Copy letter from Isaac Newton to Thomas Burnet

Author: Isaac Newton
Source: Keynes Ms. 106(B), King's College, Cambridge, UK
Published online: August 2007

<1r>

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 overstretcht 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 shaddow collected by Lunar Eclipses I cannot tell, nor what from the measures on the earth answering to a degree in several latitudes, 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 beleive was then formed as Moses expresses, but not like our sea, but with an eaven bottom, without any precipices or steep descents as I think I exprest 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 barrs 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 & leave the first coagulated places standing up like hills: which subsiding would be encreased by the draining & drying of that limus. That the veins & tracts of limus in the bowels of those mountains <1v> 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 subterraneal 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 them selves into 40 or 50 times the room they lay in, or more, had they been at liberty. ffor if air in a glass may be crouded into 18 or 20 times less room then it takes at liberty & yet not burst the glass, much more may subterranean exhalations by the vast weight of the incumbent earth be keept crouded 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 by 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 subterraneal vapors which then first brake out & have ever since continued frequently to do so, being found by experience noxious to mans 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 and cavities.

But you will ask how could an uniform chaos coagulate at first irregularly in heterogenous veins or masses to cause hills. Tell me then how an uniform solution of saltpeter coagulates irregularly into long barrs; 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 congeale at the edges, if it be inclined on one side for the more fluid part of the Tin to run from those parts which congeale first, you will see a good part of the Tin congealed in lumps which after the fluider 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 for the Chaos.

All **{**this**}** I write not to oppose you, for I think the main part <2r> 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 avoyded. 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 handsomly as he could to the sense & capacity of the vulgar. So when he tells us of two great lights & the starrs made the 4^{th} 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 physicall bodies in themselves some of them greater then 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 then one day to one thing, they were to be referred to some day or other & rather to the 4^{th} day then 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. ffor 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 4^{th} 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 becaus 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 fift 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 Mosaical 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 that all 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 **{**too**}** had at first <2v> 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 diurnall 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 <u>the deep</u> & <u>the waters</u> 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. ffor which separation nothing more was requisite then 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 then 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. ffor 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 & starrs 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 them selves would have made the narration tedious & confused, **{**amased**}** 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 <3> 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 earth**{**'s**}** diurnal motion. Where natural causes are at hand God uses them as instruments in his works, but I doe not think 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 and cold? ffor what think you would become of an egge or Embryo which should frequently grow hot & 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 commandment 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.