.)}

This transparent fluid w.c surrounds our globe, is the most powerful & universal menstruum in all nature. menstruum, is a barbarous word introduced by the old che-mists & means no more than a solvent, or desolver. Thus water desolves salt, water is ∴ a menstruum to salt. It is a pretty general law in chemistry that the a thinner subtle fluid will desolve a thicker. Thus water being thinner than a syrup will desolve it & take it up & mix it with it; and Air w.c is the most subtle of all fluids, (ex-cepting fire) will desolve every thing, and water among the rest. Now water or any other menstruum, will de-solve just so much of a thing & no more. e.g. ½ a pint

of water will desolve ℥j of salts, and no more; when the water has taken up as much salts as it can contain & remain transparent, it is then said to be saturated; but if you add more salt, it cannot hold it in solution, it lets it fall to the bottom, w.ch falling to the bottom is called by the chemists precipitation, and the liquid or menstruum is s.d to be supersaturated, or contains more yn. enough. — Now the air being in contact with the ~~vapours~~ waters of the ocean & of the earth desolves them. But the air, like other menstrua can desolve so much water & no more, without being in a degree turbid, or what we call cloudy, and, ~~and~~ if more & more water, that is vapours are crowded into it, the air becomes supersaturated, and lets go the superabundant water in the same manner the solution of salt does, and it falls in drops to the earth in the form of rain. Thus, can the phenomena of rain be accounted for on chemical principles. Thus, at ~~least~~ N. appears to me, to be the least exceptionable of the various hypotheses that has been advanced for explaining this common phenomenon. Hence, you will understand what some philosophers mean, when they call the Atmosphere, a great chemical vessel.

When we consider the innumerable animals, small & great that die, & are dying every moment on the face of the earth, it w^d lead one to suppose that the putrid particles flying off from these rotten bodies would in time render this fluid the air, unfit for the purposes of living; and that the older the world grew, the air surrounding it, would grow more & more putrid, and shorten the period of ~~the life of man~~ human life & finally exterpate ~~him~~ man from the face of the earth. This is a natural supposition, and w^d in fact be the case, did not the Parent of Nature, provide a remedy to correct & obviate this growing putrefaceney.

This remedy is growing Vegetables, w^c give out what is called dephlogisticated air, or pure respirable air, from their leaves. This air is sometimes called Empirical air. While the sun shines on growing vegetables they pour forth this air in abundance, but in a thick shade & during the night, they do not. But this is not all:— a Vegetable not only corrects the atmosphere air by pouring forth this empirical air; but absorbs, or sucks out of the atmosphere the abounding putrichly: This putrichity is the food of plants, & causes them to grow rapidly. This, you see explains the operations of manures w^c you all know causes vegetables to grow in proportion to it's strength, i.e. its putrichly.— We can make this respirable air by mixing the nitrous acid with small fragments of Iron —

This mean of correcting the atmosphere by growing vegetables is not given to you as an hypothesis, but as a fact founded on undeniable experiment.— Dr. Priestley —