Brief notes taken at a course of lectures on pneumatic chemistry, or the production, medical use, & application of factitious airs.

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Chymistry
& other
Physicks

MSS

A manuscript on 146 pages.

* Samuel Varley was a scientific instrument maker and founder of the Chemical Society, forerunner of the Royal Institution. The anonymous student has taken pains with his notes, which give a very clear picture of the state of Chemistry at the time.

The notes also include a series of lectures by A. Walker delivered in 1797.

Brief Notes taken at a course of Lectures
on Pneumatic Chemistry
or the
Production, Medicinal use, & Application of
Factitious Airs.

By Samuel Varley

Delivered at Hatton-House. No. 16. Cross Street, Hatton Garden.
Comprised in 12 Lectures, commencing Nov. 24. 1796.

Explanatory & suppletory remarks.

There is often found a little carbonic acid air, as 1 in 100 pts in y^e^ atmospheric air. tho' no fire burns or animal breathes near.

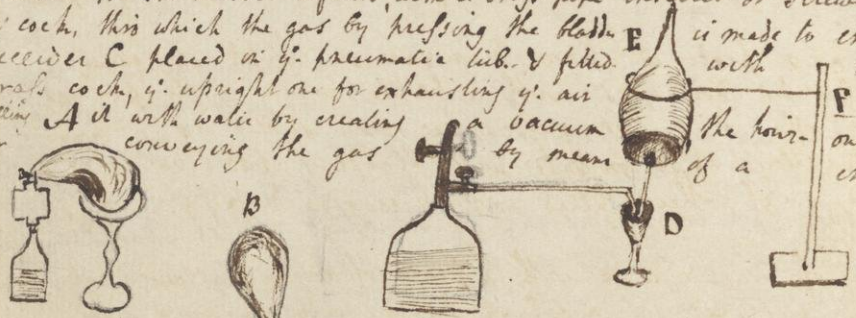
Prima Lectio.

Pneumatics. 1mo

Atmospheric air consists of 28 pts ~~Oxygene~~ Hydrogene, & 72 azotic gas
Priestley & Scheele discovered Oxygen ys about same time.
Lavoisiers pneumatical apparatus cost £ or £3000, but y^{r}
simple one of Priestley equally useful, except in measuring
calorie & weighing gasses.
Hydrogene g^{s} made by putting a few iron turnings into a
common glass phial, then adding water & sulphuric acid aa
equal pts, an effervescence takes place & y^{e} hydrogene gas
is extricated or formed which is to be conducted into any
other glass phial by means of a glass tube. NB. One end
of y^{e} tube is inserted in a cork previously perforated by
an iron rod, which is applied to y^{e} mouth of y^{e} bottle
containing y^{e} iron & acid. It is matter of dispute between
Priestley & Lavoisier whether in this process y^{e} iron or y^{e}

Apparatus for making hydrogene gas & by burning it with oxygene producing water. see Lect. 9.

A. a common quart bottle with zinc filings, sulphuric acid & water. On y^e top of y^e bottle is a tin box. to which is adapted a bladder with brass cock. B. The bladder inflated with a brass pipe inserted or screwed into y^e cock, this which the gas by pressing the bladder is forced into C placed in y^e pneumatic trough & filled with water by creating a vacuum by means of the brass cock, y^e upright one for exhausting y^e air for conveying the gas



a double tube under as by a cork fixed to which is fixed to the bladder down into from

E is made to enter the

F & thereby

the hair-

ontal one

crotchet

C inverted funnel E or such like vessel supported y^e stand F. The glass D is for the water to y^e funnel E.

water is decomposed, Dy contends for ye former, Lavoisiers experiments more decisive.

This Hydrogene G. may be confined in any common phial by means of a cork; its goodness is ascertained by holding ye mouth of ye phial to a candle, ye quicker & louder ye explosion ye better.

Oxygen gas procured from Manganese, kept in quart bottles, fixed downards with a little water in to prevent access of other air. All gasses are very subtle as is known from Priestley's experiments with bladders filled with blood & placed right others filled with hydrogene & oxygene gas respectively.

A piece of twisted wire with a piece of cotton tallowed at ye end & inserted in a phial filled with oxygene gas affords a beautiful sight. The phial for this purpose ought to have no bottom & set in an hollow saucer [if white ye better] with a little water in to receive & cool ye balls

of iron q^t are melted & formed in this experiment. The longer q^t gas supports the combustion q^t more pure & strong it is.

This Oxygene gas is of great use in preventing contagious disorders. Take one or more earthern pipkins containing ℔ss of hot sand, place in q^t middle a cup containing ℥ss of sulphuric acid to which add ℥ss of purified nitre, q^t gas so obtained & denominated nitric gas purifies q^t air by attracting or seizing q^t putrid exhalations. 27 pipkins suffice for an hospital ship & will last 4 hours.

Pneumatics

Secunda — Lectio.

Chymical union attended with several singular circumstances such as change of properties of q^t ingredients. Thus muriatic acid which may be safely taken if only diluted united with mercury which is of a bland nature constitutes a strong corrosive substance. A change of taste is produced, as is manifest from tasting q^t compound result last mentioned. A change of smell which is

shewn by taking ammonia & quick-lime inodorous substances, grinding them together, their compound (ammonia preparata) is highly pungent. Change of color shewn by adding aqua ammonia to a solution of ~~zinc~~ cuprum vitriolatum, a fine blue color is produced which may be destroyed by vitriolic acid.

Synthesis & analysis of salt, an example of chymical affinities. Synthesis. Common salt or soda muriata consists of soda & muriatic acid, mix these & set them to evaporate slowly you will have good salt (in the process ye carbonic acid escapes. Analysis. Pour sulphuric acid on salt, ye muriatic acid escapes in fumes which if received in water wd constitute aqua fortis: ye compound left behind wd be soda vitriolata Glauberi salts. Other examples of ye changes produced by chymical union exemplified by metals. Thus zinc & copper rubbed together give a brass color & are called brass; which metal differs in hardness from ye constituent parts. If to brass thus formed more zinc be added you obtain a

different metal still of extreme hardness so as to bear an excellent polish which makes it fit to be used for reflectors, especially as it never rusts.

The constituent parts of all bodies most probably hard, for water a drop of confined in a glass tube exhausted of air sounds like a stone when shaken.

That metals are susceptible of expansion by heat proved by only rubbing a metallic rod by yr hand, it will not enter yr same groove it did. Straight wood expands about yr 40 part as much as iron.

Passive caloric yr same as latent heat.

Mix = weights of sulphuric acid & water, no effervescence takes place yet much heat ensues; yr caloric of yr water probably is displaced & shews itself. Something is disengaged one wd. suppose because yr bulk of yr compound is not equal to yr bulk of the ingredients.

Mix equal weights of sulphuric acid & water pour it on soda
vitriolata, ye cold produced will be 40 or 50 degrees below ye com:
:mon temperature.
Add to 2 oz of soda vitriolata 1/2 dr. of ammonia & 10 of liquida
nitrata ye cold will be more intense
The doctrine here alluded to further illustrated by covering
ye bulb of a thermometer with a resin coat, this on ye application
of warmth melts but ye mercury descends.
The double bulbed tube containing colored alcohol applied to
this subject; for when ye spt is driven out into ye remote
bulb a degree of cold is felt by ye hand.

Lectio 5ta

Pressure of ye atmosphere demonstrated by laying ye hand on ye top of an open receiver & then exhausting ye internal air, ye hand cannot be taken off.

This is further explained by affixing a piece of wet bladder instead of ye hand; at every stroke of ye pump ye bladder is pressed inwards in a funnel form and at last is burst by ye superincumbent pressure of atmospheric air. The explosion is great owing to repercussion of ye air against ye plate at ye bottom.

An experiment illustrating ye doctrine of sounds made by enclosing a drop of water in a bulbous tube exhausted. On ye application of ye warm hand ye water is impelled against ye sides of ye bulb with ye noise of a pebble or shot

Pressure of ye atmosphere shewn by inverting a small

bolt head & immerging it halfway in a glass of water which is placed under a receiver; on exhausting ye receiver ye air descends from ye bolthead into ye water & ascends up in bubbles; on restoring ye air into ye receiver ye water is forced up into ye neck of ye bolthead to supply ye place of ye air yt had escaped.

Let ye same bolthead be placed as before only let it be filled with water leaving however a bubble or little space of air at ye top; on exhausting ye receiver this confined air expands itself & expells yt water.

Pressure of ye atmosphere shewn by exhausting ye air out of a receiver, it is then so fast as not to be displaced.

Further illustrated by placing two receivers on ye plate one within ye other; on exhausting ye air, ye external large

receiver will be rivetted to its place by ye. atmosphere but ye. small interior receiver not being acted upon by any external air (being within an exhausted receiver or vacuum) is moveable by shaking; but take away ye. exterior receiver & it is in its turn immoveable

The same doctrine exemplified by taking two hollow brass hemispheres, which are made to fit tight by means of tallowed leather; there is an hollow neck to ye. inferior one so ye. being placed over ye. orifice of ye. plate ye. air within ye. sphere may be exhausted & prevented from returning by means of a stop cock; the air being exhausted ye. hemisphere cannot be severed by ye. strength of any one person, but on turning ye. stop cock & readmitting ye. air are easy seperated.

Put a small bladder fastened at ye. neck & enclosing a little

air under ye. receiver; on exhausting ye. air within ye. receiver & removing ye. pressure, ye. air within ye. bladder dilates so as ultimately to burst it.

The converse of this shewn by means of a bladder within a glass, & put under ye. receiver; in this case ye. more ye. receiver is exhausted ye. more is ye. bladder compressed.

The expansive power of ye. air when ye. pressure of ye. atmosphere is removed is further shewn by taking a phiale part full of water with a siphon in it connecting it with another vessel of water; on exhausting ye. receiver ye. small portion of air left in ye. first phiale expands & drives ye. water out by means of ye. siphon, but on restoring ye. equilibrium ye. water disemboqued returns & ascends by ye. siphon.

The last experiment diversified by using a short siphon whose
external end did not communicate with ye water in ye open vessel,
& therefore ye water discharged cd not return by it but only air;
a second phial was therefore adhibited with a long siphon communi-
: cating with ye water in ye open vessel likewise & thro' this
ye water which had been discharged by ye first siphon was
transmitted to a third vessel or phial.

This doctrine further illustrated by artificial fountain.

Air weighed by means of a florence flask, with a brass cap
perforated & covered close by a piece of oiled bladder. this admits
ye air to be exhausted but does not suffer it readily to return.

A piece of cork & lead suspended in equilibrio at ye ends of
a balance, put into an exhausted receiver, shew ye ye cork
being buoyed & meeting with no resisting medium sinks first.

A piece of wood put into water ~~& the~~ in an exhausted receiver emits for ye space of an hour a prodigious quantity of air an apple does ye same; but after ye operation is shrivelled. ye wood is heavier having absorbed so much water in lieu of its air; if it had been immersed in mercury it wd being cut appear full of metallic particles.

A glass of porter submitted to ye receiver emits an astonishing quantity of air in ye form of froth; after ye operation it is flat & vapid. This shews yt ye carbonic acid air is ye best of malt liquors.

The nature of ye Air Gun explained

For making oxygen gas from manganese, choose ye larger pieces & take care ye it be clean & free from all all foreign substances especially inflammable ones as straws &c. Let all the vessels used in the process be very clean. The manganese must be powdered in a glass or marble mortar. Wedgwood one is better than any. An earthen retort, glass tube, water tub & bottles, open furnace with charcoal fire used by Mr. Parkes.

This oxygen is the acidifying principle of the universe, as is hereafter shewn by deflagrating sulphur, charcoal, & phosphorous in it; whereby acids are produced.

Oxygen gas may be inspired 5 times before it be reduced to ye state of atmospheric air. Is not miscible with water. Heavier ye atmospheric air. Mr. C. thinks that after entering ye blood it is united with the carbonic acid & passes off thro ye pores as well as lungs, being thus rendered volatile.

Tis a question among chymists whether calx of manganese will recover its oxygen by long exposure to ye. atmosphere— Mr. C. thinks it does not. The calx however is equally serviceable as ye. manganese earth itself in making glass & enamel.

Distinction is to be made between oxygen & oxygen gas. The oxygen is united with ye. manganese earth from which being separated & combined with caloric becomes a permanent elastic fluid denominated oxygen gas.

Oxygen gas inhaled increases the pulse in 4 minutes from 74 to 94 & in 4 minutes more to 124.

Oxygen gas has a great affinity for azotic gas. Hence oxygen gas thi' bottled & suffered to remain in the vicinity of a necessary is soon corrupted. Further experiment with bladders of blood. Also by wetting ye. leaves in one end of a book with solution of acetate of lead & the other end with hepar sulphuris; the writing made by ye. former appears. ye. acetate of lead discharges its oxygen & ye. lead becomes mineralized or vegulized as seen thro' a microscope.

is open at both ends, y^e^ upper end is closed with a piece of blue slate or glass grinded exactly the value, & y^e^ lower end is placed in a tub of water. After the combustion been over, the water ascends with y^e^ jar which indicates y^t^ nothing has been expelled from y^e^ metals & other substances, but something has been absorbed. This phenomenon takes effect when only atmospheric air is used in a small degree.

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In making phosphorus Mr. C. finds that when pure glass is used & the distillation is slow, y^e^ best is obtained. Great care necessary in using it as it ignites at 40 degrees of temperature. Many shocking accidents have happened from not using this with due care.

Thick glasses when exposed to any heat crack sooner than thin ones.

It is almost impossible to expell y^e^ last portion of water from charcoal, hence its impurity. 72 grains of oxyd muriate of pot ash yield 100 cubic inches of oxygene gas; great care however is to be taken y^t^ no inflammable substance come into contact with it or it will explode.

Water is very greedy of carbonic acid air; takes up voluntarily an equal quantity & by agitation a great deal more.

Test papers to try acidulated liquors, prepared from a solution of lychnis.

Experiments made by burning phosphorus charcoal, & sulphur in oxygene air – in y^e first case phosphoric acid is produced by a brilliant deflagration, in y^e second, carbonic acid; in y^e third sulphuric acid attended with a pale blue flame.

A steel watch spring burnt in oxygene air deflagrates with much brilliancy, y^e sides of y^e glass are covered with a sort of rust, y^e red oxyds of iron

A common iron wire is converted into black oxyd of iron, but steel which is free from plumbago carbon & which of itself is in the first stage of oxygenation is converted as observed into a red oxyd.

If these oxyds were weighed they wo^d be found equal to y^e metal & the oxygene air consumed. Hence it is inferred y^t instead of something being thrown out from y^e metal as the Phlogistians contend, something is absorbed – The acids formed from y^e simple substances sulphur & phosphorus are equal in weight to y^e substances & y^e oxygene gas used.

In oxygenating these substances another circumstance occurs which militates against the Phlogistian system. The glass jar used on these occasions is

For making a simple apparatus at a cheap expence for obtaining different gasses; provide yourself with an earthen pipkin, & let it have a stand or shelf wither held fast to the side by means of two upright deal sticks tightened by a screw or string. Then procure a few pipe stoppers; let y^e^ ends of y^e^ pipes be tapered or ground with a scythe sag stone, and let y^e^ corks be first perforated with a broach & then rounded & enlarged with a file or hot iron. If they should not be air tight which may be known by keeping them under water & blowing thro' them, take a little wet shrubbish clay, or beet wax. The latter however must not be used, where any heat is present: the former may be got in Long-acre & near S^t^ John's Gate, & should be passed thro' a lawn sieve before used. Then nitrous gas is prepared. The more crooked the pipe the better

This glass used for breathing in & conducting y^e^ air into, wood: or it may be filled with oxygen air & used for complaints.

a bird confined in a Glass half full of water with a wood perforated to stand upon, in a little time grows faint but on y^e admission of oxygen recovers.

Air passed thro' y^e lungs is impregnated with carbonic acid, proved by blowing thro' a tube into a phial of lime water which becomes precipitated

Air in which a candle has burnt is charged with carbonic acid & precipitates lime water in like manner; when y^e candle is just expiring apply oxygen & it recovers.

The goodness of air formerly tried by seeing how long a candle or mouse w^d live in a given quantity, but is now tried by uniting nitrous gas to it which absorbs y^e oxygen & occupies less room in proportion to y^e purity of y^e air.

Nitrous gas is produced by pouring nitrous acid diluted with an equal quantity of water on

The residuum after nitrous gas is obtained, may be used for making match papers. Take slips of brown paper & dip them in y^e^ nitrate of copper, dry them, & they will take fire with almost the warmth of the hand. useful for igniting any air or other matters in close vessels, by first putting in a slip of this paper & then holding a hot poker on the outside. After deflagration the red copper appears which may be used for making enamel

Before y^e^ atmospheric, oxygene or other gas be combined together in the eudiometer, let the two airs be poured into a wide mouth bottle & shaken smartly as they are mixed; then pass them into y^e^ Eudiometer; this is Mr. Cavendish's method. Instead of marking the Eudiometer with a diamond as Dr. Priestley does which mark is not seen when the tube is full of water; Mr. C applys a common wood scale to the outside. If y^e^ nitrous gas has much water to pass thro' (which is the case in long narrow tubes) its strength will be impaired by y^e^ absorption of the water.

or copper filings or clippings in a phial; y^e^ apparatus is simple &
contrived by tobacco pipes.

Azot obtained by means of hepar sulphuris or sulphate of potash made of caustic
fixed alkali & sulphur which must be kept in close bottles.
The attraction of hepar sulphuris is such, y^t^ if you write well
a solution of sac. saturni or sulphate of lead on y^e^ beginning
of a blank book & wet y^e^ last leaf with a sponge dipped in
solution of hep. sulp. it will strike through all y^e^ leaves & cause
y^e^ writing to be visible. It will even act thro a stone wall
which proves y^t^ nothing much less y^e^ lungs is impervious to
y^e^ action of oxygene.

Atmospheric air may be respired 5 times successively & with
a little respite 8 or 9 times. It fatigues & oppresses the
person very much, but this may be removed by taking a
little hydrogene or hydrogen carbonic acid gas

Hydrogene gas obtained from zinc or iron filings or clipsprings immersed in a dilution of vitriolic acid. Iron filings are apt to be greasy, require more acid, & more heat. Zinc requires no heat & only 1/4 of acid to q^n. water used. After an ei cone away, white vitriol will be formed. Hydrogen is q^n lightest of all airs, & therefore when mixed with oxygen to produce an explosion if it has stood any time, should be shaken together.

The phial containing the ingredients

A. The bladder used for making bubbles, with a wood cock. B. The adoption of wood also to which C the pipe is fitted.

In order to expell the air from the bladder, it should be laid flat on the table & rolled; if some hydrogene gas was introduced & then expelled the bladder would be better prepared. Apply a candle to the end of the glass tube as the hydrogene comes over & you have a philosophical candle.

Lecture 7

mixed with ⅔ atmospheric air or ⅓ oxygene

Hydrogene gas conducted into a bladder by means of a bottle without a bottom which being immersed in water y^e air is driven upwards thro y^e neck of y^e bottle into y^e of y^e bladder; it is made by pressing y^e bladder to pass thro a pipe & inflate soap bubbles which ascend to y^e top of y^e room; touch these as they float with a lighted candle & they explode with prodigious noise. N.B. I believe a certain proportion of oxygene is mixed with it.

Tis remarkable that tho' this air is inflammable when in contact with atmospheric air, it of itself extinguishes flame as is tried by putting a lighted match into a phial full of it. Invert the bottle & it will continue to blaze at the mouth. The flame called y^e philosophical candle is different to blow out & owing to y^e carbonic acid breathed from the

A curious phenomenon is exhibited by means of phosphorus mixed with caustic lixie. For instance put into a bulbous phial holding 6 or 8 ℥ a dram or two of salt of tartar & half the quantity of caustic alt lixie, then about an ounce or more of water, & put under a spirit lamp; when you think the atmospheric air in the phial is expelled add 5 or 6 grains of phosphorus, & apply the lamp again. By means of a glass tube crooked at both ends, one inserted in the mouth of the phial, & the other dipped in water, so as leave its orifice just at the surface, you will have bubbles of flame come over, accompanied with curious rings of smoke.

lungs, gives a blue flame when blown upon.
An Air pistol charged with hydrogen, & fired by means of an electrophorus gives a good report; instead of hydrogene a drop of ether let fall into the pistol will answer. But the most stunning noise ever heard is made by filling the bladder with 2 parts hydrogene & 1 oxygene & by means of a pipe stopper affixed to the end of it, blow up a number of soap bubbles in a wash hand basin, then set fire to them & they all explode at once.
Hydrogen breathed 3 or 4 times over loses its inflammability, owing to its being impregnated with carbonic acid gas.
It lowers the pulse very much.
Fulminating silver, explodes with the least motion.

Lectio 8.

Hydrogene inflamed by electrical fluid in an electrophorus. this gas will preserve its strength 8 or 10 weeks. A bladder is fitted to the head of a bottle containing y^e. zinc & sulphuric acid, which bladder has a stop cock, & is afterwards disengaged into the electrophorus, displacing by force y^e. water in the lower part or vessel & compelling it to ascend by means of a tube into the superior part— Mix minium or litharge with tallow, put a lump into excavated charcoal & with a blow pipe direct the flame of a candle to it, y^e. metal will be revived. A wafer held to a candle will exhibit particles of lead. Zinc plate dipped into a solution of acetate of lead will have y^e. latter precipitated upon it. y^e. same happens if iron immersed in solution of copper. Ether a few drops of it put into a bladder on y^e. admission of air converts it into hydrogene. Shewn by fixing a pipe to the mouth of the bladder & then forcing the gas out at the point of a candle, a stream of fire issues from the pipe; if the bladder

has been filled with air from the lungs y^e flame will be blue.
Instead of a pipe, a pair of flyers may be affixed to the bladder
which will afford a resemblance of a fire wheel. Hydrogene
mixed with dephl, gives a red flame. Nitrous gas a green.
Hydrogene which has passed the lungs acquires a little carbonic
acid, as it precipitates lime water.

Lectio. 9.

An experiment was made by some Chymists on water. They took
a gun barrel, laid it in a long furnace, at one end was a retort
containing 12 ℔ of distilled water heated by a chafing dish. The
steam passed y^e gun barrel, & when condensed weighed as much as
at first, & was unchanged or decomposed. They then filled the
barrel with iron filings, the water was by that means decomposed
& convoled into hydrogene gas; the tube was weighed & found
to have gained what y^e hydrogene wanted in weight. Then
instead of iron filings, charcoal was used, it should not be produced

too fine, nor yet be in large pieces, in y^e former case y^e charcoal w^d be carried off by y^e water, in y^e latter it w^d pervade the interstices without acting on it) here then hydro-carbonate gas, by some called carbonated hydrogene, & by others Heavy inflammable air was formed. It is a compound of hydrogene & carbonic gas, but different from these gases mixed simply. M^r Varley sets his Gun barrel perpendicular, the lower end being filled with a brass cap or breech & a large touch hole made capable of receiving a retort. Kelly experiments made by deflagrating y^e bark of charcoal in oxygen, y^e bark which is brittle, & looks metallic, & crackles when ignited is the best. Water formed by causing oxygene & hydrogene to enter y^e same receiver on y^e opposite sides thro' gun barrels. M^r. O's plan is to fill a phial with zinc filings, sulp. acid & water, & conduct the hydrogene under a receiver two thirds full of water; y^e pressure of y^e water drives y^e gas thro' a cock at y^e top & thro' a small tube which is bent & turned upwards The gas is lighted with a candle & a glass receiver or inverted funnel is held over it, the wat escapes thro' y^e top of y^e funnel, y^e oxygene comes from y^e atmosphere & uniting with y^e hydrogene is converted into water which trickles down y^e sides of y^e funnel

Fermentation may be considered as nothing more than the extrication of carbonic acid air.

Carbonic acid air heavier than atmospheric, and is easy mixed with water.

If soda be mixed with the water it will take up a double quantity of this air; but ordinarily only equal part or quantity; when mixed there is no increase of bulk in the water; by other improvements & by the assistance of pressure & agitation the water may be made to take up 4 or 5 times its quantity

This air is obtained by pouring marble dust into a bottle then a little water & afterwards an equal quantity or thereabouts of vitriolic acid; the air is immediately disengaged & by means of a crooked tube inserted in

the Cork is conducted by means of a bladder under a bottle inverted in water, which becomes impregnated thereby, with a little agitation.

It has been found serviceable in paralytic cases by both drinking q.s. impregnated water, washing the parts affected by it, and also applying q.s. air to the part: it is proposed to introduce the air under the bed cloaths. The water after the body has been washed by it is divested of its air.

It has been tried with success in healing ulcers & stopping mortifications; in which cases the air is applied & confined to the parts by means of bladders —
Philosopher Walker's wife was cured of a sore breast by the air.
The water impregnated is eminently serviceable in cases of stone & gravel, & probably the air or water might avail in the gout.
When the ulcers have been very foul, the carbonic acid air is sometimes decomposed, & q: water turns black.
This air extinguishes flame
The water impregnated with this air when bottled and with q: addition of a spoonful of iron filings is a fine chalybeate & good in low nervous cases.

There is a singular experiment to be made with charcoal. Heat it well pound it in a heated marble mortar put it into a cup over a gentle heat or lamp for the purpose of extracting & expelling aqueous particles then pour upon it strong nitric acid & the charcoal will become ignited in a brilliant manner. This should be done in the chimney on account of the nitrous fumes that arise.

All species of spars or spathose earths yield fluor acid gas. by pounding them to a coarse powder, adding equal quantity of sulphuric acid, & applying a gentle heat as lamp. Tis observed however yt coloured spars are most productive. The fluor acid gas has yt singular property of corroding glass with yt same facility as aqua fortis does metals: and it is observable yt in countries abounding with spar the windows of churches have suffered much.

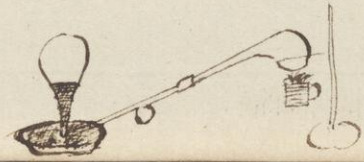
It has been found by Mr Darley yt in those parts where spar abounds as in yt district between Doncaster & Gainsboro' yt corpses are long before they corrupt after interment.

To etch glass let it be coated with bees wax & colcothar, & in 5 minutes after it has been exposed to the action of the f.a. gas it will be marked. The extrication of yt air after yt operation is done may be checked by yt external

application of cold water or even placing the materials in a cold place. (51)

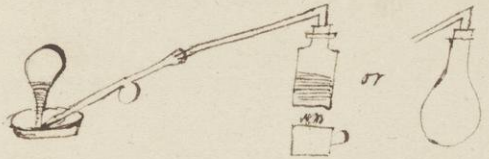
The fluor acid affects glass ye same way as the gas & is obtained by mixing ye Spar & acid in a retort or other glass vessel & applying heat. The air ye comes over is made to pass thro quicksilver in a dish into a long necked phial containing a little quicksilver & a good deal of water; wher it unites with the water in a gelatinous or chrystaccous manner; which crust is to be squeezed & ye result is fluor acid.

In making ye lutes putty is used – sometimes Shurbridge clay.



muriatic acid with q.s. application of a little warmth yields muriatic acid gas— but common salt 2 pts & sulp. acid. 1 pt. yield it also. mixed together in a phial or retort & assisted by q.s. heat of a warm hand, warm water, or lamp. The operation is checked like the preceding by cold.

Mercury also as in the former case it is to be used in conveying the gas which otherwise would form with water muriatic acid. If the salt were decrepitated it would be better.



A bit of dry charcoal sprinkled with powdered nitre suspended & deflagrated in oxygen air affords a pretty sight.

Sect. 12.

Oximuriatic gas obtained by distillation of salt with sulp. acid with y^e^ assistance of manganese. Proportions. Manganese 6 ℥. salt powdered 16 ℥. sulp. acid & water aa 12 ℥. These ingredients will of themselves yield y^e^ gas, but it is better to assist y^e^ operation with a lamp. As glass phials are apt to burst & in this case produce disagreeable consequences, we use contrived lead ones, but they also are liable to melt.

In the large phial is a capillary tube called the tube of safety, which prevents y^e^ gas from bursting the phial. y^e^ water within y^e^ tube is driven up when the gas is violent & by y^e^ superincumbent water cannot escape

The crooked tubes are inserted loosely into the necks of the phials, & closed with putty which effectually prevents the nitric gas from escaping. If it does however escape, it may be detected by dipping a feather in vol. alkali & applying it to y^e^ neck of y^e^ bottle, y^e^ gas will be precipitated in a white cloud.

This oxemuriatic gas is highly serviceable in bleaching destroying colors, washing &c^a^. it will applied to y^e^ sheets of a blackamoor turn him white.

If instead of water alone in the large three necked bial, a solution of pot ash be used, a salt will be produced called Salt of Sylvius, which will be succeeded by a second (y^e^ first being taken away) called oxyd muriate of pot ash with prismatic fibrous chrystals. Some use mild, some caustic, some vegetable, & some mineral alkali for this purpose

The grains of this oxyd muriate of pot ash, mixed with 2 grains of sulphur, in a marble mortar, with the addition of 16 grains of phosphorous will by strong friction produce a great explosion. The French intended substituting this discovery for gun-powder, it being much stronger.

60 cubic inches of oxydmuriatic gas in a temperature of 70 will (contained in a bottle) by pouring in powdered antimony produce an agreeable sight. Some precaution is however necessary for as the oxygen is absorbed to the nitric gas is set loose.

Experiment of Boyles. Take a Florence flask, put in 1 ℥ of water & a little phosphorous suppose ℈i. hold it over a Lamp, a beautiful green flame arises in the bottle, accompanied by sparks like shooting stars – every now & then the lamp is

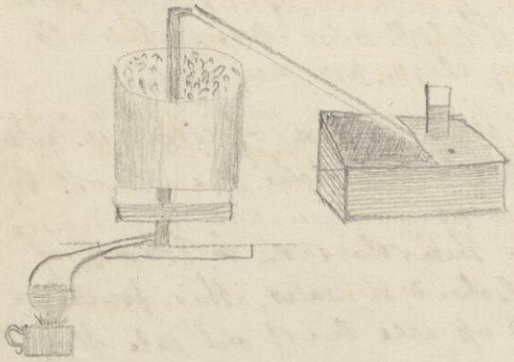
is extinguished, for y^e purpose of making the stars shoot better.
Phosphorus which is not reckoned very pure suits this best,
as y^t made from urine answers better than y^t from bones.

—

Concentrated sp^t of nitre poured on oil of turpentine produce
an instantaneous ignition. The oil used was rather old,
the nitric acid was not very clear nor very strong

—

If brown paper be steeped in a solution of copper in nitric
acid it makes good matches & will take fire almost by
y^e application of a warm hand.
If y^e crystals which form themselves in the solution of
copper in nitric acid be dissolved in water, this poured on
tin foil & immediately capped up will burst out into flame
& the tin will be oxidized



1. Sitting.

Was employed in making hydrogene gas from iron assisted by charcoal. A small gun barrel was filled with iron turnings & made to pass thro a small iron furnace or pot filled with charcoal, at y^e^ bottom of the iron tube was inserted a small glass retort half filled with water to which was closely applied a lamp or tin box with spts of wine & cotton.

This experiment did not altogether succeed, much gas was not generated; owing as was supposed to the heat within the furnace not being sufficiently great to decompose the steam as it passed thro y^e^ tube, as appeared from the great quantity of condensed vapor which came over along with the gas. The retort broke at y^e^ conclusion, as soon as the water was all evaporated.

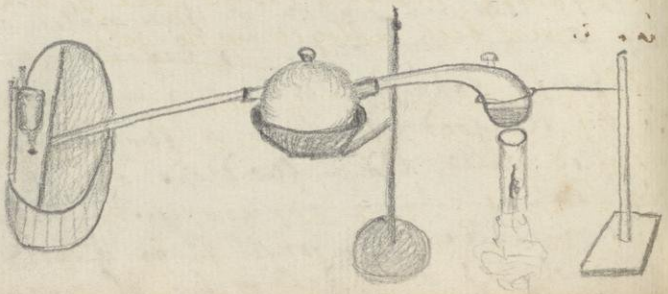
2.

Analysis of Earths. For assaying a blow pipe is necessary. Mr Varley uses two kinds made of brass, one with a crooked end, the other with a transverse one at right angles; the tubes are conical. ~~Best of~~ An iron ring or two or three of different diameters are used to contain the subject while beaten or pounded with an hammer. A piece of square marble to place the ring & subject on. Charcoal to serve as a bed for the subject, & a pair of forceps to hold it, or to take up the metal. If there be iron in the subject, pound it, & apply a loadstone. Tis usual first to try the hardness of it by seeing if it will strike fire with steel. The ore is first to be roasted in order to drive out the sulphur & arsenic, which are discoverable by the smell & green flame. Then add a little borax & ring minute & melt the subject, when fused apply an iron wire & if there be

any copper present it will attack duly & be precipitated on the iron; if silver be suspected to exist, use an copper wire in like manner. A magnifying glass is necessary both before & after fusion to examine the shape & color of the materials. In some cases a gold silver or platinar spoon is used, but the bole of a tobacco pipe Wt. 6 pence as good as ought. In lieu of Borax, mineral alkali & micro-cosmic salt is necessary.

Detonating powder. Take 3 grains of oxymuriate of potash 1/p gr. of sulphur, & 1/p gr. of charcoal; grind them all separately then mix them; place the compound on a piece of paper on an anvil & strike the anvil with an hammer. The powder will burn deflagrate & detonate.

Nitric acid. Take ℥iii of nitre powdered, put it into a stoppered retort with a tubulated receiver luted on; to which must be added 3 vials connected by crooked tubes half filled with water, & terminating with a tube in a pneumatic cistern. Place the retort over Argand's lamp & add to y^e^ nitre ℥iss of sulphuric acid. The acid which will be found in y^e^ receiver is very good & free of all muriatic & sulphuric acid & amounts to ℥iss. or more. The gas which passes thro' y^e^ several phials & is at last received under y^e^ pneumatic cistern is oxygene gas but not very pure. To free y^e^ nitric ~~gas~~ acid of its red fumes expose it in an open vessel over Argand's lamp. To try its goodness, pour a few drops into a glass of distilled water, add a few drops of nitrated silver, if any cloud or precipitation ensues, 'tis a proof that it is not free from muriatic acid; for if it be clear & you add a grain or two of salt or a drop or two of muriatic acid, you will



leave y^e^ mixture turn milky. Again to try whether it contains any sulphuric acid, pour a few drops into a glass of distilled water as before, then add a few drops of nitrated barytes, & if a cloud follows its a sign y^t^ y^e^ sulphuric acid is present; for if it should prove clear, & you drop in a little epsom salt or sulphuric acid y^e^ mixture will be thick & milky.

In making nitrated silver, care shd be taken y^t^ y^e^ silver has never been alloyed with gold

Phosphorus immerged in nitric gas super-oxygenated (i,e distilled with manganese) causes a great heat, & smoke, & at last a surprising deflagration.

Fuming nitrous acid was purified by distilling it afresh in a glass retort over Argand's lamp; y^e^ fumes passed thro y^e^ retort

into y^e receiver, where they collected. to y^e receiver was luted a glass tube connected at y^e other end with an pneumatic apparatus for y^e purpose of collecting & trying y^e gas y^t came over. A great deal of gas or air was produced, but it was not oxygene as was conjectured. The Nitrous acid by this process was rendered very clear.

Notes taken at a Lecture on Chymistry by A Walker delivered in Conduit Street Hanover Square in April. 1797.

Pound some Pyrites, add water to it, then apply the Thermometer; you will find an increase of temperature — Hence y^e warmth of Bath waters accounted for: they are percolated thro' mountains abounding with Pyrites — the heat proceeds from y^e sulphur (y^e mother of vitriolic acid) which is contained in y^e pyrites — add a little vitriolic acid to water, heat is generated, i,e caloric escapes.

Again Pyrites contains Iron, & therefore ye. water in which Pyrites has lain will by ~~black~~ with green tea or a solution of galls turn black.

Let some Iron nails or filings be put into a mixture of vitriolic acid & water, & hydrogen Gas will be produced; an open glass vessel in which this Gas has been received will on ye. application of a lighted Candle produce a flame with a slight explosion.

Put a hollow or tubular match into ye. top of a Phial containing ye. ingredients producing hydrogene gas & hold over it a glass Receiver, an aqueous mist will be formed within. this say ye. Anti-Phlogisticks is water formed by ye. union of hydrogen & oxygen - But Dr. Priestley & Mr. Walker think it is only ye. water within ye. Phial raised by ye. heat into a slight steam or vapor.

Limestone consists of a Calx combined with Water & Carbonic Acid, which may be expelled by heat. The Calx is difficoluble in water, & then constitutes limewater; if this solution be acted upon by ye. Breath, ye. calx is again converted into limestone, & in that state is precipitated to ye. bottom. This is illustrated by putting a little lime-water into a Syphon & blowing into it. It is owing to its capacious affinity to fixed Air or Carbonic Acid, ye. lime tears ye. flesh from ye. bones of a carcase in 24 hours.

Soot consists of Spirit, Water & Tartar; fill a copper still with soot which heat with spirits of turpentine & ye. water & spirit will be distilled & come away pellucid, leaving ye. tartar which is ye. colouring ingredient at ye. bottom.

Water containing an acid becomes milky by adding a solution of tartar; ye. acid of sugar produces ye. same effect where an alkaline quality is present.

Geology.

The anchor on Selencian Medals marks y^t. coin to be struck at Antioch, where an Anchor was found upon digging y^e. first foundation of y^e. City, tho' at a considerable distance from y^e. Sea. (Pinkertons Medels. 1789. v:1. p 191.)

Seeing y^t. organised bodies are found entombed in y^e. heart of rocky mountains, it follows y^t. these mountains must at one time or other have been in a soft state, & y^t. y^e. world was replenished by vegetables & animals of all kinds previous to y^e. formation of these mountains

Now as all bodies owe their softness to y^e. agency of fire or water, i,e. to fusion or solution, & as these mountainous masses had they been liquefied by fire w^d. have destroyed y^e. texture of most bodies that occur in them & particularly kinds which are found now alive, it

destroyed y^e texture of most bodies
that occurs in them & particularly

follows, y^t y^e liquefaction of these
rocky mountains must have been
effected by moisture & not heat.

From loads being found also imbedded in
stone quarries even under y^e sea,
it seems y^t they must have been
incarcerated & excluded from y^e air
when in a torpid state, from which
they cd. not recover without y^e admiss-
-ion of air & an alteration of tempera-
-ture; & from y^e paucity of vegetables
found in a petrified state, as well as
from y^e description of those which are
found, may we not conclude y^t
y^e inundation took place here in the
winter season?

The soil which is found upon secondary
mountains which contain petrifactions
is of course post-diluvian. Quere. Is
any part of y^e soil, antidiluvian? If
y^e deluge was general, a great deal of
y^e present soil must be antidiluvian.
Otherwise, how all y^e antidiluvian soil
have perished or been overwhelmed, alle

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vegetable kingdom must have perished along with it, & so subsistence left for those land animals which survived. We are told indeed by Scripture that those Trees &c escaped y^e^ flood; for was any provision made by Noah to preserve y^e^ vegetable kingdom which it was intended therefore shd not suffer in y^e^ Catastrophe.

What proportion is there between y^e^ antidiluvian & post-diluvian land in point of extent?

Most mountains have their strata horizontal as if formed by deposition. Some however as y^e^ Westmoreland mountains have their strata oblique & even perpendicular; has not y^e^ position of such strata been effected by volcanos subsequent to their first creation?

'Tis said y^t^ there are instances of petrified bodies been found in oblique & vertical strata; if this be true

Quaere whether animals are generally found in Caves, Dens, & other such places

It may confirm y^e^ opinion y^t^ such mountains have had their strata disordered by volcanos subsequent to y^e^ deluge. N. This must have happened soon after y^e^ deluge, else y^e^ Ark cd not have carried those animals as it probably did.

Marine animals are generally found in limestone: Quere. whether any land animals or vegetables are found in limestone.? I have got a set of vegetables from Switzerland in a calcareous stone. vid. Parkinson. 1. 422.

From y^e^ very few land animals & vegetables found in a petrified state compared with y^e^ number of marine bodies, are we to conclude y^t^ what is land now was formerly y^e^ bottom of y^e^ sea; or y^t^ y^e^ bottom of y^e^ sea with its contents were projected by subterraneous force on y^e^ land where they now remain covering y^e^ former surface?

If all what is now land was formerly y^e^ bottom of y^e^ sea, whence did all y^e^ present vegetable & animal kingdom originate?

Geology.

Had ye. order of ye. Strata been ye. same all over ye. globe, however they might have been disturbed by convulsions, their formation might have easily been accounted for by repeated precipitation & deposition. but not only ye. order of ye. Strata varies in every district & in every mountain almost, but ye. nature too or ye. genera of ye. earths varies. Doe ye. Strata at different times assume different appearances, & do minerals as well as vegetables & other bodies pass from one state into another? Some stones we know perish in course of time, whilst other earths & substances are concreted into stones by length of time. Stones grow, stones contain air, stones suffer decomposition, & then enter into new compositions. There is much analogy in all ye. works of nature.

Is it possible ye. ye. Zoology of Elephants &c ye. inhabitants of ye. warmer climates may have been transfused into these northern climates by means of whirlpools

y. warmer climates may have
been found into this another
[illegible]

y. subterraneous channels effected
when y. fountains of y. great deep
were broken up. N.B. Quere, whether y. bones of the
Mammoth are not taken for those of y. elephant.

Rejecting this account, it must
follow that y. three animals formerly
inhabited these climates, which
consequently must have been
warmer y.n at present; it also
follows y.t y.e vegetable kingdom
must have been different in
these climates ~~from~~ which y.
Lithoxyla & Lithophylla seem to
confirm; it also follows (unless
each Island was originally replenished
which neither Revelation nor Experience
allow) y.t England & other Islands
where y. bones of Elephants & Rhinoceros
been occur y. inhabitants of America
& Asia must have been at one time
contiguous & made part of y. 2
continents, but at what time did y.
separation take place

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Geology.

If y^e^ separation took place previous to y^e^ deluge, then y^e^ deluge was not universal; because had all y^e^ earth been covered with water & thereby all Land animals destroyed by what means or y^e^ retreat of y^e^ waters did these islands get replenished with animals particularly of y^e^ noxious kind as serpents, spiders, (mice) moths, ? were y^e^ eggs of these animals permitted to escape y^e^ destructive effects of water?

If y^e^ separation took place immediately after y^e^ deluge, this objection will still hold good.

If y^e^ separation took place at a considerable period after the deluge then y^e^ occupation of these islands may be accounted for.

It seems however wonderful y^t^ Noah shd be able to collect y^e^ exhibitants of all climates into y^e^ ark as y^e^ white Bear & Bison deer from y^e^ Frigid Zone & y^e^ Zebra &

ark as y^e whole race of Lions does in y^e Frigid Zone & y^e Lion
y^e Ass & Bear from y^e Torrid Zone;
& also proper food for them;
if collected, nothing short of a miracle
cd. preserve such different species
in y^e same atmosphere.
How were y^e Crocodiles, y^e Hippopotami,
& all fresh water fish preserved?
As Nature always operates by
y^e most simple & ready means,
we may suppose y^t either y^e deluge
was not universal at least at y^e
same time, or y^t most of y^e
organized bodies attached to different
countries have been formed since
y^e general deluge. This process
seems to require fewer miracles
to accomplish it than y^e other
of collecting & preserving in ye Ark
all y^e animals of every sort & country.
It seems to be a matter of uncertainty
whether any carnivorous or noxious
animal of any kind existed before y^e
deluge; have we any fossils of such
animals? It seems y^t man as well

Geology

as all other animals was previous to ye era graminivorous; after however ye deluge, these animals of a ferocious & noxious kind were produced as well to prevent too great an increase of ye other kinds as to punish man for his impiety.

Some animals of an anomalous nature may likewise have been created subsequent to ye deluge adapted to ye variation of climate which has succeeded ye event or at least preceded it.

Have any Land animal exuvia been found in Limestone strata; if not, are we to suppose yt Limestone mountains abounding with marine exuvia have been ye bottom of ye sea formerly; and are we to conclude yt strata abounding with terrestrial exuvia have been established over land; are marine & terrestrial exuvia ever found together imbedded; are they

found ever in alternate strata?

Are there any instances of a district of limestone containing petrifactions surrounded by land not touching y^e^ sea in any part of there & this surrounding land contains exuvia of limestical bodies for this district of limestone must have resembled y^e^ Caspian Sea which is very unlikely or must have been collected by y^e^ deluge & not have been part of y^e^ antediluvian ocean. An instance or two of this sort might suppose: some much light on y^e^ subject.

Had y^e^ chalk stone mountains been of a soft state when y^e^ deluge was abating, y^e^ waters wd have carried off with them a great portion of the calcareous earth & thereby left traces of their channels & ebbing; but y^e^ valleys among & near y^e^ chalk hills existed of

Geology

very full of Calcareous earth are full of soil; as if y^e^ chalk hills had been in a solid state during y^e^ time of y^e^ deluge, & y^e^ soil only which covered them had been washed off. There is reason to think these mountains as well as all others were prior to y^e^ deluge, & yt. y^e^ extraneous fossils are y^e^ remains of y^t^ globe or planet out of which the earth was formed a peice

As y^e^ greatest part of y^e^ fossil shells belongs to y^e^ Nautilus or Polythalamian sort, as Nautilus, Ammonia, Belemnites, which from what we know of them are of y^e^ pelagian sort; may we not conclude yt. at first y^e^ sea prevailed & very deep, so as to be unfit for y^e^ abode of any but y^e^ pelagian sort. What reasons are there to

Suppose yt such was ye State of ye globe previous to ye deluge.

Do ye Pelagian fossils present themselves in ye lowest strata in exclusion of others?

Probably however ye Sea to have prevailed generally at first & ye deep; yt Pelagian Shells were first formed, & yt as ye Sea grew shallow by depositions, exhalations, or absorptions below, yt other shells were formed; yt afterwards Islands or continents were formed as we see them, by volcanoes, by extension of ye globe, or by violent diffract depressions of ye bed of ye sea in some parts. how do we assign all this account for terrestrial exuvia been found imbedd subsequent to ye formation of land.?

The exuvia of land animals which inhabited ye first islands were washed into ye sea & contributed to ye formation of other islands, or were destroyed when we find them by ye general deluge.

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Geology.

The most comprehensive system is this; yt. ye. chaotic flood was peopled by degrees as it became more clear & shallow by shell fish adapted to ye. different periods. but this is not what I intended. I meant to say, That it is best to suppose Sea & Land formed nearly at ye. same time agreeable to ye. Mosaic Account; yt. ye. Sea was peopled & ye. Land also by their respective genera; yt. afterwards at ye. time of catastrophe called ye. Deluge, ye. Sea & Land nearly changed places, that was ye. bottom or bed of ye. Sea forms ye present Land, & ye. Land yt. was sunk down to ye. present level of ye. bed of ye. Sea. On this principle we are to infer ye. ye. mountains we now

see were formed gradually by precipitation & attraction of corpuscles at ye bottom of ye sea according to them of course all ye shells found & which were above them ye were dead; ye ye excrescences of living bodies were such as had been washed away & carried by ye reflux of ye waters into ye sea; ye in some places ye bed of ye sea was such as ye channel between ye French & English coast; yt in other parts ye land (which we may suppose to have been low) was

In ye nature of Geology is obtuse & hidden as it were within ye earth, are we to conclude yt ye knowledge of ye formation of ye earth was meant to be concealed from men?

Are we to lay it down as a general proposition, yt Natural History may be as well learnt by observing merely what Nature has laid before us as by minute experiments of our own & laborious researches into ye arcana of Nature?

It does not indeed appear to us that our best information of ye nature of things ye we entertain more just or more certain ideas of their formation than ye Greek Philosophers

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Geology.

Amidst all ye. revolutions & convulsions which ye. Globe seem to have undergone we never meet with any of mould or soil below ye. surface. Wer ye. antediluvian earth as D. Woodward thinks all dissolved in ye. water, previous to ye. changes which ye. Globe experienced as appears by ye. Shells &c? We must admit this or suppose ye. there was no Antediluvian earth, or lastly ye. ye. convulsions of ye. globe were previous to ye. deluge & formation of soil.

Is it true ye. Charr fish is only to be found in one small lake in Cumberland, & ye. there are several species of fish only to be found in certain rivers; how came ye. Charr in this lake, before or after ye. deluge? If before, then this part of ye. country cd never have been ye. bottom of ye. sea, because 'tis a fresh water fish.

Was ye. antediluvian water fresh or salt?

The fossil shells as they resemble salt water shells shew y^t y^e Sea was salt. But there are also shells resembling freshwater shells, hence we may conclude y^t there was fresh water also — but I am not clear as to this latter description.

Now y^e increase of water at y^e deluge if it was also salt must have destroyed all y^e freshwater fish: if it was fresh, quere whether y^e saltwater fish wd not have been destroyed. At least it remains to be proved y^t salt & fresh water can be mixed in so just a proportion as to serve as an element both for sea & river fish. This may be soon tried.

If no such mixture can be made, then y^e deluge was not general, or if general, animals have been created since to replenish y^e waters.

If such a mixture was made, y^e waters of many lakes & inland seas wd have partook of this degree of saltness now; but we find them all either very salt or very fresh.

Geology.

The existence of caverns shews that the globe was not united in one solid mass which afterwards was hardened, concreted or chrystallized, without having experienced subsequent revolutions. These caverns & deep glens must have been formed by subterraneous convulsions or earthquakes after the mountains had attained their present degree of solidity.

One remarkable feature in the globe is the gradual elevation of the earth from the sea to the centre of the land, by which means rivers are enabled to flow into the sea. How had the mountains been created by any sudden revolution as the mandalais or innumerable volcanos not one river would have been able to have flowed into the sea. Between the thousands & millions of mountains which occur in most large islands & continents, a way is provided amongst them which the often circuitous windings the fresh waters to the sea. Were it not for these passages, we should have lakes every where surrounded by mountains.

In discovery upon Geology, it must
first be compared w^th Moses's account with
facts; & 2dly. if be found unsatisfactorily,
to suppose some other hypothesis - Whitehurst
which makes y^e globe to have been covered
with water, & on y^e. Sides inhabited by
fish, & afterwards divided into land &
water by volcanos or central fires seems
to be very probable but perhaps not
comprehensive enough. Quere, do there
any such water fish found petrified? v.p.103.
It must be remarked y^t y^e hypothesis of
Whitehurst does not account for wood
's being found petrified - but I believe
I mistake him: he thinks y^e lands were
first formed gradually, & replenished, previous
to y^e grand eruption or deluge, whichever
it be.
If y^e. perturbations in mountains were
caused by y^e deluge, then y^e mountains
which occasion them were created by y^e
deluge; but how d^d. y^e deluge make moun-
tains like y^e Derbyshire ones, or how d^d.
it act so regularly as to leave channels
from y^e very bottom of them gently declining
to y^e sea.

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Geology.

Whether is it more probable yt
yᵉ isthmus between France & England
was depressed by a falling in of
crust of yᵉ globe, or yt yᵉ two continents
were sundered by a subterraneous explosion
under each?

The vents in yᵉ mountains & between
adjacent islands in which yᵉ strata
are similar on both sides but have
different levels shew that convulsions
have taken place since yᵉ strata were
formed & since yᵉ inundation which
prevailed because these strata so disordered
have many of them petrifactions.

Altho yᵉ strata do not take place
according to their specific gravities, yet
yᵉ very formation of them seems to be
yᵉ result of a regular slow process
& not of an accumulating undulating
swithery cause as a deluge.

As it generally happens that a
great number of shells &c of yᵉ same
genus occur in yᵉ same place, ex. gr.
yᵉ entrochi & cornu in yᵉ Derby shire
marble, we may infer yt there

shells have never been removed far from y^e^ place of their existence for had they been brought from a distance by an incendiary succeeding torrent they w^d^ have been entirely destroyed & mixed with various other particles of a terrestrial & marine origin.

As most of y^e^ petrified shells found in our seas are inhabitants of y^e^ Indian Ocean. Q^y^ whether y^e^ petrified shells found in y^e^ vicinity of that sea correspond with y^e^ shells inhabiting y^e^ temperate zone.

Q^y^ whether y^e^ great change which has been effected in y^e^ climates has been gradual or violent.

The Society Islands in y^e^ Pacific Ocean seem at present to enjoy the same temperature which once prevailed in this northern ocean; their plants seem to correspond with those we find petrified here. Their mountains are covered with ferns, y^e^ principal vegetable whose covers occur here. They have not above 3 or 4 sorts of animals, which may account for y^e^ paucity of terrestrial bodies imbedded.

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Geology.

I once thought that fishes might have most of them been created since y^e^ deluge, & again that no noxious animals existed before y^e^ era; but both those ideas vanish at y^e^ sight of so many shark teeth as are found here especially in y^e^ isle of Sheppy. Crocodiles also have been dug up here.

If it be difficult to account for y^e^ preservation of both sea water & fresh water fish at y^e^ time of y^e^ deluge, we must admit y^t^ y^e^ sea-water fish only existed before & that y^e^ freshwater fish have been created since. The small quantity of fish bones found imbedded shew that they did not suffer at y^e^ deluge.

Supposing this climate originally enjoyed y^e^ temperature of southern countries as do y^e^ extraneous fossils vegetable, marine, & terrestrial confirm: did any effect at that [illegible] labour under y^e^ disadvantages of a frigid Zone, or even of our present climate. Was there a frigid Zone. & if there was, were y^e^ seas or lands under it inhabited by animals? What record have we of

such animals or vegetables as are peculiar to y^e frigid Zone. Perhaps y^e Rein Deer is y^e principal one.

It seems extraordinary that we find we are continually meeting with y^e fossil bones of elephants, rein deer, & perhaps Mammoth; we meet with bones of horses, oxen &c. Here are proofs open of a change of indigenous animals.

If there was not originally a frigid Zone, where were denied y^e vegetables & animals ex. gr. y^e rein deer & white bear which now inhabit it. This compells us again to resort to a subsequent creation. Unless indeed it can be proved (which is not improbable) that y^e present vegetables & animals have assumed different characteristicks from what originally possessed in consequence of y^e effect of cold. How different y^e Newfoundland Dog is from an Indian Greyhound or a French Lap Dog, & yet it is y^e opinion of some naturalists as M^r. J. Hunter that all dogs are sprung from y^e wolf.

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Geology.

As most if not all vegetable petrefactions resemble no vegetables now in existence, we may safely attribute their origin to an antidiluvian era. The same observation extends to many animal petrifactions — This is a mighty proof that there existed a world prior to this, producing vegetables & animals different from the present.

Tis most probable y^t America was divided from Europe & Asia in the days of Peleg — The curse denounced against the earth for Adam's transgression implies y^t noxious weeds are of a subsequent creation. Might not y^e earth have experienced some of those violent changes which disfigure it at y^e same time? & might not various noxious animals have been created then also?

The days spoken of denote y^e creation of y^e world must have been periods of 24 hours, because 'tis said the evening & morning were y^e 1^st day & so of the rest. If y^e earth is further proved from y^e oblate spheroidical figure of y^e earth. y^e temperate zone excluded the Arctic circle as some imagine in order to account for y^e inhabitancy of elephants crocodiles &c, where did y^e white bear y^e reindeer & other animals as well vegetable inhabitants of y^e frigid zone enjoy existence?

I have an ill petrified Jaw of some sort of large species from Maestricht, of vertebra of a crocodile 30 feet long, was found in a stratum of sandstone - The remains of a Crocodile were also found in a stratum of stone at Kirkdown & are now in the possession of the learned Mr. Bayard. An impression also of a crocodile was found in limestone at Ashford by Mr. H. Watson of Bakewell. Whitehurst p. 29. & 184.

As most of the bones found in this country are of the granivorous class, are we to conclude that the carnivorous animals formally existed. It is to be remembered that few if any carnivorous animals exist in N. America, whose crowns & those of Britain bear a great affinity.

As so few if any crowns of bones & exercrescence, are we to conclude that such animals did not exist at all: or that they did not exist in the present soils or that being domesticated were driven by their proprietors upon the approach of the deluge to places of greatest security where they were overwhelmed with their owners - This seems probable, because we do not meet with human bones no more than those of a domestic genus -

Minerals

Minerals shd be divided into primary & secondary ones. All metals, chrystallized substances, & minerals are secreted from Strata of Limestone &c. & therefore may be denominated secondary minerals, or mineral secretions. We find no such substance as wax in the nest, hive, or flowers, yet such substances are secreted, so lead ore, spar, &c are secreted from stony Strata, tho' the particles of those bodies do not present themselves in the Strata. In fact no such particles do exist in the Strata, the minerals being created where found on the surface of the Strata by means of secretory ducts analogous to the various glands of animal bodies.

'Tis evident from Whitehurst's own work altho' his inferences are many of them founded on a supposed general uniform order or series of Strata that no such order exists in different places. For instance in Derbyshire Millstone Grit produces neither minerals nor ex[illegible] but in Sweden & Norway minerals are found in fissures of gneiss & stone which exists into the composition

minerals are found in fissures of quarry
stone called rake the Mineral

of Limestone — Shale he says p. 182
in Derbyshire contains neither animal
nor vegetable impressions; but p. 84 he
observed a stratum of Shale at Claxby
in Lincolnshire great number of
fossil shells, & nodules of ironstone. The
Shale was covered by a stratum of
limestone, which in Derbyshire lies
under y^e Shale — He says too that altho'
Shale is not productive of Minerals, a mine
near Ingam contained a vein of lead ore —
Again: altho' he lays it down as a general
rule that coal is not found under limestone,
yet he acknowledges an instance to the
contrary at Etruria & Little Fenton near
Newcastle in Staffordshire. 109.

1. Stratum. Rubble or pavements of stone
2. Limestone 4 foot thick, devoid of ~~metallic~~ Mineral bodies
3. Sand — 4. hydiaceous stone — 5. Bind — 6. Coal
This stratum of limestone the Author however
thinks a recent production, which is rendered
probable by y^e adventitious beds of sand & gravel.
213.
It will seem that copper ore also is found
in a mine ~~near~~ (Shale I expect) near
Gordon in Staffordshire. p. 227.

Minerals

Whinstone. In y^e^ county of Chester fragments of blue quartose stone seem to be universally mixed with y^e^ soil.
Whitehurst. p. 65.

In many parts of N. Wales the strata are quartzose or whinstone; a substance similar to rounded pebbles & boulders, observed in the gravel & sand pits in Cheshire & other parts of England, where no such strata appear. ib. 244.

In y^e^ vicinity of Maghera (N. of Ireland) I observed many fragments of lava & also of blueish quartzose stone called whinstone. p. 246. (vid. Millstone p. 112)
The generality of these fragments are rounded as it were by attrition, as stones upon a sea beach, & are usually applied to the paving of streets, public roads &c. I have observed a stratum similar to the above in N. Wales, & upon the Peker in Shropshire. p. 65. supra.

Two miles east of Ballycastle the following strata commence 1. whinstone a quartzose substance, which strikes fire with steel, (v. infra 125)
NB. The 7^th^ stratum is coal — the 10^th^ limestone & y^e^ 14^th^ Millstone Grit. p. 260

NB. The 4th stratum is coal — the 10th limestone
[illegible]

Lava & whinstone in some instances are so similar as to render them not easily distinguishable from each other. ibid.

The above stratum of whinstone incumbent on coal is the only instance of the kind which has occurred to me.

(vid. Millstone. 112) ibid. 6. Vol. 125.

At Skady (Ireland) a vein of lead ore has been discovered in a stratum of whinstone. (vid. Millstone. 112) Which 2 6/4.

Whinstone, Basaltes, & other stones whose hardness is such that their angular parts will scratch glass & whose fracture exhibits an appearance so much like that which might be expected from scarcely vitrified, as to have induced many to suspect them of volcanic origin from strata of considerable impalpable from their hardness & quantity in most coalmines. They are called Cockle in Cornwall & Stirdy in the north of Scotland.

Parkinson's Organic Remains. 1. 170.

Geology.

Whitehurst never observed any asteriæ
in ye Derbyshire strata, tho many intermixed
with ye soil. p. 241.

Nor fossil bones & teeth, imbedded together
with ye shells of fish in limestone strata. p. 57.

Nor recollects ever seeing any univalves
in Derbyshire limestone. 164.

And whenever bivalve shells occur with their
valves entire & close, they form select
classes. p. 53.

But where ye beds of shells consist of several
species, ye valves are not united, but separated
from each other as fragments. p. 54.

Nor are ye exuvia of terrestrial animals
often if ever found intermixed with
marine relics in limestone strata; nor are
marine ones often if ever found in argillo-
-arenous strata containing vegetable
impressions. p. 57. & 204.

Nor did he observe any beds of sand that
were totally free from extraneous bodies
or other marks of ye sand having been
deposited by ye flowing of water. p. 216.

Tis almost evident from inspecting the section of the Derby shire Strata, more particularly where toadstone occurs, that the Limestone strata had been fissured i.e. divided in a vertical direction previous to the introduction of toadstone not only between its laminæ but into its fissures which it frequently occupies. Tis evident also from the appearance of the Strata at Darley Mill (p. 120) & also where the Strata on each side of a fracture are nearly parallel; as well as from the Strata at Matlock High Tor where they are considerably depressed on one side of the fracture, that these fractures were subsequent to the introduction of toadstone between the Strata. It also seems from toadstone between Castleton & Castleton that the argillaceous & coal Strata incumbent on Limestone must have been destroyed some or perhaps all the eruption & ascension of the volcanic toadstone. Tis probable that the fractures (which bisect all the several Strata) were produced by the same convulsion which dejected the Strata incumbent on Limestone.

Geology.

Many exuvia have been deposited by these ex. g. since the deluge
a human skeleton with British beads &c. were dug up in a stone quarry near Ilkley Wednesday Hill at Blankney in Lincolnshire. Whitehurst. 29
Human bones & armour with horses coin & fibula &c were found in a stone pit in Ingoldsthorpe in Norfolk. Phil. & Baldwin's abridg. phil. Trans. 0-6-p-144.

Whitehurst observes that although shell fish are generally deposited in limestone. bones & teeth of fish occur rarely, but chiefly in gravel & sand. p. 44.

But on Ingleborough mountains of Cartmel (says Dr Watson) there is a bed of white laminated stone containing between the laminæ carnivorous fish compressed like fern. ibid.

Hom. The teeth of sharks have been taken out of a rock in Hindenthall park near Malton (which I expect is limestone as also the preceding). Lonthorp. A. P. T. 0-2-428.

See page 103 for examples of crocodiles found imbedded in limestone.

Instances too there have been of toads found in limestone.

But we may infer from the observation of Whitehurst as well as others that either shell fish were created before others, or that they lay more active they were

Either shells fish were created before there
in that bed? Or before they were

buried & circulated in the place where
they existed. And this might be the case
before as well as at ye deluge.

—

As lakes frequently occupy ye place
of mountains & towns absorbed by earthquakes
(as Port royal Jamaica 1692, mountain near
Portmorant there, St Euphemia ile of Malta
1538, Pico in the Moluccas, vid. Cohlehurst p. 72)
we may suppose that these waters are
occasioned by ye low situation of the places,
or that there is water beneath the
crust of the sea, which is the more proba-
ble because were the exterior of
the earth solid, how cd mountains &
towns subside? There certainly are
large caverns below ye surface.

The eruptions of volcanoes will account
for the formation of many solid strata,
as well as for detached fragments of
the strata being found — also for alternate
layers of soil & lava — also for beds
of gravel, sand &c — Inundations or
rather alternate occupations of sea &
land will account for layers of soil,
gravel, for ye remains of towns, anchors
& remains of arts.

111

Minerals.

Millstone-Grit. A coarse sandstone composed of granulated quartz & quartz pebbles. The former relate to the sharpness of fragments newly broken, the latter are rounded by attrition as stones upon the sea beach. This stratum (Derbyshire) is not productive of any fossil exuvia. or minerals.
The quartz pebbles contained in this stratum indicate the pre-existent state of a quartzose stratum, as spar is found in those of lime-stone.
The quartz pebbles above are white, the colour of the quartzose stones from whence produced is various, as black, brown &c. They are in common use for paving streets, & are frequently variegated with seams of white quartz running thro them. They are the common gravel stone of Wolverhampton Staffordsh. Derbysh. Cheshire &c.

We are told the minerals in Norway & Sweden are contained in the fissures of quartzose stone
Whitehurst. p. 182
(vid. Whitstone. p. 106)
Between the Lamina or beds of millstone Grit at Lincoln Hill near Colebrook Dale Shropshire intervene small strata of quartz pebbles. Whitch. p. 209. Plate.

Siliceous Grit, Sandstone lies in beds, differs much in texture & color within a few miles, is composed of Quartz, & Felt-spar or pebbles with Mica & Steatite) being of different textures, it is useful for Millstones, Buildings, Filtering Cisterns &c

It contains vegetable impressions / vid sup. con. & Iron like ~~y. foss~~ Argillaceous Grit Strata: Galena & other minerals are found in it: but this circumstance may probably be owing to Dykes.

No marine petrifactions have as yet been observed in this Stratum: Coals have been taken out of y^e solid rock at great depths, They have also been found in limestone blocks, but all deeply imbedded on being exposed to y^e air.

Granite is found in detached rounded fragments of different sizes in all parts of Derbyshire, but whence they came is not yet ascertained.

W. Watson Derby^r. Strata

Shale or Shiver. a black laminated clay, much indurated. it contains neither animal nor vegetable impressions, & is not considered as productive of minerals, as lead ore, spar &c. The stratum contains iron stone in nodules, & sometimes is stalified. The springs issuing from it are of the chalybeate kind; 4. gr. one near y^e^ bridge at Buxton one at Quarndon, & another beyond Matlock bridge towards Chatsworth.

Whitehurst. 183.

The lamina of limestone are seperated by Shale or Shiver, y^e^ upper layers are a good black, take a fine polish, & are there called black marble. The lower layers are rather brown, as may be observed in y^e^ rocks at Matlock High Tor &

Whitehurst. p. 184

183. The author is speaking of the limestone stratum in Derbyshire which lies under the Shale & Millstone strata. vid. p. infra 120

Lead ore has been found in Shale at Shaw Edge near Eyam, & copper ore near Quarndon in Staffordshire - but these are rare instances

Whitehurst. p. 227.

See p. infra. 125. where Shale is same as Tile.

Shale or slate clay, called also Shiver black metal, & bleer, & by the northern colliers blae or till, often forms the roof of coal mines.

Shale or Slate clay, called also Shiver black metal & Blee, & by the northern colliers

It is generally bluish, blackish, or of a reddish grey. It is frequently marked with impressions of vegetables [vid. supra contra] It breaks into long thin shivery lamina, & is very friable. It readily resolves, or being immersed in water, or even on exposure to the air, into a fine soft clay. It contains a portion of bituminous matter, & generally has an unctuous feel, on which account the Derbyshire colliers term it greasy Shales or greasy Blaes.

Parkinson. Org. rem. 1. 170.

Note. When Whitehurst speaks that Shale has no vegetable impressions, he is then speaking of the Shale-Strata which intervene between Millstone Grit & Limestone, see p. 120.

Shale, Shiver, Aluminous Schistus is a black argillaceous earth, of a laminated texture, which freely cleaving when exposed to the air, decomposes to clay. This Stratum is productive of alum, & abounds with nodules of Iron stone, some of which contain Petroleum or a fluid State; Asphaltum is found in these beds; also balls of Ochre & clay.

The Shale is generally a cover for the best Coal & accounted a good criterion; small Coals sometimes occur but they seem to be formed from the Coal beds in the adjacent Limestone Stratum.

W. Watson's Derbyshire Strata

It is remarkable that at the Boseting or coming up of the Shale to the surface & consequently at which point the Limestone appears there are Springs of warm water, namely at Stoney Middleton N. 63° Fah. Matlock S. 68°, Bakewell E. 58° & Buxton W. 53°

Ibm.

vid. p. 120

Geology.

Essays or Propositions. or Elements or Principles

1. The sea encroaches on q^ land in places.
   Cor. The quantum of q^ sea being q^ some, q^ land must encroach on q^ sea in places.
2. The land encroaches on q^ sea in places.
   New islands, coral rocks, sandbanks, detachments, alluvions.
3. Lakes & seas are formed sometimes by earthquakes or Earthquakes produce lakes & seas.
   Adelantia - Coasts of England & France.
4. Volcanoes produce earth & mountains.
5. The mountains were once fluid.
6. Some mountains made fluid by fire
7. others by water.
8. Mountains are primary or secondary.
9. Minerals are all secondary productions or secretions & decompositions.
10. Petrifactions their different origin.
11. Stones their different origin.
12. Fossil exuviæ their origin.

12. Tafel 1 Mark Blei weiß.

Toadstone. a blackish substance, very hard; contains bladder holes, like ye Scoria of metals, or Iceland lava, & has ye same chymical properties of exciting acids. Some of its bladder holes are filled with spar, others in part, others quite empty. This stratum is not lemniated but consists of one entire solid mass, & breaks alike in all directions. It does not produce any minerals, or figured stones, nor contains any decorations bodies.

This stratum (No. 4.) is known by different names; at Matlock & Wirster, toadstone, & blackstone; at Money ark & Tideswell Channel; at Castleton, cat dirt; at Ashover black clay.

Stratum (No. 6. p. 120) lies from bladder holes as may be seen at Money moor mine near Winster

Stratum (No. 8. p. 120) yet more solid, as may be seen at Stubbendale mine, near Money ark.

Toadstone has no corresponding fissures to those of limestone, & frequently fills up ye fissures in ye strata underneath it.

The stratum of clay lying under No. 6 is apparently burnt, so as not to be distinguished from ye burnt clay on Heydor Common, which was burnt by a stratum of coal on fire underneath it.

Whitehurst. 184. 196.

In Tideswell Moor, ye toadstone or channel as there called has been dug 100 fathoms deep & no bottom found. In seven other mines its thickness is as follows.

	fathoms
Black Hillock —	100 not cut thro
Heath Buck —	16
St. Andrews —	2
St. James —	12
Constant —	7
Calvestone —	7
Darkeck —	19
Chap-maiden —	27

This shews that toadstone is extremely variable in its thickness. Whitehurst. p. 195.

The spar contained in ye bladder holes implies not only the a solution of spar, but also that toadstone is pervious to water thus impregnated descending from the incumbent strata; for wherever the toadstone basaltes or has no incumbent strata, the bladder holes are void of all extraneous substances. Whitehurst. p. 228.

119

Vide p. 139.

Strata between Grange Mill & Darley Moor. Derbyshire.

compare p. 124.

No		
1.	Millstone-Grit.	420.
2.	Shale or Shiver.	120
3.	Limestone.	50
4.	Toadstone.	16
5.	Limestone.	50
6.	Toadstone.	46
7.	Limestone.	60
8.	Toadstone.	22
9.	Limestone. not cut thro.	

All the Strata from No. 3. to. 9 are divided by others called clays, or Wayboards. from 1 to 6 feet thick. Their color is lightish blue, with a small kind of green & They all contain pyrites & Spar in small nodules; and it has been observed by Mr. Geo. Fisherton of Worster that all the Springs flowing from them are warm like those of Buxton & Matlock. These clays are calcareous, & may therefore be classed with Marles.

Of these Strata. No. 2. appears or outcrops on the Banks of the Derwent; No. 3. in Thorpes pasture; No. 4. 5. 6. 7. & 8. on Bonsal Moor.

Agaii No. 2. appears on y^e Vallies of Bakewell, Ashford, & Castleton, & likewise on Mam-Tor - No. 4. forms y^e summit of a mountain near y^e Castle & is called Cal-dale. No. 5. forms y^e surface of Money ash Moor, particularly at y^e Marble quarry & likewise at Herbertdale mine - The quarry on y^e Money Ash Moor near y^e road between Flat town & Bakewell produces the Derbyshire marble

The strata No. 4. & 6. are not universal they not exist in Herbertdale mine, near Money Ash - nor Harrowarn mine, or Bostal moor - nor at High cake near Tideswell.

Whitehurst. 182-187, 188. P. I.

By y^e Clays or Wayboards the thickness of y^e other strata are ascertained, which would otherwise be difficult as the limestone beds consist of various laminæ

Whitk. p. 187.

The strata at Matlock High Tor on each side which are similar to those at Grange mill, evince a great convulsion; for the beds on Mason mountain are elevated about 100 yds above Matlock High Tor, & yet y^e same beds are depressed 100 yds below the foot of it at the river. Whitk. p. 189. P. II

121

Strata.

At Alpeton Common.

	feet	inch.
1. Clay		
2. Ratchell, fragments of Stone.	9	0
3. Bind. indurated clay	13	4
4. Stone. argillaceous concreted clay	6	0
5. Bind	8	8
6. Bind	25	0
7. Stone, Red color.	5	0
8. Bind	2	0
9. Stone	2	0
10. Bind	5	0
11. Bind	5	0
12. Coal	1	6
13. Bind	1	6
14. Stone	23	0
15. Stone	14	0
16. Bind	7	0
17. Smut. a black substance like coal dust	3	0
18. Bind	2	0
19. Stone	20	0
20. Bind	16	0
21. Coal	7	4
	184	4

Whitehurst. p. 211

Strata at Wall Hallam.

	feet	inch	
1.	Clay	7.	6	
2.	Bind	48.	0	
3.	Smutt	1.	6	
4.	Church	4.	0	indurated clay
5.	Bind	3.	0	
6.	Stone	2.	3	
7.	Bind	1.	0	
8.	Stone	1.	0	
9.	Bind	3.	0	
10.	Stone	1.	0	
11.	Bind	16.	0	
12.	Shale	2.	0	
13.	Bind	12.	0	
14.	Shale	3.	0	
15.	Church	54.	0	Stone & sometimes cark.
16.	Soft Coal	4.	0	
17.	Clay	0.	6	
16.	Soft Coal	2.	6	
19.	Church & Bind	21.	0	
20.	Coal	1.	0	
21.	Bind	1.	0	
22.	Stony Bind	25.	0	
23.	Coal	6.	0	
		222.	3	

For observation see Whitehaven. 211. Difference in the Clay from Bind & Bind from Church, will be seen by the Church, Bind & Coal as Stony Black Clay, Church, & Bind are Stony many terms.

Whitehaven. p. 212

123

at Bagillt - Flintshire - N. Wales.

1. Gravel, sand &c.		45. 0
2. Shale		9. 0
3. Freestone argillaceous		6. 0
4. Shale argillaceous		1. 0
5. Coal		6. 0
6. Clay		9. 0
7. Freestone argillaceous		44. 0
8. Coal		2. 3
9. Freestone		90. 0
10. Shale		15. 6
11. Coal		15. 0
12. Clay		12. 0
13. Shale		6. 0
14. Freestone		1. 6
15. Clay much indurated		9. 0
16. Shale		1. 6
17. Blackish Stone containing Bitumen		1. 0
18. Coal		9. 0
19. Shale		1. 0
20. Clay or Bind		20. 0
21. Freestone		40. 0
22. Coal		5. 6

The Shells in No. 17 show that the Limestone Strata are more recent than the Shales or Freestone they covered; therefore a Testimony of the progressive Operations of Nature

Winchmore. p. 242.

Strata.

two miles east of Bolsover Castle. Derbyshire

1. White stone, v. sup. 106.
2. Freestone, argillaceous
3. Till, shale, or laminated clay.
4. Stone, argillaceous
5. Till or shale.
6. Freestone, argillaceous.
7. Coal 4 feet 6 inch. thick.
8. Stone, argillaceous
9. Till or shale.
10. Limestone, brown, to shale.
11. Bind, indurated clay.
12. Stone, argillaceous.
13. Strata not ascertained.

½. Millstone grit. Whitehurst

Tablet of Derbyshire Strata by White Watson.

1. Argillaceous Grit.
2. Argillaceous Freestone.
3. Coal
4. Siliceous Grit.
5. Shale.
6. Limestone
7. Toadstone.
8. Limestone
9. Toadstone
10. Limestone
11. Toadstone
12. Limestone

125

It may be laid down as pretty certain principle yt. yt. formation of stony strata is yt. effect of aqueous deposition & yt. yt. transposition or obliquity of them is the effect of igneous earthquakes.

Volcanoes as well as earthquakes are produced by subterraneous fires; but by the former such emptions of matter are produced, by yt. latter the existing strata are only dislocated.

Earth, sand, & gravel may be the consequence either of deposition or volcanoes.

Lava is certainly of volcanic origin.

The observations made on toad stone seem to prove yt. yt. original strata were disturbed when this substance issued from the bowels of the earth. But perhaps on second consideration this may not be a conclusive argument. It being evident from the great fractures yt. the strata were most violently disturbed subsequent to the introduction of toad stone. &

The sediment found at the bottom of Tea-kettle as well as the tufaceous depositions in the neighbourhood of petrifying springs prove the possibility of strata being formed by water

2. The intrusion of fused basaltine between the strata might occasion their fractures.

Whitehurst has observed many instances of dog tooth spar being so uniformly incrusted by calamine as to preserve y^e true crystalline figure of y^e spar.
Also instances of the spar thus incrusted being wholly, or only in part decomposed & replaced by calamine, a tile retaining y^e external figure of y^e spar — Croft Rake mine in Matlock High Tor abounds with specimens
Whitehurst. 229.

Rotherstone (found 2 miles W. of Bakewell in D. of Rutland's Lands) is not stratified nor generated in fissures of limestone strata but is found as broken fragments of stone, imbedded in vegetable soil from y^e surface of y^e earth to y^e depth of 18 inches — It is accompanied with numerous nodules of chert, a siliceous substance, generated in limestone strata — Chert & rotherstone being thus blended together manifestly imply the dissolution of a limestone strata in which y^e chert was generated & that rotherstone is nothing more than y^e fragments of limestone reduced to a calx.
Whitehurst. 234.

Many nodulous masses of chert contain the impressions of entrochi; which evidently shew that y^e entrochi existed anterior to the chert.

Basaltes - Giants causeway

Giants causeway is 4 miles east of Port Rush Strand & 9 west of Balley Castle irish measure - The causeway is situate at y^e^ foot of a cliff, the elevation whereof is 5 or 600 feet perpendicular above the Atlantic Ocean; & yet y^e^ whole cliff consists of one entire mass, composed of different Strata of lava: apparently y^e^ effect of several eruptions. This lava seems to extend all y^e^ way between Port Rush Strand & Balley Castle.

The columns which compose the Causeway are vertical, of various diameters from 15 to 20 inches, & some of them 30 feet long. They are prismatical & equally thick from end to end, & of various sided figures as pentagonal hexagonal, heptagonal &c - There various forms evidicate that they were not owing to crystallization - The columns have also one uniform color, a dark brown, & one uniform density, apparently quite free from bladder holes altho' y^e^ cliff is replete with them - Each column is apparently divided into unequal parts, by means of transverse joints but many bisect y^e^ columns partially leaving 5 or 6 inches of y^e^ central part solid. In some instances y^e^ joints extend, quite thro' y^e^ columns, but they have originally united & probably separated by water lodging & freezing in them.

in them.

The articulations are not flat, but convex & concave, exactly fitted together, but not in any order with respect to the convexity or concavity being upwards or downwards: for in many instances they have been observed in both directions.

From these & other circumstances it seems probable that these columnar bodies were originally in the heart of the mountain & in a state of fusion; which in cooling from must have contracted considerably & gradually.

Mr. Raspe on extinguished volcanoes says that basaltes is commonly found in the vicinity of them.

Mr. Faujas on the same subject presents instances of lava being found near craters wholly & in part columnar — and that in some of the corresponding faces of these prismatic columns are inserted fragments of granite evidently broke & separated by the contraction of the lava in cooling.

That basaltes is lava is evident also from the observations of Rev. Dr. Frole in his tour thro' Iceland, for this great island is allowed to be composed principally of lava, & yet various parts thereof abound with basalt columns.

Mr. Hodges in his tour thro' India says, that a cliff called Montagena is wholly composed of basaltes, & that under the cliff is a spacious cavern, which he examined by torch light & observed the same columnar appearances

Basaltes & Giants causeway

as on ye exterior thereof, & likewise that charcoal was imbeded in the solid substance of ye stone throughout the whole extent of ye causeway.

At the foot of ye cliff near the Causeway Mr. Whitehurst found a piece of iron ore similar in appearance to the Cumberland ore, vitrified on one side, which is some testimony of ye cause whereby some lavas may be magnetical, & likewise that the substances supposed to be lava, have also been in a state of fusion

Two miles N. of Coleraine on ye road to Portrush Wark hes a stratum of lava in which a pit had been dug to repair the road. The upper part of ye stratum was become totally decomposed & reduced to vegetable soil, tho it still retained its original dark color. The soil was succeeded by small pagments of lava, ye magnitude whereof increased downwards to the bottom of the pit, where ye stratum became one solid mass. This lava contains many bladder holes either wholly or in part filled up with Zeolite a substance rarely found in England. In some of ye holes not completely filled up may be observed ye cry stallized figure of the zeolite namely cubical very similar to fluor.

These crystallized bodies shew yt they were not enclosed in yr lava while it was liquid fire, having been evidently exuded thro yr substance of yr lava; consequently lava seems equally as pervious to a solution of zeolite, as to sandstone or limestone it is a solution of mineral substances.

Zeolite has much yr appearance of Fluor both as to color, figure, transparency, & hardness. Nor will it effervesce like fluor in acids, tho it is said to be soluble in them.

Whitehurst. 248. &c.

Medicine.

Spts of Turpentine. Dec. 23. 1824. I took 12 drops of Spirits of Turpentine in a glass of water at bed time, being a little ague[sh] & experimentally inclined, but perceived no other effects than a strong violet scent imparted to y[e] urine. In the morning I took 20 drops in a glass of water but had no evacuation whatsoever until evening when I had a male discharge of urine scented as before. The scent continued for smelled in my gutta-percha bags

2y. Whether this medicine might be useful in dropsy or tic.

N.B. Spts of Turpentine diluted a little is most efficacious of any thing yet found out in taking away the dental pains occasioned by Hydrargyrus. 2y. Whether it will remove y[e] common tooth-ach.

Geolog. Extract.

Vidi ego, quod fuerat quondam solidissima tellus,
Esse fretum. Vidi facta ex aquore terras:
Et procul a pelago conchæ jacuere marinæ;
Et vetus inventa est in montibus ancora summis.
(Perhibitor) Ov. Metamph. lib. 15. l. 262.

Flexibus Heliadum cum vipera serpit,
Fluxit ut obstantem succina gumma feram;
Quæ, dum miratur, perfusa rore teneri,
Concreto riguit bracta repente gelu.
Ne tibi regales placeas, Cleopatra, sepulchro,
Vipera sit tumulo nobiliore jacet.
(Perhibitor) Martial. l. 4. ep. 59

Cum Pheathontea formica vagatur ut umbra,
Implicuit teneram succina gutta feram.
Sic, modo quæ fuerat olim contempta manenti,
Funeribus facta est nunc pretiosa suis.
(Perhibitor) Martial. l. 4. ep. 15.

Et latet et lucet Pheathontide condita gutta
Ut videatur apis nectare clausa suo.
Dignum tantorum pectinem tulit ilex laborum;
Credibile est ipsam sic voluisse mori.
(Perhibitor) Martial. l. 4. ep. 32.

Toadstone.

Trap, rowley rag, toadstone, or wacken are stones in which argillaceous matter very much predominates. Their from y^e manner in which they are diffused thro y^e subterraneous regions, & from y^e peculiar structure they possess have been supposed by many, to be of volcanic origin.

Parkinson. O.R. 143.

Toadstone is not in beds, but is a certain stratum of an irregular thickness composed of balls of various sizes, of different textures & colors, strongly coated of Petrifactions; some appearing a Basalt or Trap abounding with Hornblende & Glimm; others, as Amygdaloid, seems an argillaceous base in which are irregularly disposed nodules of Chalcedony, Quartz, Calcareous Spar, Steatite, Greenearth, Haystone / Actynolite of Kirwan / & some of y^e Quartz nodules are hollow lined with Crystals of Quartz, Calcareous Spar, Cawk & other substances.

Besides Toadstone this stratum is called Channel, Blackstone, Cat-dirt &c and appears to be the substance called Whinstone in Scotland, Mandelstein in Germany, Basaltes in Ireland, & Trap by y^e Swedes.

The rake veins containing ore in the neighbourhood Limestone Strata generally decend thro the Toadstone, but are seldom found to contain ore when in toadstone. Galena is sometimes found with Blende & other minerals, but this circumstance rarely occurs; y^e veins when in y^e toadstone are generally very small & composed chiefly of Calcareous Spar accompanied by Asphaltum;

[illegible] they suppose [illegible] y^e limestone under y^e toadstone, they become thicker again [illegible]

generally very small & composed chiefly of Calcareous Shells accompanied by Asbestus,

when they descend into ye Limestone under ye Toadstone, they become thicker again & frequently as rich as ever — Mountain leather sometimes is discovered in these veins, but very rarely.

Tools, as ye Heads of Hammers & Axes are found made of Toadstone, used by ye antient Inhabitants of the County [Derby]

Watson's Derbyshire Strata p. 21.

Geology.

The dock yard at Woolwich has been visited by Mr. Churchman accompanied by Mr. Whitby in making observations on the gradual rising of y^e^ tide waters of y^e^ Thames. There were made at this place one whole years observation commencing on y^e^ 1^st^ of May 1761 & according to y^e^ register they were continued during the arrival of our most Gracious Queen at Harwich y^e^ 8. September. The orders from y^e^ Admiralty were to send an account of y^e^ spring & neap tides at this port after keeping an exact account of y^e^ perpendicular rise from low to high water in each tide, taking notice of y^e^ course of y^e^ wind each day of y^e^ month & whether morning or evening tide. The cill at y^e^ bottom of y^e^ single dock gates was a fixed mark, & y^e^ depth y^e^ water ebbed below it, was added to y^e^ height y^e^ next tide flowed above it, which gave y^e^ perpendicular flow of each tide. Now it is ascertained y^t^ since y^e^ year 1761 there have been 2 new sets of Dock gates, on account of y^e^ old ones going to decay; y^e^ first was said to be somewhere about y^e^ year 1766 & y^e^ last in 1783. Dr Ley is particular in attention to y^e^ cill of y^e^ dock gates at low water it did not appear above surface, but a considerable piece was observed under water, but above y^e^ cill. And altho y^e^ difference

between high & low water remains nearly
y^e same, both high & low water marks
are about 4 feet perpendicular higher than
was y^e case in 1761; which remains to be
confirmed by corresponding observations to be
made in different parts of y^e United Kingdoms.
But as there is not any effect without a
cause, it is hard to dispute y^e effect while y^e
cause remains something of a mystery; but it
appears rather extraordinary y^t shells should
was enacted in y^e voyage of y^e celebrated
Captain Cheverau Vol. 2. p. 293 when on the N.W.
Coast of America." Mr. Whitby states, y^t in his
2 last excursions, several places were seen
where y^e beach was evidently encroaching very
rapidly on y^e land, & y^t y^e low borders extending
from y^e base of y^e mountains to y^e sea side had
not at any very remote period of time produced
tall & stately timber, as many of their dead
trunks were found standing erect, & still
rooted fast in y^e ground at different stages of
decay, those being y^e most perfect that had
been least subject to y^e influence of y^e salt
water by which they were surrounded every
flood tide. The stumps in some instances at low
water mark were even with or below y^e surface
of y^e sea. Similar observations were made by
him at Port Chalmers, P. Williams Sound,
Cook's river, & Gray's Harbour."

London Chronicle Dec. 27. 1804

x. This effect may perhaps be owing to y^e bed of y^e
river being raised by deposition. Note.

Argillaceous Grit.

Lies in beds, is equable & rough to y^e touch, has when just broken an earthy smell, differs much in texture & color within a few miles; is chiefly serviceable in building & slating, in either of which cases, y^e stones must be placed in y^e same direction as when taken from y^e Rock, otherwise they crumble & separate & perish in a few years.

This stratum is productive of no mineral but Iron, which is observed in Nodes of shaded brown. No marine Petrifactions appear in it, vegetables &c, chiefly unknown species of Arundo & Euphorbium.

There is generally found under this Gritstone where y^e coal abounds, a thin stratum of a compact, siliceous matter abounding with impressions of an unknown vegetable. This stone is called Gannister, Crowstone, Cank, Calliard &c & is much used for repairing y^e roads.

W. Watson Derby. Inn. Strata.

vid. p. 124

Argillaceous Ironstone.

Is destitute of metallic lustre but weighty, absorbs water like Clay, & by torrefaction yields to y^e. attractive power of y^e. Magnet.

In some places it forms a regular Stratum, abounding with petrified muscle shells, incumbent upon which is a ferruginous calcareous clay in various ramifications, whilst in other places it bore Ammonites imbedded in clay. These nodules are of various textures affording different sorts of Iron; when broken they sometimes contain vegetable & animal Impressions probably of unknown species. & frequently Septaria of Spany Ironstone which is sometimes chrystallized with Galena, Blende, & Iron-pyrites.

W. Watson Derbysh. Wales.

v. p. 124.

Principles or Elements
or
Introduction to Geology.

Should be composed in the manner of Euclids Elements. First begin with definitions of Earths, Minerals, Fluids, Rocks, Mountains, Hills, Rivers, Seas, Lakes, Layers, Strata, Veins, Fossils, Fire, Metals, Salts, Chrystals, Nodules, Subsidence, Precipitation, Volcanic, Alluvial, Debris, Organic bodies, Stones.
Then arrange propositions in regular succession & discourse upon them as, That the Sea gains upon the Land in places, That the Land gains upon the Sea in places. That some Mountains are produced by earthquakes or Volcanos. That Mountains were once fluid &c. That some Mountains are more ancient than others. That Minerals are subject to decomposition & recomposition. &

Consult Valencius Geography for definitions & Facts. Rees Cyclopedia. Kirwick. Thomson. Jameson. Lavoisier. Hutton. Perkinson. Whitehurst. De Luc. Saussure.
What if the work was divided into books with definitions prefixed to each. Suppose one on Mountains, 2d on Minerals & Metals. 3d on Petrifactions. 4. on Stones.

Definitions

The Earth is that Planet which we inhabit.
this sentence to be omitted

A Solid is a dry Substance.

A Fluid is a humid Substance.

Air & Earth is a solid.

Water is a fluid.

Land is a tract of earth ~~uncovered by water~~.

Sea is a tract of water covering the same extent of earth.

The Earth or The Globe is that Planet which we inhabit, whose Surface (surface) consists partly of land partly of sea.

An Island is a tract of land surrounded by sea or water.

A Continent is a more extensive tract of land & not wholly (entirely) surrounded by water.

(It is not necessary to use the definitions generally followed at those of a Lake & Sea but such as will be adhered to in the work; and yet it would be as well to explain every term according to its common sense.)

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VARLEY'S
NOTES ON
PNEUMATIC
CHEMISTRY