

Correspondence with Thomas Burnet

Author: Isaac Newton

Source: Keynes Ms. 106, King's College, Cambridge, UK

Published online: January 2008

<envelope>

For

M^r Isaac Newton

Mathematick Professor and
Fellow of Trinity Coll.

Cambridge

<1>

London Ian. 13. 8 $\frac{0}{1}$

Sir

I received your letter of Dec. 24th. & the favour of those exceptions you haue made to some passages of my booke; which I cannot but take very kindly; seing you haue had, it seems, both the Patience to read it over & to make reflection upon seueral parts of it. The argument you note p. 118. seems to me conclusiue for soe far as it goes; I doe there in a manner distinguish the Earth into 3 parts *terram planam et humilem, montes mediocres, et montes maximos*, And show upon the suppositions there mentioned, that all the Earth should bee covered *maximis* or *mediocribus montibus*, and consequently, that there should bee noe *regiones planæ* or *humiles*, if soe much Earth as is capable to fill the chanel of the sea was thrown upon a surface of equal height with the sea, as the opinion there mentioned supposeth. And seing wee find that there are a great many regions & countrys of the Earth that are *planæ et humiles*, some lower then the surface of the sea, some equal to it, some little higher, & a great many that haue neither *montes magnos*, nor *mediocres*, I conclude that the mountains wee find upon the Earth, greater or less, would not altogether fill the cavity of the Ocean by many degrees. Neither doe I mention how the subterraneous Ocean & the subterraneous cavities, which some thinke may bee a third or 4th part as much as the cavity of the external Ocean; And their bowels or what was dug out of them must bee thrown upon the Earth too, and the mountaines & higher parts of the Earth should bee capable of filling them alsoe; which how far they must come short of I leaue you to imagine.//

Tis true if those dimentions were known more exactly, the depth of the sea, the height of the mountaines, the quantity of the whole Earth higher then the surface of the sea, their proportions might bee stated more demonstratively, but soe far as wee know them the mountaines or higher parts of the Earth doe not answer by many degrees to the cavity of the sea & all subterraneous cavities.//

And this calculus is confirmed by that which immediately follows to the same effect (p. 119.) & is in a manner the same under another forme & more simple; Tis in this tenour, that the mountaines upon

supposition that they were taken out of the chanel of the sea, should bee equal to the first Abyss, represented there in the scheme; whereas if you suppose that Abyss but halfe as deep as our deepest Ocean, that calculus I thinke doth demonstrate that the aggregate of the mountaines of the Earth, or of all the Earth higher then the surface of the sea, doth not equal by many degrees the bulk of the Abyss, nor consequently the cavity of the Ocean which now containes it.//

<2>

Then the 3^d argument which follows immediately p. 120. confirms these reasonings, by disproueing the same opinion from other considerations. And indeed your supposition which men that hold this opinion must goe upon, or the idea they must forme of the Exterior Earth is altogether groundless & Chymical; for they must suppose that there is some general or common surface of the Earth, of an equal height with the sea, & which runs round the Earth uninterruptedly in an uniforme convexity, upon which surface as upon a foundation or pauement the mountaines were set & all the Earth that was dugg out of the sea. which is a meer idle notion that doth not answer to any thing in nature, nor to any observation, as I haue shown there p. 120. 121. & as is confirmd by all that haue to doe or know what belongs to the interiour structure of the Earth. These argumentations confirme one another, besides those general heads mentiond p. 117. which show the inconveniences or impossibility of this Theological opinion, or of the vulgar account how the mountaines, the cavity of the sea, & all other cavitys & inæqualities in the forme of the Earth came at first.//

But you seem rather to incline to the philosphical account of these inequalities & of the irregular forme of the Earth; namely, that the heat of the sun rarefying the side of the Chaos that lay next it, or by the pressure of the vortext or of the moon upon the waters, some inequalities might bee made in the Earth, & then the waters flowing to those lower parts or cavities would make the seas there, & the upper parts of the Earth towards the poles which they flowd from, would bee dry land. And all this might the rather bee, because at first wee may suppose the diurnal revolutions of the Earth to haue been very slow, soe that the first 6 revolutions or days might containe time enough for the whole Creation, & the sun in that time might convert & shrink the parts of the Earth about the Æquator more then towards the poles, & make them holower.//

But methinkes you forget Moses (whom in another place you will not suffer us to recede from) in this account of the formation of the Earth; for hee makes the seas & dry land to bee diuided & the Earth wholly formd before the Sun or Moon existed. These were made the fourth day according to Moses, & the Earth was finisht the 3^d day, as to the inanimate part of it, sea & land, & euen the plants alsoe; you must then according to Moses bring the Earth into this irregular forme it hath by other causes & independently upon the Sun or Moon. Besides the Earth at first was cover'd with an Abyss of Water as both Moses & philosophy assure us, what great influence or effect then could the sun haue upon the Earth which ley at the bottome of this Abyss, any more then it hath now upon the bottome of the sea? Thirdly, if the chanel of the sea had been formd this way, it would haue been regular according to the course of the sun or the pressure of the Moon, but there is nothing of regularity in the figure of the <3> Sea; & it lies towards the poles as much as towards the Æquator, & in all degrees of latitude. And soe for the mountaines too; & these mountaines are sometimes neerer the sea, sometimes further off, as throughout Asia & Africa. And then when al's done, these causes or their effects would by noe meanes answer the vast mountaines & precipices of the Earth, & the prodigious vorago of the sea. Nor doth it giue any account of the subterraneous cavities, whose bowels neither the Sun could suck out nor the pressure of the Moon squeeze from within the Earth.//

Some of the Ancient philosophers I remember, especially the Epicureans as wee see in Gassendus, attempted such a like explication of the Origin of the Earth, and of the formation of the sea & mountaines & all other inequalities. But when one considers on the one hand how inadequate those causes are to the effects, how indistinct, how unsatisfactory when presst & examin'd; and on the other hand how congruously, how easily, how naturally, the Dissolution of the Exterior Earth (As wee haue explайд it p. 58. 59. 60.) doth at once answer all those inequalities wee now find in it, both the great chanel of the Ocean, the heapes & huge juga of Mountaines, the Origine of Islands & the causes of subterraneous cavitys: how easily tis applicable to them all, how distinctly & fittly it answers them & all their uncouth properties, wee cannot rationally imagine that they proceeded from any other causes. Especially this giuing an account alsoe of the universal Deluge which upon noe other hypothesis is intelligible.//

As for Moses his description of the formation of the Earth in the first chap. of Genesis, I thinke I haue given a true account of it p. 253. that this a description of the present forme of the Earth, which was its forme alsoe then when Moses writ, and not of the primæval Earth which was gone out of being long before. And soe when the Sea is mentiond there, or Seasons or any such thing it onely shows what I say; that that description respects the present Earth & not the primæval; wherof if Moses had giuen the Theory it would haue ben a thing altogether inaccommo to the people & an useless dstracting amusement and therefore instead of it hee giues a short ideal draught of a Terraqueous Earth rising from a Chaos, not according to the order of Nature & natural causes, but in the order which was most conceiuable to the people, & wherin they could easily imagine an Omnipotent power might forme it, with respect to the conveniency of men & animals: Beginning first with what was most necessary, & proceeding/ by steps in the same order to prepare an habitable world, furnisht with euery thing proper first for animals, & then for Man the Master of all, & whoseuer considers the whole impartially as tis represented li. 2. c. 8. I thinke will haue the same thoughts of it.//

And if all Diuines were as rational & judicious as your selfe, I should not feare that this would retard the reception of the Theory, as you suggest it may. For I would aske them in the first place whether Moses his Hexameron or 6 days description of the creation, doth respect the whole universe or onely the sublunary world, all the heavens & the heaven of heavens, <4> & all the host of them stars or Angels; Or our Earth onely & the Orb or heaven that belongs to it: And I would not stir one step further till that was determind betwixt us. Now it being demonstrable I thinke that the whole univers was not made out of the Mosaical Chaos, I would in the next place aske them whether the Sun Moon & stars mentioned the 4th day, were made out of the Chaos, & then first brought into being when the Earth was formed? If they grant that this Chaos did not extend to the whole universe, then they must grant that the sun Moon & stars were not made out of it; but are mentiond as things necessary to make this Earth an habitable world. From which concession I would inferr 2 things, first that the distinction of 6 days in the Mosaical formation of the world is noe physical reality, seing one of the 6 you see is taken up with a non-reality, the creation of those things that existed before. 2^{dly} I inferr from this, that as the distinction of 6 dayes is noe physical reality soe neither is this draught of the creation physical but Ideal, or if you will, morall. Seing it is not physically true that the Sun Moon & stars were made at that time, viz. 5 or 6000 yeares since when the Earth was form'd. And if it bee Ideal in one part, it may in some proportion bee ideal in euery part. For confirmation of this I'll instance in another thing, Moses his Firmament, which was the 2^d dayes work; by the proportion wherof you may easily understand that it is noe physical reality, as it is there set down; unless it bee lookt upon as a memorandum onely or a memorial of the firmamentum interaquæum that was in the primæval Earth. You see the first property of the firmament as it is set down is to diuide betwixt the celestial waters & the terrestriall, and the 2^d is to bee the seat of the Sun Moon & stars. Now I appeale to any man whether those 2 local proportions bee not utterly inconsistent? to diuide betwixt the Cælestial & terrestrial waters it must bee far below the Moon, & the cælestial waters must bee supposd betwixt it & the moon; and to bee the seat of the Sun Moon & stars it must bee not onely as high as the Moon but as the Sun, nay as the fixt stars which are at an immense distance aboue the Sun. Therefore the Firmament with these proportions can bee noe physical reality. and soe you see how is another day of the 6 imployd upon noe physical reality.//

If you make the firmament to bee the Atmosphære as you seem to doe, & the vapours aboue it to bee the celestial waters, which upon the disruption of the Abyss were suddenly & excessiueyly condenst; with all my heart: but then how are the Sun Moon & Stars pact in the firmament? and which is as bad how are these vapours extracted & settled aboue the firmament before there is a Sun to extract them? Neither indeed are those vapours or clouds or any space betwixt us & them soe considerable a thing methinkes, as to take up a 6th part of the creation; these things are rather a necessary consequent of the Earth formd & the Sun acting upon it, then the first & most material thing in the formation of it; and if this had been wholly omitted by Moses, his cosmopœia would haue appeared as compleat, & wee should haue misst noe parts of our world. Thus for the 4th & 2^d day.

Then for the first day & the Light made then, what was that pray? what physical reality, where made <5> or how? was it made out of the Chaos as other things, in what manner pray? if not out of the Chaos, it doth not seem to belong to Moses his world, nor to haue any right to take up one of his 6 dayes: neither doe I know what Light was then first made that was not before, or how upon the formation of a planet any new Light would bee product. Upon the whole I confess I see noe other account of these things then what I haue giuen in the 8th ch. li. 2. & that the Hexameron or hypothesis of 6 dayes is onely Ideal, accomodated to the present

Terraqueous forme of the Earth; but the Cosmopœia, if one may soe cal it, in the 2^d chapter of that Garden which God planted מֵהָרִם a principio, that is real & physical, & the productions of man & other creatures there: Neither doe I see why that 2^d makeing of man animals & plants should haue been instituted if the first had been a physical reality.//

Your supposition that the first revolutions of the Earth were much slower & the dayes much longer then they are now, & consequently a day might then bee a competent time for some great change or transformation of the Chaos, lookes pretty well at the first; but unless you make the first 6 dayes as long as 6 yeares or rather much longer, I cannot imagine that they should bee sufficient for the work. for instance the 3^d day when the waters were gathered into one place & the dry land made to appeare, & consequently the chanel of the sea made then & the mountaines, could these grand changes bee wrought in the body of the Earth in less then a yeares time? I thinke not in a much longer time. then the Sun Moon & Stars which were made the 4th day, was not that a good days work, though the day was as long as a yeare. then if the day was thus long what a dolefull night would there bee? I am affraid that would undoe all that was done on the day time, & doe as much hurt in the state & progress of nature as the day did good. But if the revolutions of the Earth were thus slow at first, how came they to bee swifter? from natural causes or Supernatural? & did they come subitaneously or by degrees to that swiftness they haue now? if they came to it by degrees, what prodigious long life did Adam & his children liue? Adams 900 & 30 yeares would make 9000 of ours at least; & soe proportionably of the rest.//

These things, Sir & some others of this nature I would suggest to those Diuines that insist upon the hypothesis of 6 dayes as a physical reality, which euen many of the Fathers as I remember haue allowd to bee onely an artificial scheame of narration, they supposing the creation to haue been momentaneous. And I would further desire these persons to explaine to me the forme of S^t Peters κόσμος ἀρχαίος or ante-diluvian Earth & heavens; wherein it was different from ours & different in such a manner that it was thereby peculiarly subject to perish by a Deluge, as I haue noted p. 25. & in many other places. They must alsoe tell me what is or can bee understood by Moses's disruption of the Abyss at the Deluge, if the Earth was then in the same forme it is in now. And what that Gyrus or Orbis which both in Iob & Salomons Cosmopœia is <6> plac't round the Abyss or face of the first waters; which I haue taken notice of p. 426. &c & li. 2. c. 8. When they haue considerd these places & especially that of S^t Peter and joynd all the other reasons both a priori & a posteriori which I haue brought to show that the Earth was at first in a different forme from what it is in now, I thinke they will judge my supposition very reasonable that Moses his hypothesis of 6 dayes work is but the Idea of a creation accomodate to the people & to the present forme of the Earth.//

Concerning Paradise you seem to bee of opinion that it might bee under the Æquator: but I doe not see how this alone would answer its phænomena. I distinguish the phænomena of paradise (in the 2^d book) into those that were general & common to it with all that Earth, and into those that respect its particuler region & situation. Its general phænomena were a perpetual serenity & temperature of air without any vicissitude of seasons; longævity of animals, & their production out of the Earth: And wee must first find an Earth capable of these things, before wee enquire what region of the Earth was most paradisiacal. Now these things I say our primæval Earth was very capable of, considering the eaveness & equality of its surface, the temper of its soyle, & its right situation to the Sun, which gaue it a perpetual equinox. which situation of the primæval Earth I thinke I haue shown both from reason p. 182. &c. & from Antiquity p. 291. 292 &c. and I should be willing to know your opinion of that hypothesis.

Then as for the particuler situation of paradise, whether hemispheare twas in, I doe not undertake to determine that by the Theory onely, but depend cheifely upon the testimony of the Ancients, who excepting one or two that place it under the æquator as you doe, did generally place it in the other hemispheare; either explicitly or by necessary consequence.//

Sir, persueing those things that were of greatest extent in your letter, as what you had offerd concerning the possibility of formeing the Earth, as it now is, out of a Chaos; Or what related to Moses's Hexameron, Or to paradise; I haue omitted to speake to your exception about the Oval figure of the Earth or rather the cause of it. I suppose (p. 198. lin. 21. 22) as you doe, that the equinoctial parts would first endeavour to rise & fly off

but could not, because of the greater strength & resistency of the air ouer those parts of the Earth, then the other; for you must consider that the Earth was then involved in a kind of Chaos or Spiss atmosphear, as tis represented p. 36. and this was soe thick & <7> strong, that it may bee considerd as a kind of membrane or bag about the Abyss, and the parts of this Chaotical orb being far more agitated & in a far stronger motion about the equator then towards the poles, & the space there being alsoe narrower, it would bee far more difficult to make these parts yeeld then those towards the poles; as if you conceiue this bag or membrane more stretcht or to haue a stronger tone in one part then another, it would yeeld there sooner where twas less stretcht or its tone was weaker. Soe that the waters attempting first to rise & fly off at the equator, & finding there a strong resistance which they could not overcome, they must necessarily by this repercussion & their own continual tendency from the center in one way or other, fall off towards the poles; and soe conforme themselves into an Elliptical or oblong figure answerable to that of their Orb or particuler vortex.//

I should bee glad to know what you thinke of the opinion of the oblong figure of the Earth whatsoever the cause of it was; & whether you know any argument or observation that either proves the contrary or demonstrates that. what I mention p. 197. of degrees of latitude from the poles to the equator being unequal or the spaces upon the Earth that answer to them, is taken out of Dechaies a French Iesuite, who hath writ a large cursus Mathematicus, & in a little tract about the general principles of Geography, hee hath observed that Ricciolus, the Mathematicians of Paris, & Snellius, who haue all measurd the circuit of the Earth, & to that purpose tooke the proportion of a degree, differ each of them in their measure of a degree, according as they tooke it more or less North-wards; & finds they differ much what in such a proportion as the paralels where they tooke the degrees were more or less distant from the equator. If this observation was pursued it would come the nearest to a demonstration of any thing I know that the Earth is still oblong North & South.//

Sir your kindness hath brought upon you the trouble of this long letter; which I could not avoyd seing you had insisted upon 2 such material points, the possibility (as you suppose) of forming the Earth as it now is, immediately from the Chaos or without a dissolution; & the possibility of adhering to Moses his Hexameron as a physical description to show the contrary to these 2 hath swold my letter too much, which will howeuer giue you noe further trouble then the reading, unless your humour lead you sometime to reflect againe upon that Theory. Sir wee are all here busy in gazeing upon the Comet, & what doe you say at Cambridge can bee the cause of such a prodigious coma as it had. I am

Sir

your affectionate freind & servant

T. Burnet.

<8>

Sir

Your argument p 118 I acknowledg good against those who suppose only hills & mountains taken out of the sea, & it may be good against those who suppose all the earth higher then the sea taken out thence but one who would have mountains & the sea made by removing earth from one place to another might suppose (if it were necessary) all the earth a quarter of a mile or half a mile lower then the top of the seas or then the lowest valleys, or even lower then that, was thrown out of the deep. But the opinion being to me absurd, I say no more of it. I could wish I was as well satisfied with your argument about the oval figure of the earth. ffor it seems hard to me that a constant force applied to stretch a membrane (as you figuratively term the atmosphere) should make it shrink, unless you suppose it at first overstretched by a tumultuary force & so to return by way of undulation, & that the limus of the earth hardened while it was in the ebb. But what ever may be the reason of the earths figure you desire my opinion what that figure is. I am most inclined to beleive it spherical or not much oval. And my chief reason for that opinion is the analogy of the Planets. They all appear round so far as we can discern by Telescopes, & I take the earth to be like the rest. If it's diurnal motion would make it oval that of Iupiter would much more make Iupiter oval the vis centrifuga at his equator caused by his diurnal motion being 20 or 30 times greater then the vis centrifuga at our equator caused by the diurnal motion of our earth, as may be collected from the largeness of his body & swiftness of his revolutions. The sun also has a motion about his axis & yet is round. What may be argued from the

dimensions of the earth's shadow collected by Lunar Eclipses I cannot tell, nor what from the measures on the earth answering to a degree in several latitude's, not knowing how exactly those measures were made or the Latitudes of places taken.

You seem to apprehend that I would have the present face of the earth formed in the first creation. A sea I believe was then formed as Moses expresses, but not like our sea, but with an even bottom, without any precipices or steep descents as I think I express in my letter. Of our present sea, rocks, mountains &c I think you have given the most plausible account. And yet if one would go about to explain it otherwise Philosophically, he might say that as saltpeter dissolved in water, though the solution be uniform crystallises not all over the vessel alike but here & there in long bars of salt: so the limus of the Chaos or some substances in it might coagulate at first, not all over the earth alike, but here & there in veins or beds of divers sorts of stones & minerals. That in other places which remained yet soft, the air which in some measure subsided out of the superior regions of the chaos together with the earth or limus, by degrees extricating it self, gave liberty to the limus to shrink & subside & have the first coagulated places standing up like hills: which subsiding would be increased by the draining & drying of the limus. That the veins & tracts of limus in the bowels of the {mountains} <9> also drying & consequently shrinking, crack't & left many cavities some dry others filled with water. That after the upper crust of the earth by the heat of the sun together with that caused by action of minerals, was hardened & set; the earth in the lower regions still going closer together left large caverns between it & the upper crust filled with the water which upon subsiding by its weight it spewed out by degrees till it had done shrinking, which caverns, or subterranean seas might be the great deep of Moses And if you will, it may be supposed one great orb of water between the upper crust or gyrus & the lower earth, though perhaps not a very regular one. That in process of time many exhalations were gathered in those caverns which would have expanded themselves into 40 or 50 times the room they lay in, or more, had they been at liberty. For if air in a glass may be crowded into 18 or 20 times less room than it takes at liberty & yet not burst the glass, much more may subterranean exhalations by the vast weight of the incumbent earth be kept crowded into a less room before they can in any place lift up & burst that crust of earth. That at length somewhere forcing a breach, they by expanding themselves forced out vast quantities of water before they could all get out themselves, which commotion caused tempests in the air & thereby great falls of rain in spouts & all together made the flood & after the vapors were out the waters retired into their former place. That the air which in the beginning subsided with the earth, by degrees extricating it self might be pent up in one or more great caverns in the lower earth under the abyss & at the time of the flood breaking out into the abyss & consequently expanding it self might also force out the waters of the abyss before it. That the upper crust or gyrus of earth might be upon the stretch before the breaking out of the abyss & then by its weight shrinking to its natural posture might help much to force out the waters. That the subterranean vapors which then first broke out & have ever since continued frequently to do so, being found by experience noxious to man's health infect the air & cause that shortness of life which has been ever since the flood. And that several pieces of earth either at the flood or since falling, some perhaps into the great deep, others into less & shallower cavities, have caused many of those Phænomena we see on the earth besides the original hills & cavities.

But you will ask how could an uniform chaos coagulate at first irregularly in heterogeneous veins or masses to cause hills. Tell me then how an uniform solution of saltpeter coagulates irregularly into long bars; or to give you another instance, if Tinn, (such as the Pewterers buy from the mines in Cornwel to make Pewter of) be melted & then let stand to cool till it begin to congeal & when it begins to congeal at the edges, if it be inclined on one side for the more fluid part of the Tin to run from those parts which congeal first, you will see a good part of the Tin congealed in lumps which after the fluid part of the Tin which congeales not so soon is run from between them appear like so many hills with as much irregularity as any hills on the earth do. Tell me the cause of this & the answer will perhaps serve also for the Chaos.

All this I write not to oppose you, for I think the main part <10> of your Hypothesis as probable as what I have here written, if not in some respects more probable. And though the pressure of the Moon or Vortex &c may promote the irregularity of the causes of hills, yet I did not in my former letter design to explain the generation of hills thereby, but only to insinuate how a Sea might be made above ground in your own hypothesis before the flood besides the subterranean great deep, & thereby all difficulty of explaining rivers & the main point in which some may think you & Moses disagree might be avoided. But this sea I do not suppose round the equator but rather to be two seas in two opposite parts of it where the cause of the flux & reflux of our present sea deprest the soft mass of the earth at that time when the upper crust of it hardened.

As to Moses I do not think his description of the creation either Philosophical or feigned, but that he described realities in a language artificially adapted to the sense of the vulgar. Thus where he speaks of two great lights I suppose he means their apparent not real greatness. So when he tells us God placed those lights in the firmament, he speaks I suppose of their apparent not of their real place, his business being not to correct the vulgar notions in matters philosophical but to adapt a description of the creation as handsomely as he could to the sense & capacity of the vulgar. So when he tells us of two great lights & the stars made the 4th day, I do not think their creation from beginning to end was done the fourth day nor in any one day of the creation nor that Moses mentions their creation as they were physical bodies in themselves some of them greater than this earth & perhaps habitable worlds, but only as they were lights to this earth, & therefore though their creation could not physically {be} assigned to any one day, yet being a part of the sensible creation which it was Moses's design to describe & it being his design to describe things in order according to the succession of days allotting no more than one day to one thing, they were to be referred to some day or other & rather to the 4th day than any other if the air then first became clear enough for them to shine through it & so put on the appearance of lights in the firmament to enlighten the earth. For till then they could not properly be described under the notion of such lights, nor was their description under that notion to be deferred after they had that appearance though it may be the creation of some of them was not yet completed. Thus far perhaps one might be allowed to go in the explaining the creation of the 4th day, but in the third day for Moses to describe the creation of seas when there was no such thing done neither in reality nor in appearance me thinks is something hard, & that the rather because if before the flood there was no water but that of rivers that is none but fresh water above ground there could be no fish but such as live in fresh water & so one half of the five days work will be a non entity & God must be put upon a new creation after the flood to replenish one half of this terraqueous globe with Whales & all those other kinds of sea fish we now have.

You ask what was that light created the first day? Of what extent was the Mosaic chaos? Was the firmament if taken for the atmosphere so considerable a thing as to take up one day's work? & would not the description of the creation have been complete without mentioning it? To answer these things fully would require comment upon Moses whom I dare not pretend to understand: yet to say something by way of conjecture, one may suppose the Planets about our sun were created together, there being in no history any mention of new ones appearing or old ones ceasing. That they all & the sun had at first <11> one common Chaos. That this Chaos by the spirit of God moving upon it became separated into several parcels each parcel for a planet. That at the same time the matter of the sun also separated from the rest & upon the separation began to shine before it was formed into that compact & well defined body we now see it. And the preceding darkness & light now cast upon the chaos of every Planet from the solar Chaos was the evening & morning which Moses calls the first day even before the earth had any diurnal motion or was formed into a globular body. That it being Moses design to describe the origination of this earth only & to touch upon other things only so far as they related to it, he passes over the division of the general chaos into particular ones & does not so much as describe the fountain of that light God made that is the Chaos of the Sun, but only with respect to the Chaos of our Earth tells us that God made light upon the face of the deep where darkness was before. Further one might suppose that after our chaos was separated from the rest, by the same principle which promoted its separation (which might be gravitation towards a center) it shrunk closer together & at length a great part of it condensing subsided in the form of a muddy water or limus to compose this terraqueous globe. The rest which condensed not separated into two parts the vapors above & the air which being of a middle degree of gravity, ascended from the one descended from the other & gathered into a body stagnating between both. Thus was the Chaos at once separated into three regions the globe of muddy waters below the firmament the vapors or waters above the firmament & the air or firmament it self. Moses had before called the Chaos the deep & the waters on the face of which the spirit of God moved, & here he teaches the division of all those waters into two parts with a firmament between them: which being the main step in the generation of this earth was in no wise to be omitted by Moses. After this general division of the chaos Moses teaches a subdivision of one of its parts, that is of the miry waters under the firmament into clear water & dry land on the surface of the whole globous mass. For which separation nothing more was requisite than that the water should be drained from the higher parts of the limus to leave them dry land & gather together into the lower to compose seas. And some parts might be made higher than others not only by the cause of the flux & reflux but also by the figure of the Chaos if it was made by division from the Chaos's of other Planets. For then it could not be spherical. And now while the new planted vegetables grew to be food for Animals, the heavens becoming clear for the sun in the day & Moon & stars in the night to shine distinctly through them on the earth & so put on the form of lights in the firmament so that had men been now living on the earth to view the

process of the creation they would have judged those lights created at this time, Moses here sets down their creation as if he had then lived & were now describing what he saw. Omit them he could not without rendring his description of the creation imperfect in the judgment of the vulgar. To describe them distinctly as they were in themselves would have made the narration tedious & confused, amused the vulgar & become a Philosopher more then a Prophet. He mentions them therefore only so far as the vulgar had a notion of them, that is as they were phænomena in our firmament & describes their making only so far & at such a time as they were made such phænomena. Consider therefore whether any one who understood the process of the creation & designed to accommodate to the vulgar not an Ideal or poetical but a true description of it as succinctly & theologically as Moses has done, without omitting any thing material which the vulgar have a notion of or describing any being further then the vulgar have a notion of it, could mend that description which Moses has given us. If it be {said} that the expression of making & setting two great lights in the firmament is more poetical then natural, so also are some other expressions of Moses, as where <12> he tells us the windows or floodgates of heaven were opened Gen 7 & afterwards stopped again Gen 8 & yet the things signified by such figurative expressions are not Ideall or moral but true. ffor Moses accommodating his words to the gross conceptions of the vulgar, describes things much after the manner as one of the vulgar would have been inclined to do had he lived & seen the whole series of what Moses describes.

Now for the number & length of the six days: by what is said above you may make the first day as long as you please, & the second day too if there was no diurnal motion till there was a terraqueous globe, that is till towards the end of that days work. And then if you will suppose the earth put in motion by an eaven force applied to it, & that the first revolution was done in one of our years, in the time of another year there would be three revolutions of a third five of a fourth seaven &c & of the 183^d yeare 365 revolutions, that is as many as there are days in our year & in all this time Adams life would be increased but about 90 of our years, which is no such great business. But yet I must profess I know no sufficient naturall cause of the earths diurnal motion Where natural causes are at hand God uses them as instruments in his works, but I doe not thinck them alone sufficient for the creation & therefore may be allowed to suppose that amongst other things God gave the earth it's motion by such degrees & at such times as was most suitable to the creatures. If you would have a year for each days work you may by supposing day & night was made by the annual motion of the earth only & that the earth had no diurnal motion till towards the end of the six days. But you'l complain of long & dolefull nights. And why might not birds & fishes endure one long night as well as those & other animals endure many in Greenland, or rather why not better then the tender substances which were growing into animals might endure successions of short days & nights & consequently of heat & cold? ffor what think you would become of an egge or Embryo which should frequently grow hot and cold? Yet if you think the night too long, it's but supposing the divine operations quicker. But be it as it will, me thinks one of the tenn commandments given by God in mount Sina, prest by divers of the prophets, observed by our Saviour, his Apostles & first Christians for 300 years & with a day's alteration by all Christians to this day, should not be grounded on a fiction. At least Divines will hardly be perswaded to beleive so.

As I am writing, another illustration of the generation of hills proposed above comes into my mind. Milk is as uniform a liquor as the chaos was. If beer be poured into it & the mixture let stand till it be dry, the surface of the curdled substance will appear as rugged & mountanous as the earth in any place. I forbear to describe other causes of mountains, as the breaking out of vapours from below before the earth was well hardned, the settling & shrinking of the whole globe after the upper regions or surface began to be hard. Nor will I urge their antiquity out of Prov. 8.25. Iob: 15.7 Psal. 90.2 but rather beg your excuse for this tedious letter which I have the more reason to do because I have not set down any thing I have well considered or will undertake to defend.
