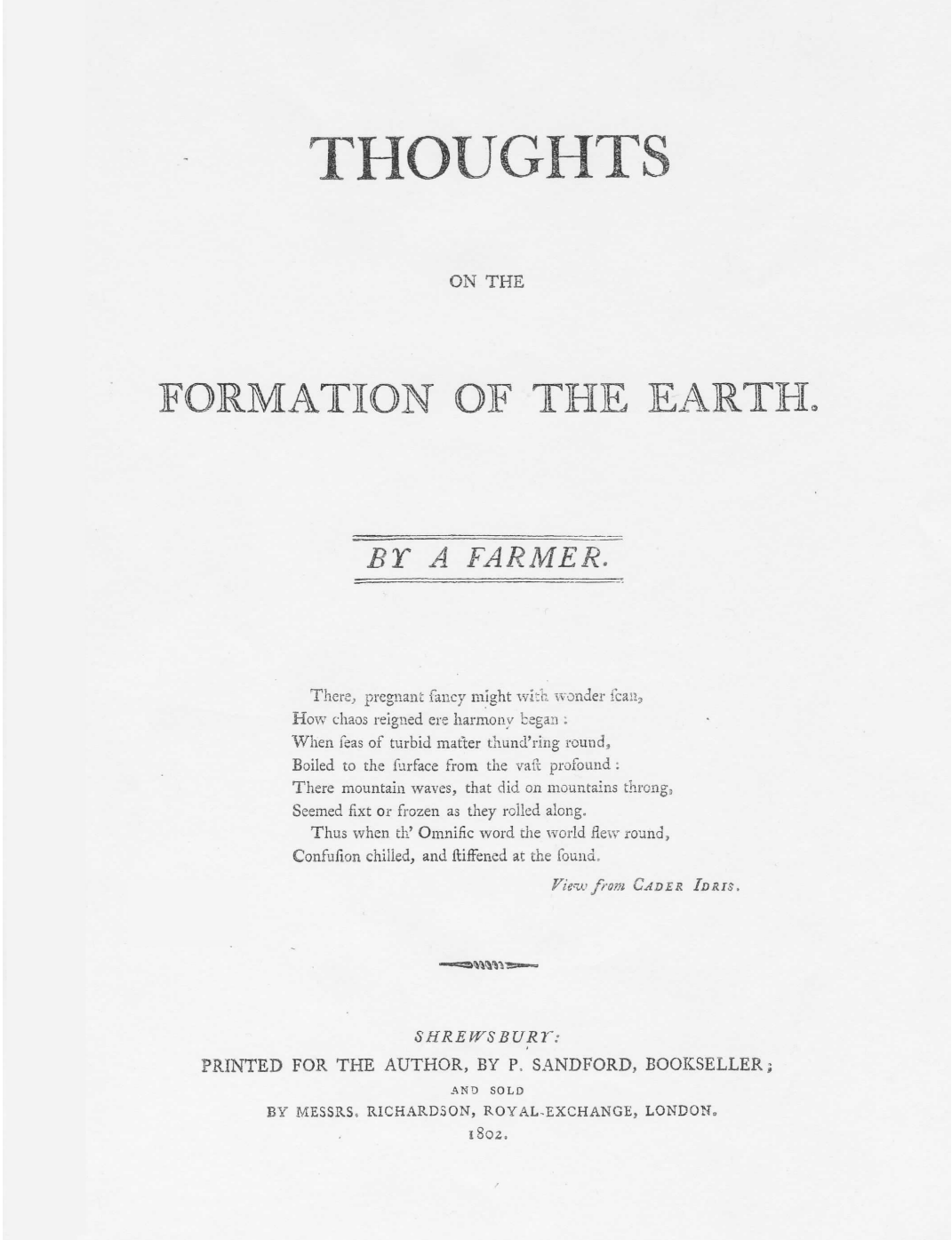
ISSN 1750-855X (Print)
ISSN 1750-8568 (Online)

Thoughts on the Formation of the Earth

A Farmer[1]

FARMER, A. (1802 and 2017) [1]. *Thoughts on the Formation of the Earth*. Printed for the author by P. Sandford, bookseller, Shrewsbury and sold by Messrs Richardson, Royal Exchange, London, 28 pp.. and reproduced in facsimile in the *Proceedings of the Shropshire Geological Society*, **18**, 5–52 (2017). The text is appended as an OCR file to facilitate word searches.

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THOUGHTS

ON THE

FORMATION OF THE EARTH.

BY A FARMER.

There, pregnant fancy might with wonder ſcan,
How chaos reigned ere harmony began:
When ſeas of turbid matter thund'ring round,
Boiled to the ſurface from the vaſt profound:
There mountain waves, that did on mountains throng,
Seemed fixt or frozen as they rolled along.
Thus when th' Omnific word the world flew round,
Confuſion chilled, and ſtiffened at the ſound.

View from CADER IDRIS.

SHREWSBURY:
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AND SOLD
BY MESSRS. RICHARDSON, ROYAL-EXCHANGE, LONDON.
1802.

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ISSN 1750-855X (Print)
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PREFACE.

TO the Public it is proper to declare, that by endeavouring to pleaſe myſelf, in trying to account for ſome phenomenæ I had ſeen, theſe ideas of the formation of the earth occured to me. They were committed to paper merely to try whether my ſyſtem would appear reaſonable, and to me it did. Now they are laid before them to know if my concluſion was juſt; this is all the apology I can make for the intruſion of theſe crude, and very probably weak ideas: for I cannot ſay, as is often ſaid on ſuch occaſions, that ſome friends prevailed on me to publiſh them, not having ſhewn them to any perſon, nor have I any acquaintance ſufficiently ſkilled in philoſophy and chemiſtry, to furniſh me with the information I wiſhed to obtain on theſe heads; for then I might have ſeen the imperfection of my own reaſoning, or have advanced on more certain and extenſive grounds. I am the leſs ſanguine in my expectations, from my little knowledge in the art of writing, and for want of a ſufficient ſtock of technical terms to expreſs myſelf; I fear alſo, ſome of thoſe made uſe of are miſapplied, or not applicable to the thoughts intended to be conveyed. Beſides theſe diſadvantages, I had never read the works of any author on the theory of the earth, until this was nearly compleated, when I procured an abridged tranſlation of Monſieur

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Buffon: being thus unqualified, through want of ſcientific ſkill and reading, from entering into the minutiæ of my ſubject, I am convinced this production can be but an imperfect outline even of my own ideas: but as my diurnal walk for many months, lay over grounds covered with marine wreck, it acted on me as an irreſiſtible ſtimulant. I acknowledge, if there ſhould appear one original thought of any merit in it, it will give me pleaſure, and if on the contrary it ſhould be found the moſt abſurd publication ever read, it will not give me a moment's pain.

But this bantling of my brain, now grown to a little book, demanded from me the ſame ornament to uſher into the world with, as the books of other men filled with wiſer matter,—a quotation of Greek, Latin or profound Engliſh, from ſome great philoſopher or claſſic author, in proſe or verſe, to adorn its title page, I had none; a few lines from rhymes of my own rude imagination, produced by a ſublime proſpect, from one of the higheſt mountains in Wales, ſhall ſerve,—thus the head will fit the body: either great wiſdom or claſſic elegance, I apprehend, would have appeared ill matched, in the eyes of my reader, to this pamphlet; the former as a Judge's great perriwig, to the garb and manners of an empty ſkulled cryer of a court; and the latter as ludicrous as that of a courtier's, all curled, bagged and powdered, on the head of a tattered ſtroller.

NORTH-WALES, 1802.

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THOUGHTS

ON THE

FORMATION OF THE EARTH.

To the appearance of the high ground called Whitcliff, near the town of Ludlow, in Shropſhire, the following ideas owe their exiſtence. Theſe extenſive hills chiefly conſiſt of a hard grey ſand-ſtone, abounding with the wreck of fiſhes: among thoſe of the cruſtaceous and teſtaceous kinds, I found lobſters, cockles, razor-ſhells, barnacles, and oyſters; alſo a number of broken ſtones, apparently petrified fiſhes of the finny tribe, are confuſedly ſcattered over the face of the country.—From the depoſition of theſe phænomena, I have endeavoured to reaſon back to the formation of the earth, and have drawn therefrom the ſubſequent concluſions.

Firſt. That this wreck did form parts of fiſhes of the ſame kinds as are now found in the ſea; were once alive in, and on this ground; and though there never was a greater quantity of water in the globe than at preſent, yet this hill was immerſed in the ocean: conſequently the whole iſland, with all the continents and lands, now above its ſurface, and the exterior of the world, to uſe Milton's language, was "ſea without ſhore."

The hypotheſis of the ſuperficial part of the globe having been all water, I ſhall endeavour to ſuſtain on the following baſis of reaſoning.

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2

The ſolid maſs of matter we call land, I conceive was once ſoft, and in conſequence ſmoothly round; in that ſtate the quantity of water now in this planet, was ſufficient to bury it many fathoms beneath its ſurface; at which period, the exuviæ above-mentioned, and all ſuch as are found on hills and plains, in different parts of the world, were living animals, the only inhabitants of this globe, and probably, continued ſo for many ages.

The conjecture of the globoſity and ſoftneſs of the land, will be corroborated, when it is conſidered, that the natural figure of all fluid bodies, are round; of which the ſun, planets, and their ſatellites, are a proof; although ſome parts of them appear to be fixed, and project beyond the regular limits of a ſphere, ſtill the liquid and ſoft ſubſtances are compelled to reſtore their rotundity as far as poſſible, by changing their ſituation, to obtain the equilibrium: this is exemplified on the globe we inhabit. Now, from the circularity of the heavenly bodies, we may rationally conclude, that all the matter of this world, and perhaps all the planets and ſuns of the univerſe, were in a fluid ſtate, when they were flung from the hand of the Deity to their proper ſtations in the different ſyſtems, thence their ſpherical form: ſo I conceive, that the ſolid and rocky part of this globe was the ſame, and encompaſſed by the ſea.* But when this ſoft ſubſtance was ſufficiently agitated, or its particles blended to a certain degree, probably by the water, which by means of its penetrating, extracting and diffuſing powers, had filled the interſtices of the atoms with the matter neceſſary for petrifaction, ſo as to bring them within the ſphere of adheſion. However, when this maſs was duly prepared by a proceſs beyond the reach of human reaſon to define, I imagine, it leaves little room to doubt, but a general fixation of the rocky matter took place, and did (as ſalt made one of its principal conſtituent parts) in its tranſmutation, from fluidity to ſtony firmneſs,

* The writer does not think the globe came from the hand of its Maker, firſt with a watry ſurface as here deſcribed, but as a chaos, and had now gone through one change, as will be explained hereafter.

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give itſelf another figure. Thus it contracted in moſt places now covered by the ſea, and puſhed itſelf forward, where it appears above its ſurface; and the water rolling off from the projecting parts, found itſelf a reſting place on the indented ſides; and thus again reſtored the ſpherical form of the planet, ſo far as its quantity would allow.

That the tract of land which gave riſe to theſe obſervations was once a bed of ſand, is demonſtrated by its laying expoſed to the air and froſt on the highways, to repair which it is often uſed, where it ſoon loſes the power of adheſion, and reſumes its original looſeneſs, leaving the ſhells perfect, and entirely diſencumbered from any other matter, which ſhells are of the ſame kind as belong to fiſh now found in ſuch ſands, particularly the razor-ſhell or pivot; therefore, when the petrifaction of the rocky matter took place, all the fiſh that were lodged in the ſands that became fixed, muſt be involved in the ſame fate, and although the exuviæ of fiſh are found in many ſorts of ſtones, yet in the calcarious rock, and moſt others, they lay in maſſes, which from their heterogenity appear to owe their ſituation to accident; but in ſand-ſtone they are in general more regularly diſtributed, more perfect, and the ſame ſpecies that now inhabit ſands to which theſe ſtones bear the neareſt reſemblance when pulverized: and as it is known, beyond all poſſibility of doubt, that theſe animals cannot exiſt in any other than ſea water, ſo it muſt be an equal truiſm, that the lands whereon ſuch wreck is found muſt have been immerſed in that element for an immenſe ſpace of time.

Nor do I think that this firſt creation, which I have ſuppoſed to be the inhabitants of the ſea, and ſuch as dwell beneath the ſurface of the ſands, were all deſtroyed when the land became a fixed ſubſtance, particularly the former, and the Deity thereby compelled to a new creation: there are plauſible grounds to ſuppoſe that many regions even of ſands, with the various layers of earths, did not undergo any change, or its inhabitants receive injury; I mean thoſe which were ſituated on the

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contracting ſides of the earth, and were not lifted above the ſurface of the water; the particles of ſands in which they dwelt, being too large to be brought to the point of adheſion, like thoſe whoſe conſtituent parts were of finer atoms; as ſtones may increaſe in their denſity, in proportion to the minuteneſs of the particles whereof they are compoſed.* So it is probable theſe rocks which are now the hardeſt, were moſt weighty and ductile before cryſtallization; ſand-ſtone being far inferior to moſt others in hardneſs, and ſome of them ſo looſely conjoined, as barely to adhere together, but from the largeneſs of their interſtices only, did theſe maſſes become a proper reſidence for the animals now found therein; as the more heavy and finer parts of the ſtony ſubſtance, which are now the hardeſt rocks, conſiſting of ſmaller atoms, prevented the admiſſion of a ſufficient quantity of air to ſupport life, and conſequently, were uninhabited, and in all probability covered by a thick coat of coarſer particles of ſtone and earthy matter equally firm, as the ſands now beneath the ſea; and the wreck of fiſhes which are found in mountains compoſed of theſe finer particles might be drawn into them, by the motion of the water, when the rocky body was in a ſtate of ſoftneſs; for the ocean meeting with no reſiſtance, moved regularly round the globe, from eaſt to weſt, except the variation which was cauſed by the attraction of the ſun and moon; by this action of the ſea, the exuviæ of its inhabitants might be diſtributed and blended for ſome depth over the whole maſs: or if that was prevented by the coats of ſand which covered it, it might at the time of fixation, by its rolling motion † and boiling

* Want of chymical books, or acquaintance with ſome perſon ſkilled therein, compels me to expreſs myſelf with caution on various points, and oftentimes to omit others, by which I ſuppoſe the ſyſtem might be ſtrengthened. Although I am aware that from this unſkilfulneſs I am more liable to make a wrong aſſertion, reaſon thereon, and conceive imaginary pillars to ſupport my theory, which on application might throw the whole fabrick to the ground.

† To draw concluſions from the motion and manner in which ſmall bodies cryſtallize, and to apply them to aſcertain the action of this great maſs, would, I conceive, be ineffectual; for the movement of ſuch an immenſe body, unconfined on all ſides, can meet with no real reſemblance in nature.

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up of the internal matter, envelope ſome of the marine with other ſubſtances, that laid on its ſurface.

The fiſſures of rocks ſeem to be the natural effects of concretion or cryſtallization; the layers in hills and riſing grounds being in general parallel with the ſurface, is preſumptive proof, that the exterior of the rocky maſs was fixed ſome time before the interior, which by being puſhed forward as it formed cauſed thoſe parallel and vertical cracks: at other places, by burſting the incruſtated part aſunder in large chaſms, many of the pieces of fixed matter became inſulated, ſome of which were in the act of overturning, and being immerſed by the commotion of the fluid on which it reſted, and in this floating ſtate, the ſoft matter ſeems to have become ſolid and held them faſt. To this the principal part of the unevenneſs of the earth's ſurface may owe its origin: an ingenious eye will often ſee this idea illuſtrated, when he looks from an eminence, over an extenſive plain, in which a few hills are thinly ſcattered, though the imagination will be conſiderably aſſiſted, if the beholder ever ſaw ſhips, or other large bodies ſinking in the ſea, as they generally turn on their ſides, or deſcend by an inclination of the head or ſtern; then to finiſh the deſcription, he muſt conceive a ſudden freezing of the water to take place and ſuſpend the ſhips partly immerſed.

Of a hill which raiſes like an hemiſphere where the ſtrata are regular and unſhattered, they are continued with equal thickneſs, from the top down the ſides, until they are abruptly broken off. Now had theſe been formed by the ſediments of water reſting on an inclining plain, according to the theory of Monſieur Buffon, or had their extremities been quite ſoft when lifted from the regular ſurface, the layers of the ſides muſt have been thinner than at the top; and that in proportion as thoſe ſides were inclined to the horizon.

The violent running off of the ſea from the land when the continents immerged therefrom, muſt cauſe many maſſes of the ſkeletons of its inhabitants to be collected, where that element met with any ob-

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ſtruction in hurling them towards its preſent repoſitory; and ſuch are often found in different places on the earth. This, ſome of the moſt ingenious and learned men have laboured to ſhew, was produced by the general deluge, or what is commonly called Noah's flood: the earth it ſeems was at that time covered with the water one hundred and fifty days, too ſhort a period for oyſters, muſcles, &c. to arrive at a ſtate of maturity, and be eſtabliſhed in ſuch large beds. This flood it is to be proved did not make much alteration on the face of the land, as the trees, and probably moſt other plants, continued alive, ſtanding in their places, and the former not diſrobed of their foliage: which is confirmed by the dove's returning with the leaf plucked from the olive tree, a convincing proof alſo, there was no great commotion or agitation of the waters; therefore thoſe ſhells were not driven on the land at that time, by its violence; as a force ſufficient to do this, would have thrown down and torn up all the trees, and have ſent them floating on the ſurface, from whence a leaf might have been as eaſily gathered at the middle, or at any period of the deluge, as at its decreaſe.

No theory, I imagine, but the ſuppoſed rotundity of the land, its ſoftneſs and concretion, can account for the wreck of fiſh being found in mountains; when we conſider the ocean muſt have diminiſhed near four miles in perpendicular height all over the world, if it ever did cover the tops of the hills, in their preſent ſtate; and how can we conceive a cavern to be left void in the globe capable of abſorbing ſuch a quantity of that element, more perhaps than is now contained in this planet? nor, I conclude, will it be leſs difficult to think, how mountains could be formed by the currents of the water,* admitting there had been enough to immerſe them, particularly with ſuch pointed or rugged heads and ſides, as thoſe are found to have that were puſhed through the coarſe layers of earths and ſands, under which it cryſtallized: the ſediments of water may create banks, but never could produce a rugged mountain.

* Vide Monſieur Buffon.

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But when we place ourſelves between two high hills of hard rock, which have not been defaced by time or accident, and compare them on either hand, you will often find the convex parts of the one exactly to correſpond with the concave of the other, which moſt clearly ſhews, they have been rended aſunder; now if we only conceive the exterior of the earth to be firſt incruſtated as before mentioned, the motion cauſed by the fixation of the matter beneath, the puſhing forward of theſe parts, which now appear above the ſea, and contraction of the moſt of what is ſtill under it, did compel the projecting ſurface to expand in proportion, as its elevation augmented the circumference of the globe; which was an effort of matter to return again to its primitive circular figure; therefore divided the rocks as we burſt the rind of a twig by bending it to form a hoop; thus the mountains as they advanced in height, retired from each other.*

At the time of fixation, it is reaſonable to ſuppoſe, from the irregular compreſſion of the ſolid exterior parts on thoſe beneath in a fluid ſtate, the latter muſt at ſome places, be preſſed up through many of the chaſms, and ſo high as to become mountains. To this the hills called Dartmoor, in Devonſhire, appear to owe their origin:† this range conſiſting of granite and other heavy ſtone loaded with ore, probably had its ſtation beneath the calcareous rock, red ſand-ſtone and ſlate, which compoſe the chief part of the county: but the land opening for the cauſes before given, the ſouth part of it ſinking into the great chaſm now the

* I can find nothing that conveys my idea of the appearance and motion of the earth, when it was lifting itſelf above the water, but two moſt humble compariſons. I conceive its motion might bear ſome reſemblance to a great body of pitch, or other thick ſubſtance, in a ſtate of ebulition: the cauſe and irregularity of its ſurface to the top of a large well-baked and levened loaf that had been confined in a veſſel, ſo as to keep its ſides from expanding, the growing elevation of the bread, cracking of its ſurface, and hardening the dough as it aroſe, might give ſome idea of its action and now of its appearance.

† My alluſion to this range of mountains in particular, is from my having ſpent the greateſt part of my life in that county, and never travelling much; therefore I know of none, that are ſo well calculated to anſwer my purpoſe.

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Britiſh, and the north into that called St. George's channel; cauſed a rent or fiſſure in the middle of the county of twenty miles long, and about ten wide, which was immediately filled with the fluid body, the ſinking fixed maſſes forced up, and formed theſe hills; for whoever examines the ſoil and face of the country, particularly the parts bordering on the confines of the mountains on the north and ſouth, will I imagine have little room to doubt, but they were once united, rended aſunder, and the matter which conſtitutes theſe hills obtruded itſelf between.

If the land was not ſoft and had altered its ſhape by cryſtallization, it would be difficult to form an idea, how any ſoft or ſandy ſubſtance could gradually collect, according to Monſieur Buffon's theory, and form itſelf acroſs the globe, ſo as to reſiſt the impetuoſity of the ocean, or by any other means, than that of a general concretion, as nothing leſs than a maſs of ſolid rock could ſtop it; particularly, when the narrowneſs of the land be obſerved that joins North and South America: for it ſhould be conſidered, that all banks formed in the ſea owe their origin to ſome obſtruction the current meets with in purſuing its regular courſe.

That the great maſs of ſolid matter we call land was once in a ſtate of fluidity will, in my humble opinion, receive conſiderable ſupport, from the reſemblance which many ſoft bodies bear to various parts of ſtones, when they become firm, and none has fallen within my narrow ſphere of obſervation, that ſtrikes more forcibly (however unphiloſophical it might ſound) than is to be found in a ſoap manufactory; the liquid in which the oils, rezins, &c. are diſſolved, being drawn from lime and ſtrongly impregnated with the vegetable alkali and marine ſalt, may be expected to produce ſome reſemblance, between a body thus compoſed, and that of the marble, from whence the menſtruum chiefly derives its fixing quality: when theſe materials are ſufficiently impregnated with the ſalts contained therein, it becomes when cold a ſolid ſubſtance, throwing off as it fixes, all the watry matter, more than is neceſſary to

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give it a proper degree of firmneſs: in the ſoap called by the manufacturers, mottled, the idea will receive more ſupport than from any other, by being placed in a larger veſſel to congeal, and remaining undiſturbed by the maker until it be quite firm; then if it be cut in a direction perpendicular to its baſe, it will have all the appearance of a variegated piece of marble: its tranſparency in the channels where the liquid has been forced through in its way to the bottom, by the congelation of the ſoap, will be found to reſemble ſtrongly the cryſtalline veins of the rock, and where it has not made its paſſage, within the ſpace of time neceſſary for the ſides to unite, like the veins called by ſtone maſons water veins, and in the larger cavities, where it has made a lodgment, the ſides are full of ſopy cryſtals; which, if not hexagonal priſms, and truncated, like thoſe of the calcareous rock, yet ſhooting out with blunted points, are ſufficient to ſhew, that both ſubſtances were once ſoft, and derive their tranſparent and variegated arrangements, from the ſame cauſes, and the ſhape of their cryſtals only altered from the difference of ſome of the conſtituent parts of the matter, of which they are compoſed.

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CHAP. II.

On the Probability of the Land's being again ſubmerged in the Ocean.

I Have ſometimes been induced to conclude, that all the matter which is unceaſingly falling from the mountains to the plains, and from thence carried to the ſea, would there accumulate, and ſo continue to increaſe for millions of ages, until a new land, all flat, and little higher than the ocean, would be formed; by which means, the latter would occupy a leſs part of the ſurface of the globe, and the land, from its greater extent, be capable of maintaining a larger number of inhabitants, on one immenſe and fruitful meadow: but the probability of this theory, however pleaſing it might be, for the idea of the land's being all abſorbed and the world occupied again only by fiſh, though it might not happen for an hundred million of centuries to come, ſeems not ſo pleaſant as the former to reflect on; yet, without the interference of the Deity, I believe it will at laſt be the caſe: for the firſt conjecture ſeems to me to be conſiderably out-weighed by the ſecond, as the water has actually made great progreſs towards the accompliſhment of its purpoſe, in proportion to what has been done by the increaſe of land; which I ſhall endeavour to prove by the following obſervations.

Of the encroachment of the ſea upon the land, we have annual proofs in many parts of this iſland; and much has been loſt ſince the

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commencement of our hiſtory, viz. great part of Kent, near half the county of Cornwall (if the ſurvey be correct that was made in the reign of Edward the firſt) the town of Winchelſea, and a conſiderable part of Merionethſhire in North Wales; the bottom of Torbay was once above its ſurface is plain, from the vaſt number of the ſtumps of trees found at low water, rooted in the clay in the ſame manner they were in when growing. Trees are here oftentimes torn from the ground, when ſhips draw up their anchors, at the diſtance of ſome miles from the ſhore, and though their appearance be quite freſh, yet they muſt have been immerſed many ages. Some acres of the high land round this bay have fallen into it ſince my remembrance, and I doubt not, but part of the Engliſh and Iriſh channels, and for a conſiderable diſtance from moſt of the ſhores in the world, was earth above the ocean when firſt it emerged therefrom: for the daſhing of the waves (even againſt the ſides of the rocks) fret, undermine, and by inceſſant battering encroach on its boundary, which in all probability extended ſo far as to cauſe the water to be very deep cloſe to the ſhore, like the lands and mountains that bound the Mediterranean ſea; where it cannot have made great progreſs, as appears by its narrowneſs and depth.

I know that many writers think the land gains as much from the ſea as it loſes; a little ſand may be accumulated at the mouth of a river, ſo as to form a ſmall iſland, or even a piece of low land, and a port thereby blocked up. Theſe banks are brought down by the river from the high grounds over which it has wandered, but the land gained in this manner bears a ſmall proportion to what we are certain has been abſorbed by the ocean.—Surely all the matter that falls into the ſea, muſt raiſe it in proportion to its bulk, and its extremities will be driven thereby over the land wherewith it is bounded; while its flux and reflux aſſiſt in drawing theſe particles, imperceptibly, towards the deepeſt water of the globe; ſay at equal diſtance between the continents, where it is ſlowly, but eternally accumulating, and will in an indefinite ſpace of

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time ſo ſwell theſe ſides, as to increaſe their globoſity, and the earth be again, though in a ſolid ſtate, immerſed in the ocean: for it appears evident to me, even to conviction, that the looſe particles of matter, are compelled by their ſpecific gravity to tend towards thoſe parts neareſt the centre, on the ſame principle as other heavy bodies ſlide down an inclined plane, and this, all atoms may continue to do, until the land becomes nearly as ſpherical as the water itſelf.

If the particles of earth were not drawn to thoſe parts neareſt the centre, there would be an immenſe accumulation of land at or near the mouth of all rivers, as the banks now ſeen there, owe their exiſtence to the earthy matter being brought down by the ſtream, faſter than they can be taken off, by their common tendency toward the moſt excavated places of the world; and I believe theſe banks are generally found, where the obliquity of the land under the ſea increaſes very gradually, or the particles meet with ſome obſtacles, which retard their progreſs to the places neareſt the centre; hence we may expect to find more banks of ſand at the mouth of the Thames, and the German rivers that empty themſelves between Calais and the entrance of the Baltic ſea, than many others; the earthy matter brought down by theſe rivers, being obliged to make a more circuitous route, and that by the Thames particularly ſo, from the proximity of its eſtuary to France.

Many low and flat tracts of land, exhibit ſtrata of ſands and marine ſubſtances, beneath the vegetable earth, though ſituated ſo far from the ſea, as never to have been viſited thereby, ſince it firſt emerged therefrom; this might be the original ſurface, when the earth was round, and beneath the water: when lands of this deſcription are the immediate boundary of the ocean, many have been induced to believe, that the latter diminiſhes: but it is as probable to aſſert, that the high grounds which heretofore protected it, were beaten down by it in its progreſs towards abſorbing the earth: we are certain, however, the ſofteſt land is always crumbling away before it, whilſt the promontories and capes of more

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obdurate matter, ſtill braving the violence of the waves in an advanced ſtation, are an inconteſtable proof the water is the invader.

To prove that the ſea does not diminiſh, let us examine the hardeſt rocks inſulated by it, and riſing a conſiderable height above its level, with ſides nearly vertical, when the tide is at its loweſt ebb. All that part left by the water will be found to be rough and corroded thereby, and that above the high-water line to project. Fiſh of the bivalvular kind ſomething reſembling the muſcle, are often found to have perforated the rock ſome inches deep, which are to be ſeen by ſtriking off the ſcurf from the part which the retreat of the ſea has expoſed.* The projection immediately above the water, is a proof that the daſhing of the waves conſumes the rock faſter than the atmoſphere. Had the ſea diminiſhed, it would have left evident tokens of its retreat, ſhould the atmoſphere have diſſolved the little protuberances, and worn the rock ſmooth, ſtill the punctures made by the animals would have remained, and their depth have increaſed in proportion as their ſituation approached the ſurface of the ſea. This to me is an irrefragable proof that the atmoſphere does not deſcend towards the baſe of the rock, or in other words, that the perpendicular height of the ſea does not decreaſe.

Furthermore, as all the land made or left by the ſea, muſt be perfectly flat, and little above its level; if theſe parts were gaining on it, they of courſe muſt be the fartheſt advanced into that element, and the ſolid mountains in the rear. Moſt part of the ſhores of the continents and iſlands ſhould have ſloping grounds of this deſcription, juſt above the water, of conſiderable extent, but the real ſtate of the ocean and earth, in contact with each other, is to this a direct contradiction.

But there are partial encroachments of the land on the ſea, beſides ſuch as I have before attributed to the courſe of rivers, which may be accounted for in the following manner. As the moſt mountainous parts of

* Theſe remarks were drawn from obſervations made on the inſulated lime-ſtone rocks in Torbay.

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the globe at the time of fixation, were rended into the wideſt and deepeſt chaſms, which ſoon became or were left filled with water, and their ſides being rocky, and almoſt impervious to the attacks of the elements, there has not, even at this period, a ſufficient quantity of ſolid matter ſlidden down to fill all of them; theſe are now lakes, or ſuch ſeas as communicate with the main ocean by a narrow ſtrait, the largeſt of which are the Mediterranean and Baltic: (for it does not appear probable to me, that the ſpace now occupied by the former, was ever land, as Monſieur Buffon concludes, and was overflowed by an irruption of that element; but that it is a great rent in the globe, made at the fixation of the earth, it being very deep, ſome hundreds of miles above the ſtraits of Gibraltar) but, in thoſe parts, leſs mountainous, and the riſing ground covered with rich deep loom, the excavations being leſs, were in time filled, and where the rents extended to the ſea, they became eſtuaries; in theſe the ſliding down of the ſoil has in many places, cauſed the water to recede from their innermoſt parts and occupied its place: there are few eſtuaries if they are not terminated immediately by high lands, where the tide has not puſhed itſelf further up than it does at preſent. I have been told by thoſe who have dug deep by the ſide of a hill, that is now the boundary of an extenſive piece of meadow land, at the head of one of theſe arms of the ſea, that the rocks below, had all the appearance of having been waſhed by it: here the increaſe of earth, by the common tendency of its particles to the centre, and continual decay of vegetables, had gained a partial elevation, ſuperior to that of the general perpendicular riſe of the whole ocean.*

But if there is a quantity of inflammable matter pent up in the interior, there may be a poſſibility, ſhould air by any means be introduced, of its becoming exploſive and emerge ſome of the land at this time be-

* Perhaps ſome idea might be formed of the univerſal riſe of the ocean, ſince it was forced to withdraw from theſe parts, by comparing the topmoſt of the water-worn marks with the preſent high-water line on the neighbouring coaſt.

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neath the ſea, and abſorb parts now above its ſurface; but as on this theory, conjecture itſelf muſt look with hopeleſs eye, we cannot form an idea how air can gain admittance; for we know very little of the interior of the globe, the ſheli of rock may be a thouſand miles through, and that more denſe as it approaches the centre. The deepeſt caverns ever made by human induſtry, advance not the one hundredth part ſo near to that point, as the thickneſs of the rind does to the middle of a large apple.

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CHAP. III.

I Shall now ſum up in as clear and conciſe a manner as I am able, the whole ſyſtem of my ideas reſpecting the formation of the earth.

I am led to conceive, that this globe did undergo one gradual change before that of cryſtallization.

At its firſt collection from ſcattered matter, it is rational to ſuppoſe it to be one vaſt globular maſs of turbid and impure fluids, in which the vital power was incapable of exiſting in any form or ſubſtance, a perfect chaos, but by what means the Deity thought proper to cauſe beauty and harmony to ariſe therefrom, is beyond the reach of human abilities to aſcertain; yet the aſpiring faculties with which he has endowed us, ſtimulates us to attempt every thing, for as far as we have been able to trace his works, they have been founded on the principles of ſcience: and having in his infinite goodneſs cauſed a ray of this divine light to ſhine on our minds, it is to be hoped, we do not offend him in making uſe of it, in admiring and endeavouring to underſtand his performances, and the means by which they were accompliſhed.*

* Fire never could be the agent employed to reduce the world to its preſent ſtate. For if the whole maſs was ever in a ſtate of igneous fuſion, no regular ſtratified matter would be found, nor would water make a conſtituent part of the rocky body: beſides, there could be no maſſes of combuſtible ſubſtances left in the interior of the globe. Coals, ſulphur, and every other body that could be analized by heat, would all have been evaporated. Fire I am of opinion has contributed no more to it, than to produce ſuch partial alterations as may be aſſigned to volcannic eruptions.

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Human ſagacity ſeems capable of comprehending a ſmall part of one phyſical method, by which ſuch an aſtoniſhing change might be produced on this immenſe world of confuſion.

Firſt cauſes being totally beyond the reach of human reaſon, fancy muſt begin by ſupplying its place.

Let us conceive a heavenly being, by the order of the Deity after he had drawn the grand contour of the univerſe, ſtanding on an enormous maſs of all the variety of matter of which each ſyſtem is compoſed, moulding and tempering the ſun, planets, and comets, then flinging them from his plaſtic hands in a ſtate of chaotic turbulence to their appointed ſtations.

The admixture of all the ſubſtances in the globe, might naturally produce fluidity, and after the agitation of its particles for a certain period of time, ſome inexplicable unity taking place, chaos was deſtroyed and matter placed itſelf round the centre according to its relative gravity; and there being a conſiderable degree of attraction between the rocky body and water, the former, mingled with a certain portion of the latter, probably in ſubſtance like a thick paſte, lodged itſelf between the weighty central maſſes and the yet turbid ocean; the remaining motes of ſtony and earthy matter left ſuſpended in the liquid, at length by their attraction of compoſition uniting and cryſtallizing, became fixed, and thereby acquired ſufficient weight and bulk to precipitate through the fluid, and formed laminæ of ſediment round the more fine and weighty particles of this maſs: hence, and from their mutual attraction, is the cauſe why water is found when we analiſe ſtones, as the interſtices of the particles depoſited muſt be filled therewith.* After the laſt depoſition, the water became tranſparent, and all the rocky maſs perfectly round was covered

* Where a volcano burſts through the ſurface, either by its intenſe heat, or by the action of ſome diſſolving ſubſtance, it would reduce ſome parts of the rock on which it could act, to a ſtate of fuſion. After the ſulphureous matter was all exhauſted, the fluid cooling, aſſumed a different contexture from other ſtones, and contained leſs moiſture. Such as have been changed by heat might, I conceive, through the ſame

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thereby. At this period fiſh were created, and the ſea became inhabited, but after a lapſe of ages, by a general diſtribution of ſome matter, or by cauſes it is in all likelihood impoſſible for us to diſcover; they were brought within the ſphere of attraction of coheſion, and by a general or quick ſucceſſion of cryſtallizations taking place, the whole maſs changed its figure. The contraction of the parts ſtill beneath the ſea, compelled theſe now above it to project, and rend its exterior incruſtrated ſhell. (for the water having greater power to act on what was in contact with the coarſer ſediment, cauſed it firſt to concrete.) Thus when the huge body lifted itſelf through the ocean, ſome of its fixed inſulated parts were raiſed ſo high as to become mountains; other matter in a ſtate of ſoftneſs, forcing up through the chaſms to the ſurface, for cauſes before explained, brought near the ſuperficies of the world, ſuch a variety of metals and other foſſils as the Deity knew would be neceſſary for the comforts and well being of its intended inhabitants, which would otherwiſe have lain ſo deep as to have rendered all human reſearches to have procured them vain. Reſpecting the ſea, it muſt be and always was ſalt, from the quantity of ſaline matter that was left ſuſpended therein after the depoſition of all other bodies, and as it made no inconſiderable part of what was precipitated, by being diffuſed throughout the whole ſtony maſs, might be the chief cauſe, at the time of cryſtallization, of compelling it to change, from round to that figure which it now bears.

On peruſing the map of the world, I am inclined to think that the land came firſt through the water, nearly in one united maſs, and that the American continent was torn from this,* for all the leſſer rents, whether

proceſs, be again melted, and when congealed, would aſſume their laſt character. By this operation, the rocks in their primitive ſtate might be diſtinguiſhed from thoſe which have ſince been altered by the action of fire. If volcanoes were ſo numerous in the early ages, as I ſhall hereafter give ſome reaſons to ſuppoſe them to be, ſtones that have gone through this change might often be found, but not in regular ſtrata like the general ſurface.

* Vide Chart hereunto annexed.

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now ſeas, bays, lakes or chaſms, would not admit of the matter expanding ſufficiently, to accommodate itſelf to the periphery of a larger circle. Had the whole remained united, it is probable, the weſtern part would have been ſo high, as to have rendered it unfit for the habitation of man: or had it been in ſuch a ſtate of ſoftneſs, as to admit of its being drawn acroſs the weſtern ocean, there would not have been matter enough to appear above the ſurface of the water; and as the American continent was higher and exceeded the other in a latitudinal direction, the centrifugal force cauſed by the motion of the earth on its axis from weſt to eaſt, makes it more probable, that that continent was torn from this part of the world, to reſtore the equilibrium.*

The capes of St. Roque and St. Auguſtine, appear to have been divided from the Gulph of Guinea, as the concave coaſts on each ſide of the Gulph of Mexico, with all its fragments, now iſlands, were rended from the convex ſhores of Africa, of which the Cape de Verde is the moſt prominent part. The remaining part of the American coaſt of the United Provinces and Labrador, muſt have been in contact with Europe, to the Britiſh iſlands: after which it ſeems to have divided in three parts, and left Greenland a central land, the eaſt ſide of which I conceive, was torn from Norway and Lapland, and the weſt between Cape Farewell to Cape Bedford, have the features of being drawn from the concave ſhores of the northern parts of Labrador, and the iſle of Good Fortune.† The mo-

* Although the ſhores of the continents are not at preſent the exact counterpart of each other, yet they bear ſtrong reſemblance; the deſcending of America to the weſt, as it reſted on a fluid baſis, might make ſome alteration on its outline, and alſo diſcompoſe its ſurface.

† If the American continent was torn from this, I imagine the water ſhould be much deeper in the Atlantic, than in the great Pacific ocean; as ſuch a ſeparation would make a deep rent towards the centre: and this ſeems in ſome meaſure to be confirmed, by the vaſt number of iſlands in the latter ſea, which the falling continent might in ſome degree aſſiſt in forcing up. I oftimes think ſome reſemblance might be drawn between the creation of theſe ſmall iſlands, and the little lateral icicles that are impelled to ſhoot from a damp wall by ſevere froſt: as the contraction of the rocky maſs under the water, aided by the above circumſtance, and the centrifugal force, cauſed by the motion of the earth on its axis, might compel ſome of the fluid matter to ruſh violently through the rents to a great length before it cryſtallized.

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tion of the falling land to the weſtward, would cauſe the water to ruſh round the Capes of Good Hope and Horn, into the chaſm, while a vaſt quantity might have rolled back over the ſurface of the deſcending continent into the ſame gulph; that it did paſs over the land ſeems evident, from all the large rivers in America running eaſtward, from the ſuperior ſize of the rivers themſelves, and from the vaſt lakes that abound in that country; as the extreme velocity and weight of the water, muſt force large channels through the land in its paſſage acroſs it, and tumbling down precipices make huge pits in its ſurface; ſome of which are now great lakes.

Here I cannot forbear giving the reins to fancy for a moment, to ſuppoſe ourſelves then in exiſtence, holding a higher rank in the chain of beings, and at a convenient diſtance from our globe, with ſouls ſufficiently comprehenſive, and eyes capable of extending over it.

At that period what a commotion ſhould we have beheld, to ſee the immenſe continent of America falling, falling, falling weſtward, and driving the ſea on heaps before it, in a prodigious ſtate of turbulency; to have obſerved the violence, with which the latter ruſhed back into the dreadful chaſm, and in all probability, an innumerable number of volcanoes; all burſting forth from different parts of the earth, on the firſt preſentation of the inflammable matter to the atmoſphere; and to conceive the finger of God or ſome ſuperior Being, arreſting this aſtoniſhing maſs in its career, juſt at a proper height above the water, when reſtored to its level, to make it fit and convenient for the animals to be created. By ſuch reflections we are loſt in wonder, and awed to ſilence and adoration.

If the fixation of the land, was wrought by means correſponding with the preceding conjectures, I think it probable, that the exterior part only became a firm body, the principal of which is the ſtony maſs, and that all within is now in a ſtate of fluidity; of theſe ponderous bodies (ſome of which may have wonderful properties) the electric and

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magnetic matter may form a conſtituent part, and that all this incruſtated maſs might ſtill be ſubject to ſome motion. It ſeems rational likewiſe to ſuppoſe, that by the juſtle cauſed at the time of cryſtallization, ſmall portions of thoſe fluids might be caught in the part that became fixed, and perhaps be the reaſon why mercury, which may conſtitute a great part of the interior, is found in the crannies of the rock, and the cauſe why inflammable matter became pent up in the firm part of the globe; which matter it is not unreaſonable to ſuppoſe, is in a ſtate of fluidity at this time: theſe ideas might receive ſome ſupport from the volcannic mountains, which ſeem to have been more numerous in the earlier ages than at preſent, probably from the great quantity of ſuch ſubſtances being at firſt caught up, or encloſed in the ſhell of the earth; many maſſes of which are now burnt out, or greatly diminiſhed, and from the variation of the needle, by the motion of the magnetic matter: not that I conceive the craters of thoſe volcanoes do communicate with the grand maſs of fluids in the center, but with ſmall caverns of inflammable bodies, confined in the exterior cruſt, and not ſo deep as totally to exclude it from the action of the air.

It might be aſked, why the higheſt mountains ſhould emit fire? as it may be thought the vallies, being nearer the centre, ſhould be the volcanoes, and the volatile parts of the combuſtible matter eſcape much eaſier than by forcing up through an immenſe body of rock; to which I reply, that all mountains, whether formed after the manner obſerved by thoſe of Dartmoor, or by ſome parts of the rocky matter, at the time of cryſtallization, being puſhed much higher than the general ſurface, the former being ſqueezed up from a more profound depth, are more likely to produce ſulphur metals, and other ſuch ponderous bodies as are contained in the bowels of the earth, than any other parts near the ſurface, and to have their ſtrata more jumbled and broken; the layer alſo that compoſes the baſe of a mountain produced by the latter means, it is probable, is of the ſame nature as would be found by digging in the

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neighbouring plain, a depth equal to the perpendicular height thereof; and from the broken ſtrata, and wide fiſſures of the moſt elevated mountains, the air can more eaſily gain admiſſion to any inflammable bodies therein, than through the horizontal lamina of earths and clays, which cover the general ſurface, or leſs broken ſtrata of the inferior hills.

But to return to that ſtate of the globe in which it was left when the water became pellucid, and fit to be inhabited with all the ſtony and earthy maſs round and beneath its ſurface.

When God ſaw it was an element fit to ſupport life, he re-animated and cauſed the ſea to be filled with the firſt parents of the preſent occupiers; and as the chief part of the ſurface within the arctic and antarctic circles, when the water covered the face of the globe, was ſoon conglaciated by the intenſeneſs of the cold, and remained a firm body, I think it not without the reach of probability to ſuppoſe, that there might be a creation of amphibious animals, if not a few land quadrupeds, to prowl over thoſe regions, to devour the carcaſes of dead fiſh, with which the polar circles are known to abound: I am led to this remark chiefly by obſerving the attention of the Deity, to permit nothing to take place without turning it to ſome advantage towards the wonderful work of creation: the plum, peach, and other fruits, we are informed by naturaliſts, are worlds to ſome ſort of animalculæ, and the remoteſt iſland, riſing from the middle of the ocean, has its inhabitants of ſome kind or other; but if there were any quadrupeds in thoſe parts, which certainly muſt be few, and in all likelihood very large, they were all deſtroyed at the time of cryſtallization; as the lands of ice muſt be overwhelmed, and others ruſh tumultuouſly into their place. Of thoſe animals, the huge bones found petrified in the northern parts of Siberia, might be the remains, as they are larger, and differ from the bones of any creature we know of in exiſtence.

How long this globe remained with its watry face, revolving round the ſun, the inheritance only of fiſh, and perhaps a few polar am-

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phibious animals, before cryſtallization, will for ever remain unknown to us; but when that great event took place, the grand field for animation was laid open before that vivifying Being, on which he ſo liberally diſplayed his wonderful power, by giving form and exiſtence to the multifarious creation, from the man to the meaneſt inſect, with all the vegetable kingdom, an immenſe and graduated chain of life; and this ſo wonderfully varied and contrived, that the grand decompounder Death, ſeems to be compelled to repair his own ravages; for in deſtroying the living faculty in one large animal, he ſupplies the means of its ſupport for thouſand of ſmaller creatures, and thus in the very act of deſtruction, gives new life to the animal, and vigour to the vegetable world. He cloathed and armed each, according to his neceſſities, and that this great work ſhould not lay unadmired, he raiſed the mental powers of one ſpecies of mortal beings ſo high, as to be capable of feeling aſtoniſhment and pleaſure in contemplating the wondrous ſcene, and gave them minds ſo capacious, as to conceive, that there muſt exiſt a great Power who did all theſe marvellous things.

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CHAP. IV.

THE chief phenomena within my ſphere of information, which appears to militate againſt this theory, and ſeems hardly to be reconciled to any at firſt view, is that of trees and other vegetables being found beneath layers of marine productions, ſands and pebbles, which apparently had been rounded by the ſea; but even this, I flatter myſelf, might be reconciled thereto: this ſtrange arrangement of ſtratified matter may, in ſome places, owe its poſition to land ſlips: it has often happened that the ſides of hills have ſlid down into the plain, and covered all the ſubjacent ſurface. Here if men ſhould chance to dig ſome centuries ſubſequent to ſuch a circumſtance, they would find under the firſt vegetable earth, the gravel, ſand, or whatſoever matter originally compoſed the ſide of that hill; then the wreck of the trees, or other plants, that heretofore occupied the level ſurface; and as the ſliding down of the ſides might have happened more than once, they would on digging further, find the remains of trees, probably covered with earths of a different kind with the former.

Earthquakes alſo, might in ſome meaſure have contributed to theſe extraordinary arrangements, and as we do not know the age of the world, nor number of places that have been ſubject to thoſe convulſions, we ſhall not exceed probability in ſuppoſing ſuch a cataſtrophe to have happened, where ſome of thoſe phenomenæ are found; and it is reaſonable to conjecture, that ſuch did often occur in the earlieſt ages.

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But the chief part of them, I conjecture, might be produced by the following cauſes, after the earth had aſſumed its new form, and when the moſt fruitful and beſt adapted parts were covered with vegetation: for I am of opinion, at that time the contexture of the ſuperficial part of the earth was leſs firm than now, and but partially covered with plants, as a conſiderable portion thereof might not be in a proper ſtate to receive them. At that period alſo, new ſprings might ariſe, and rivers unreſtrained by firm banks, would ſometimes change their courſes, and make irruptions over plains they never before had viſited; beſides ſapping the foundations of the riſing grounds through which they paſſed, and rolling its earths away with them, would throw down much of the vegetation on the low lands; might ſometimes cover it with a layer of the ſhells, and other marine productions, they had overwhelmed in their courſe, that certainly muſt be left by the ſea on different parts of the ſurface in large looſe maſſes, or with the ſands or earth that compoſed a particular part where a violent ſtorm had ſpent its fury, with which the waters muſt be fully laden: a ſtratum would be depoſited alſo, before each impediment the torrent met with, in running to the ocean; as theſe new formed layers would be ſoon cloathed with verdure, freſh irruptions of the waters might quickly overlay them with freſh matter; and in the moſt depreſſed places this would be repeated, by depoſiting ſediment after ſediment, until it was raiſed equal to the general ſurface of the land;* as the world increaſed in age and vegetation, trees, and a variety of other plants, were often hurled down with the ſtream, and became part of the matter depoſited; ſome of which being lodged in beds of fine ſands, where water oozing through rocks and earths, which had the qualities of impregnating the ſtream with ſuch ſmall ſtony atoms, that by filling up the pores, and decaying parts of the vegetables and interſtices of the ſands,

* Though the common maſs of matter increaſes in gravity, as its ſtation is nearer the centre of the globe; yet by this it will appear, that at ſome places, leſs firm and lighter ſtrata may be found beneath thoſe of greater weight and denſity.

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cauſe petrifaction: when theſe maſſes were concreted, the exact reſemblance of the plant was formed in the ſtone; and after the world became inhabited, bones might ſometimes be blended in the ſame manner. Rivers, before they had cut themſelves channels ſufficiently deep, as to contain a large portion of their waters, muſt commit ſuch ravages, and produce ſuch changes on a new formed ſoil, as we cannot without ſome conſideration conceive a proper idea of.

Why the rocky matter of particular ſorts ſhould lay in maſſes, and be covered with earths and ſands of different kinds and complexions, ſeems difficult to be accounted for, as we may conceive, that bodies of the ſame nature and gravity, would precipitate in laminæ all round the globe, like the coats of an onion; yet when the immenſe extent of the world be conſidered, it is as reaſonable to conclude, that it ſhould lay in maſſes. But if it was depoſited in lamina, by the juſtle and confuſion cauſed at the time of cryſtallization, it is probable, all the variety of rocks and ſoils which are now found, would be produced by the burſting of the exterior, and tumbling down into the chaſms, with the boiling and ſqueezing up of the interior from various depths; and I believe, the chief cauſe of the variety of the thin ſoils which compoſe the ſurface of the land, ariſes from its partaking, in a greater or leſs degree, of the nature of the rock beneath, in proportion to its hardneſs, by the diſſolution of its parts by the atmoſphere.

I hope I ſhall not be conſidered as a man who wiſhes to depreciate the account of the creation and flood, as given us in the ſacred writings; particularly ſo, when I declare my ſentiments to be, that the univerſality of the idea among mankind of a general deluge, might be attributed to the earth ariſing through the water in the manner I have attempted to ſet forth: the ſtory of a deluge, I have been informed, is among the traditions of all nations, and is ſupported by writers ſacred and prophane: it would be barely reaſonable to aſcribe the originality of the thought to be conveyed to all nations by the Jewiſh hiſtory, as a great part of the Jews

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do not know any thing of it, or even of the people which it commemorates; but the firſt race of men, whereſoever they walked, looked, or dug in the ground, muſt ſee that the whole had been covered by the ſea: thus it became natural for them to conclude, that the world and all that was in it had been drowned:—a ſtory was conſequently founded thereon. This tradition deſcended from one generation to another, the appearance of the earth in thoſe early ages, bearing teſtimony to the narration; and I conceive it muſt be ſome hundreds of years before the atmoſphere had ſo changed the face of the world, and conſumed the exuviæ of the inhabitants of the water, as not to give ample proof to the man with mental powers, even beneath mediocrity, that the ground on which he ſtood had once been beneath the ocean.

Although there may be phenomenæ in nature not immediately reconcilable to this hypotheſis, ſtill I flatter myſelf they will be found to be as few as to any other; for we ſhould conſider, that effects are often produced by cauſes to which they never would have been attributed, had not experience taught us how to expound them: we often find it difficult to account for the ſituation and appearance of ſome trifling things produced by a convulſion or diſaſter a little out of the ordinary way. If a perſon, on leaving an iſland in the Weſt Indies, who had never heard of, nor ſeen the effects of a hurricane, and one ſhould have happened in his abſence, on viewing the devaſtation made thereby on his return, would find it no eaſy taſk to account for all the changes that had taken place, as he would ſee a great many which he might think almoſt impoſſible to be accompliſhed by the action of the air. Surely then it will not appear ſtrange, if there be found ſome diffieulty in reconciling every minutia produced by the vaſt juſtle and confuſion created from the great change of ſome, and agitation of all the matter of this globe.

Since the preceding pages were written, I have ſpent ſome months in North Wales, where the fractures in the mountains, wide fiſſures, and general appearance of the country, have more impreſſed me with the pro-

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bability of this theory, all here being on a larger ſcale than any thing I had hitherto ſeen; and I believe, that by attention to the wideſt and moſt intereſting views poſſible to be attained of the grand outline of the face of the earth, equally juſt concluſions of the manner of its creation could be drawn, as by any chymical proceſs that might be wrought on its parts.

Freſh matter for obſervation is continually crouding on my mind, but the difficulty I find in tranſmitting them to paper, in a manner any way likely to be underſtood, induces me to ſay no more on the ſubject, but to leave this little pamphlet, with all its abſurdities and blunders on its head to the mercy of the public, and the more extenſive expoſure of them, to the Reviewers.



ERRATA.

Page 22, l. 9, for *re-animated*, read *animated matter*.
23, l. 10, for *thouſand*, read *thouſands*.
26, l. 17, for *tumbling down*, read *tumbling it down*.
—, l. the laſt, for *the Jews*, read *them*.
28, l. 8, for *them*, read *it*.

ERRATA

P. Sandford, Printer, Shrewſbury.

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Appendix. The text of the pamphlet as an OCR file to facilitate word searches.

THOUGHTS
ON THE
FORMATION OF THE EARTH.

BY A FARMER.

There, pregnant fancy might with wonder scan,
How chaos reigned ere harmony began:
When seas of turbid matter thund'ring round,
Boiled to the surface from the vast profound:
There mountain waves, that did on mountains throng,
Seemed fixt or frozen as they rolled along.

Thus when th' Omnific word the world flew round,
Confusion chilled, and stiffened at the sound.

View from CADER IDRIS.

SHREWSBURY:
PRINTED FOR THE AUTHOR, BY P. SANDFORD, BOOKSELLER;
AND SOLD
BY MESSRS. RICHARDSON, ROYAL EXCHANGE, LONDON.
1802.

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i PREFACE.

To the Public it is proper to declare, that by endeavouring to please myself, in trying to account for some phenomena I had seen, these ideas of the formation of the earth occurred to me. They were committed to paper merely to try whether my system would appear reasonable, and to me it did. Now they are laid before them to know if my conclusion was just; this is all the apology I can make for the intrusion of these crude, and very probably weak ideas: for I cannot say, as is often said on such occasions, that some friends prevailed on me to publish them, not having shewn them to any person, nor have I any acquaintance sufficiently skilled in philosophy and chemistry, to furnish me with the information I wished to obtain on these heads; for then I might have seen the imperfection of my own reasoning, or have advanced on more certain and extensive grounds. I am the less sanguine in my expectations, from my little knowledge in the art of writing, and for want of a sufficient stock of technical terms to express myself; I sear also, some of those made use of are misapplied, or not applicable to the thoughts intended to be conveyed. Besides these disadvantages, I had never read the works of any author on the theory of the earth, until this was nearly completed, when I procured an abridged translation of Monsieur

ii PREFACE.

Buffon: being thus unqualified, through want of scientific skill and reading, from entering into the minutiae of my subject, I am convinced this production can be but an imperfect outline even of my own ideas: but as my diurnal walk for many months, lay over grounds covered with marine wreck, it acted on me as an irresistible stimulant, I acknowledge, if there should appear one original thought of any merit in it, it will give me pleasure, and if on the contrary it should be found the most absurd publication ever read, it will not give me a moment's pain.

But this bantling of my brain, now grown to a little book, demanded from me the same ornament to usher into the world with, as the books of other men filled with wiser matter, — a quotation of Greek, Latin or profound English, from some great philosopher or classic author, in prose or verse, to adorn its title page, I had none; a few lines from rhymes of my own rude imagination, produced by a sublime prospect, from one of the highest mountains in Wales, shall serve, — thus the head will fit the body: either great wisdom or classic elegance, I apprehend, would have appeared ill matched, in the eyes of my reader, to this pamphlet; the former as a Judge's great periwig, to the garb and manners of an empty skulled cryer of a court; and the latter as ludicrous as that of a courtier's, all curled, bagged and powdered, on the head of a tattered stroller.

NORTH-WALES, 1802.

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ISSN 1750-855X (Print)
ISSN 1750-8568 (Online)

THOUGHTS ON THE FORMATION OF THE EARTH.

To the appearance of the high ground called Whitcliff, near the town of Ludlow, in Shropshire, the following ideas owe their existence. These extensive hills chiefly consist of a hard grey sand-stone, abounding with the wreck of fishes: among those of the crustaceous and testaceous kinds, I found lobsters, cockles, razor-shells, barnacles, and oysters; also a number of broken stones, apparently petrified fishes of the finny tribe, are confusedly scattered over the face of the country. — From the deposition of these phenomena, I have endeavoured to reason back to the formation of the earth, and have drawn therefrom the subsequent conclusions.

First. That this wreck did form parts of fishes of the same kinds as are now found in the sea; were once alive in, and on this ground; and though there never was a greater quantity of water in the globe than at present, yet this hill was immersed in the ocean: consequently the whole island, with all the continents and lands, now above its surface, and the exterior of the world, to use Milton's language, was "sea without shore."

The hypothesis of the superficial part of the globe having been all water, I shall endeavour to sustain on the following basis of reasoning.

The solid mass of matter we call land, I conceive was once soft, and in consequence smoothly round; in that state the quantity of water now in this planet, was sufficient to bury it many fathoms beneath its surface; at which period, the exuviæ above-mentioned, and all such as are found on hills and plains, in different parts of the world, were living animals, the only inhabitants of this globe, and probably, continued so for many ages.

The conjecture of the globosity and softness of the land, will be corroborated, when it is considered, that the natural figure of all fluid bodies, are round; of which the sun, planets, and their satellites, are a proof; although some parts of them appear to be fixed, and project beyond the regular limits of a sphere, still the liquid and soft substances are compelled to restore their rotundity as far as possible, by changing their situation, to obtain the equilibrium: this is exemplified on the globe we inhabit. Now, from the circularity of the heavenly bodies, we may rationally conclude, that all the matter of this world, and perhaps all the planets and suns of the universe, were in a fluid state, when they were flung from the hand of the Deity to their proper stations in the different systems, thence their spherical form: for I conceive, that the solid and rocky part of this globe was the same, and encompassed by the sea.* But when this soft substance was sufficiently agitated, or its particles blended to a certain degree, probably by the water, which by means of its penetrating, extracting and diffusing powers, had filled the interstices of the atoms with the matter necessary for petrifaction, so as to bring them within the sphere of adhesion. However, when this mass was duly prepared by a process beyond the reach of human reason to define, I imagine, it leaves little room to doubt, but a general fixation of the rocky matter took place, and did (as salt made one of its principal constituent parts) in its transmutation, from fluidity to stony firmness,

* The writer does not think the globe came from the hand of its Maker, first with a watery surface as here described, but as a chaos, and had now gone through one change, as will be explained hereafter.

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ISSN 1750-855X (Print)
ISSN 1750-8568 (Online)

give itself another figure. Thus it contracted in most places now covered by the sea, and pushed itself forward, where it appears above its surface; and the water rolling off from the projecting parts, found itself a resting place on the indented sides; and thus again restored the spherical form of the planet, so far as its quantity would allow.

That the tract of land which gave rise to these observations was once a bed of sand, is demonstrated by its laying exposed to the air and frost on the highways, to repair which it is often used, where it soon loses the power of adhesion, and resumes its original looseness, leaving the shells perfect, and entirely disencumbered from any other matter, which shells are of the same kind as belong to fish now found in such sands, particularly the razor-shell or pivot; therefore, when the petrifaction of the rocky matter took place, all the fish that were lodged in the sands that became fixed, must be involved in the same fate, and although the exuviæ of fish are found in many sorts of stones, yet in the calcareous rock, and most others, they lay in masses, which from their heterogeneity appear to owe their situation to accident; but in sand-stone they are in general more regularly distributed, more perfect, and the same species that now inhabit sands to which these stones bear the nearest resemblance when pulverized: and as it is known, beyond all possibility of doubt, that these animals cannot exist in any other than sea water, so it must be an equal truism, that the lands whereon such wreck is found must have been immersed in that element for an immense space of time.

Nor do I think that this first creation, which I have supposed to be the inhabitants of the sea, and such as dwell beneath the surface of the sands, were all destroyed when the land became a fixed substance, particularly the former, and the Deity thereby compelled to a new creation: there are plausible grounds to suppose that many regions even of sands, with the various layers of earths, did not undergo any change, or its inhabitants receive injury; I mean those which were situated on the

contrasting sides of the earth, and were not lifted above the surface of the water; the particles of sands in which they dwelt, being too large to be brought to the point of adhesion, like those whose constituent parts were of finer atoms; as stones may increase in their density, in proportion to the minuteness of the particles whereof they are composed.* So it is probable these rocks which are now the hardest, were most weighty and ductile before crystallization; sand-stone being far inferior to most others in hardness, and some of them so loosely conjoined, as barely to adhere together, but from the largeness of their interstices only, did these masses become a proper residence for the animals now found therein; as the more heavy and finer parts of the stony substance, which are now the hardest rocks, consisting of smaller atoms, prevented the admission of a sufficient quantity of air to support life, and consequently, were uninhabited, and in all probability covered by a thick coat of coarser particles of stone and earthy matter equally firm, as the sands now beneath the sea; and the wreck of fishes which are found in mountains composed of these finer particles might be drawn into them, by the motion of the water, when the rocky body was in a state of softness; for the ocean meeting with no resistance, moved regularly round the globe, from east to west, except the variation which was caused by the attraction of the sun and moon; by this action of the sea, the exuviæ of its inhabitants might be distributed and blended for some depth over the whole mass: or if that was prevented by the coats of sand which covered it, it might at the time of fixation, by its rolling motion† and boiling

* Want of chemical books, or acquaintance with some person skilled therein, compels me to ex-. press myself with caution on various points, and oftentimes to omit others, by which I suppose the system might be strengthened. Although I am aware that from this unskilfulness I am more liable to make a wrong assertion, reason thereon, and conceive imaginary pillars to support my theory, which on application might throw the whole fabric to the ground.

† To draw conclusions from the motion and manner in which final bodies crystallize, and to apply them to ascertain the action of this great mass would, I conceive, be ineffectual for the movement of such an immense body, unconfined on all sides, can meet with no real resemblance in nature.

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ISSN 1750-855X (Print)
ISSN 1750-8568 (Online)

up of the internal matter, envelope some of the marine with other substances, that laid on its surface.

The fissures of rocks seem to be the natural effects of concretion or crystallization; the layers in hills and rising grounds being in general parallel with the surface, is presumptive proof, that the exterior of the rocky mass was fixed some time before the interior, which by being pushed forward as it formed caused those parallel and vertical cracks: at other places, by burning the incrustated part asunder in large chasms, many of the pieces of fixed matter became insulated, some of which were in the act of overturning, and being immersed by the commotion of the fluid on which it relied, and in this floating state, the soft matter seems to have become solid and held them fast. To this the principal part of the unevenness of the earth's surface may owe its origin: an ingenious eye will often see this idea illustrated, when he looks from an eminence, over an extensive plain, in which a few hills are thinly scattered, though the imagination will be considerably assisted, if the beholder ever saw ships, or other large bodies sinking in the sea, as they generally turn on their sides, or descend by an inclination of the head or stern; then to finish the description, he must conceive a sudden freezing of the water to take place and suspend the ships partly immersed.

Of a hill which raises like a hemisphere where the strata are regular and unshattered, they are continued with equal thickness, from the top down the sides, until they are abruptly broken off. Now had these been formed by the sediments of water resting on an inclining plain, according to the theory of Monsieur Buffon, or had their extremities been quite soft when lifted from the regular surface, the layers of the sides must have been thinner than at the top; and that in proportion as those sides were inclined to the horizon.

The violent running off of the sea from the land when the continents immerged therefrom, must cause many masses of the skeletons of its inhabitants to be collected, where that element met with any ob-

struction in hurling them towards its present repository and such are often found in different places on the earth. This, some of the most ingenious and learned men have laboured to shew, was produced by the general deluge, or what is commonly called Noah's flood: the earth it seems was at that time covered with the water one hundred and fifty days, too short a period for oysters, muscles, &c. to arrive at a state of maturity, and be established in such large beds. This flood it is to be proved did not make much alteration on the face of the land, as the trees, and probably most other plants, continued alive, standing in their places, and the former not disrobed of their foliage: which is confirmed by the dove's returning with the leaf plucked from the olive tree, a convincing proof also, there was no great commotion or agitation of the waters; therefore those shells were not driven on the land at that time by its violence, as a force sufficient to do this would have thrown down and torn up all the trees, and have sent them floating on the surface, from whence a leaf might have been as easily gathered at the middle, or at any period of the deluge, as at its decrease.

No theory, I imagine, but the supposed rotundity of the land, its softness and concretion, can account for the wreck of fish being found in mountains; when we consider the ocean must have diminished near four miles in perpendicular height all over the world, if it ever did cover the tops of the hills, in their present state; and how can we conceive a cavern to be left void in the globe capable of absorbing such a quantity of that element, more perhaps than is now contained in this planet? nor, I conclude, will it be less difficult to think, how mountains could be formed by the currents of the water,* admitting there had been enough to immerse them, particularly with such pointed or rugged heads and sides, as those are found to have that were pushed through the coarse layers of earths and sands, under which it crystallized : the sediments of water may create banks, but never could produce a rugged mountain.

* Vide Monsieur Buffon.

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ISSN 1750-855X (Print)
ISSN 1750-8568 (Online)

But when we place ourselves between two high hills of hard rock, which have not been defaced by time or accident, and compare them on either hand, you will often find the convex parts of the one exactly to correspond with the concave of the other, which most clearly shews, they have been rend asunder; now if we only conceive the exterior of the earth to be first incrustated as before mentioned, the motion caused by the fixation of the matter beneath, the pushing forward of these parts, which now appear above the sea, and contraction of the most of what is still under it, did compel the projecting surface to expand in proportion, as its elevation augmented the circumference of the globe ; which was an effort of matter to return again to its primitive circular figure; therefore divided the rocks as we burst the rind of a twig by bending it to form a hoop; thus the mountains as they advanced in height, retired from each other.*

At the time of fixation, it is reasonable to suppose, from the irregular compression of the solid exterior parts on those beneath in a fluid state, the latter must at some places, be pressed up through many of the chasms, and so high as to become mountains. To this the hills called Dartmoor, in Devonshire, appear to owe their origin: † this range consisting of granite and other heavy stone loaded with ore, probably had its station beneath the calcareous rock, red sand-stone and slate, which compose the chief part of the county: but the land opening for the causes before given, the south part of it sinking into the great chasm now the

* I can find nothing that conveys my idea of the appearance and motion of the earth, when it was lifting itself above the water, but two most humble comparisons. I conceive its motion might bear some resemblance to a great body of pitch, or other thick substance, in a state of ebullition: the cause and irregularity of its surface to the top of a large well-baked and leavened loaf that had been confined in a vessel, so as to keep its sides from expanding, the growing elevation of the bread, cracking of its surface, and hardening the dough as it arose, might give some idea of its action and now of its appearance.

† My allusion to this range of mountains in particular, is from my haying spent the greatest part of my life in that county, and never travelling much; therefore I know of none, that are so well calculated to answer my purpose.

British, and the north into that called St. George's channel; caused a rent or fissure in the middle of the county of twenty miles long, and about ten wide, which was immediately filled with the fluid body, the sinking fixed masses forced up, and formed these hills; for whoever examines the soil and face of the country, particularly the parts bordering on the confines of the mountains on the north and south, will I imagine have little room to doubt, but they were once united, rend asunder, and the matter which constitutes these hills obtruded itself between.

If the land was not soft and had altered its shape by crystallization, it would be difficult to form an idea, how any soft or sandy substance could gradually collect, according to Monsieur Buffon's theory, and form itself across the globe, so as to resist the impetuosity of the ocean, or by any other means, than that of a general concretion, as nothing less than a mass of solid rock could stop it; particularly, when the narrowness of the land be observed that joins North and South America: for it should be considered, that all banks formed in the sea owe their origin to some obstruction the current meets with in pursuing its regular course.

That the great mass of solid matter we call land was once in a state of fluidity will, in my humble opinion, receive considerable support, from the resemblance which many soft bodies bear to various parts of stones, when they become firm, and none has fallen within my narrow sphere of observation, that strikes more forcibly (however unphilosophical it might sound) than is to be found in a soap manufactory; the liquid in which the oils, rezins, &c. are dissolved, being drawn from lime and strongly impregnated with the vegetable alkali and marine salt, may be expected to produce some resemblance, between a body thus composed, and that of the marble, from whence the menstruum chiefly derives its fixing quality: when these materials are sufficiently impregnated with the salts contained therein, it becomes when cold a solid substance, throwing off as it fixes, all the watery matter, more than is necessary to

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ISSN 1750-855X (Print)
ISSN 1750-8568 (Online)

give it a proper degree of firmness: in the soap called by the manufacturers, mottled, the idea will receive more support than from any other, by being placed in a larger vessel to congeal, and remaining undisturbed by the maker until it be quite firm; then if it be cut in a direction perpendicular to its base, it will have all the appearance of a variegated piece of marble: its transparency in the channels where the liquid has been forced through in its way to the bottom, by the congelation of the soap, will be found to resemble strongly the crystalline veins of the rock, and where it has not made its passage, within the space of time necessary for the sides to unite, like the veins called by stone masons water veins, and in the larger cavities, where it has made a lodgment, the sides are full of soapy crystals; which, if not hexagonal prisms, and truncated, like those of the calcareous rock, yet shooting out with blunted points, are sufficient to show, that both substances were once soft, and derive their transparent and variegated arrangements, from the same causes, and the shape of their crystals only altered from the difference of some of the constituent parts of the matter, of which they are composed.

CHAP. II

On the Probability of the Land's being again Submerged in the Ocean.

I have sometimes been induced to conclude, that all the matter which is unceasingly falling from the mountains to the plains, and from thence carried to the sea, would there accumulate, and so continue to increase for millions of ages, until a new land, all flat, and little higher than the ocean, would be formed; by which means, the latter would occupy a less part of the surface of the globe, and the land, from its greater extent, be capable of maintaining a larger number of inhabitants, on one immense and fruitful meadow: but the probability of this theory, however pleasing it might be, for the idea of the land's being all absorbed and the world occupied again only by fish, though it might not happen for a hundred million of centuries to come, seems not so pleasant as the former to reflect on; yet, without the interference of the Deity, I believe it will at last be the case: for the first conjecture seems to me to be considerably out-weighed by the second, as the water has actually made great progress towards the accomplishment of its purpose, in proportion to what has been done by the increase of land; which I shall endeavour to prove by the following observations.

Of the encroachment of the sea upon the land, we have annual proofs in many parts of this island; and much has been lost since the

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ISSN 1750-855X (Print)
ISSN 1750-8568 (Online)

commencement of our history, viz. great part of Kent, near half the county of Cornwall (if the survey be correct that was made in the reign of Edward the First) the town of Winchelsea, and a considerable part of Merionethshire in North Wales; the bottom of Torbay was once above its surface is plain, from the vast number of the stumps of trees found at low water, rooted in the clay in the same manner they were in when growing. Trees are here oftentimes torn from the ground, when ships draw up their anchors, at the distance of some miles from the shore, and though their appearance be quite fresh, yet they must have been immersed many ages. Some acres of the high land round this bay have fallen into it since my remembrance, and I doubt not, but part of the English and Irish channels, and for a considerable distance from most of the shores in the world, was earth above the ocean when first it emerged therefrom: for the dashing of the waves (even against the sides of the rocks) fret, undermine, and by incessant battering encroach on its boundary, which in all probability extended so far as to cause the water to be very deep close to the shore, like the lands and mountains that bound the Mediterranean sea; where it cannot have made great progress, as appears by its narrowness and depth.

I know that many writers think the land gains as much from the sea as it loses; a little sand may be accumulated at the mouth of a river, so as to form a small island, or even a piece of low land, and a port thereby blocked up. These banks are brought down by the river from the high grounds over which it has wandered, but the land gained in this manner bears a small proportion to what we are certain has been absorbed by the ocean. — Surely all the matter that falls into the sea, must raise it in proportion to its bulk, and its extremities will be driven thereby over the land wherewith it is bounded; while its flux and reflux assist in drawing these particles, imperceptibly, towards the deepest water of the globe; say at equal distance between the continents, where it is slowly, but eternally accumulating, and will in an indefinite space of

time to swell these sides, as to increase their globosity, and the earth be again, though in a solid state, immersed in the ocean: for it appears evident to me, even to conviction, that the loose particles of matter, are compelled by their specific gravity to tend towards those parts neared: the centre, on the same principle as other heavy bodies slide down an inclined plane, and this, all atoms may continue to do, until the land becomes nearly as spherical as the water itself.

If the particles of earth were not drawn to those parts nearest the centre, there would be an immense accumulation of land at or near the mouth of all rivers, as the banks now seen there, owe their exigence to the earthy matter being brought down by the stream, faster than they can be taken off, by their common tendency toward the most excavated places of the world; and I believe these banks are generally found, where the obliquity of the land under the sea increases very gradually, or the particles meet with some obstacles, which retard their progress to the places nearest the centre; hence we may expect to find more banks of sand at the mouth of the Thames, and the German rivers that empty themselves between Calais and the entrance of the Baltic sea, than many others; the earthy matter brought down by these rivers, being obliged to make a more circuitous route, and that by the Thames particularly so, from the proximity of its estuary to France.

Many low and flat trails of land, exhibit strata of sands and marine substances, beneath the vegetable earth, though situated so far from the sea, as never to have been visited thereby, since it first emerged therefrom; this might be the original surface, when the earth was round, and beneath the water: when lands of this description are the immediate boundary of the ocean, many have been induced to believe, that the latter diminishes: but it is as probable to assert, that the high grounds which heretofore protected it, were beaten down by it in its progress towards absorbing the earth: we are certain, however, the softest land is always crumbling away before it, whilst the promontories and capes of more

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ISSN 1750-855X (Print)
ISSN 1750-8568 (Online)

obdurate matter, still braving the violence of the waves in an advanced station, are an incontestable proof the water is the invader.

To prove that the sea does not diminish, let us examine the hardest rocks insulated by it, and rising a considerable height above its level, with sides nearly vertical, when the tide is at its lowest ebb. All that part left by the water will be found to be rough and corroded thereby, and that above the high-water line to project. Fish of the bivalvular kind something resembling the muscle, are often found to have perforated the rock some inches deep, which are to be seen by striking off the scurf from the part which the retreat of the sea has exposed.* The projection immediately above the water, is a proof that the dashing of the waves consumes the rock faster than the atmosphere. Had the sea diminished, it would have left evident tokens of its retreat, should the atmosphere have dissolved the little protuberances, and worn the rock smooth, still the punctures made by the animals would have remained, and their depth have increased in proportion as their situation approached the surface of the sea. This to me is an irrefragable proof that the atmosphere does not descend towards the base of the rock, or in other words, that the perpendicular height of the sea does not decrease.

Furthermore, as all the land made or left by the sea, must be perfectly flat, and little above its level; if these parts were gaining on it, they of course must be the farthest advanced into that element, and the solid mountains in the rear. Most part of the shores of the continents and islands should have sloping grounds of this description, just above the water, of considerable extent, but the real state of the ocean and earth, in contact with each other, is to this a direct contradiction.
But there are partial encroachments of the land on the sea, besides such as I have before attributed to the course of rivers, which may be accounted for in the following manner. As the most mountainous parts of

* These remarks were drawn from observations made on the insulated lime-stone rocks in Torbay.

the globe at the time of fixation, were rended into the widest and deepest chasms, which soon became or were left filled with water, and their sides being rocky, and almost impervious to the attacks of the elements, there has not, even at this period, a sufficient quantity of solid matter slidden down to fill all of them; these are now lakes, or such seas as communicate with the main ocean by a narrow strait, the largest of which are the Mediterranean and Baltic: (for it does not appear probable to me, that the space now occupied by the former, was ever land, as Monsieur Button concludes, and was overflowed by an irruption of that element; but that it is a great rent in the globe, made at the fixation of the earth, it being very deep, some hundreds of miles above the straits of Gibraltar) but, in those parts, less mountainous, and the rising ground covered with rich deep loom†, the excavations being less, were in time filled, and where the rents extended to the sea, they became estuaries; in these the sliding down of the soil has in many places, caused the water to recede from their innermost parts and occupied its place: there are few estuaries if they are not terminated immediately by high lands, where the tide has not pushed itself further up than it does at present, I have been told by those who have dug deep by the side of a hill, that is now the boundary of an extensive piece of meadow land, at the head of one of these arms of the sea, that the rocks below, had all the appearance of having been washed by it: here the increase of earth, by the common tendency of its particles to the centre, and continual decay of vegetables, had gained a partial elevation, superior to that of the general perpendicular rise of the whole ocean.*

But if there is a quantity of inflammable matter pent up in the interior, there may be a possibility, should air by any means be introduced, of its becoming explosive and emerge some of the land at this time be

† ?loam [Ed.]

* Perhaps some idea might be formed of the universal rise of the ocean, since it was forced to withdraw from these parts, by comparing the topmost of the water-worn marks with the present high-water line on the neighbouring coast.

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ISSN 1750-855X (Print)
ISSN 1750-8568 (Online)

neath the sea, and absorb parts now above its surface; but as on this theory, conjecture itself must look with hopeless eye, we cannot form an idea how air can gain admittance; for we know very little of the interior of the globe, the shell of rock may be a thousand miles through, and that more dense as it approaches the centre. The deepest caverns ever made by human industry, advance not the one hundredth part so near to that point, as the thickness of the rind does to the middle of a large apple.

CHAP. III

I shall now sum up in as clear and concise a manner as I am able, the whole system of my ideas respecting the formation of the earth.

I am led to conceive, that this globe did undergo one gradual change before that of crystallization.

At its first collection from scattered matter, it is rational to suppose it to be one vast globular mass of turbid and impure fluids, in which the vital power was incapable of existing in any form or substance, a perfect chaos, but by what means the Deity thought proper to cause beauty and harmony to arise therefrom, is beyond the reach of human abilities to ascertain; yet the aspiring faculties with which he has endowed us, stimulates us to attempt every thing, for as far as we have been able to trace his works, they have been founded on the principles of science: and having in his infinite goodness caused a ray of this divine light to shine on our minds, it is to be hoped, we do not offend him in making use of it, in admiring and endeavouring to understand his performances, and the means by which they were accomplished.*

* Fire never could be the agent employed to reduce the world to its present state. For if the whole mass was ever in a state of igneous fusion, no regular stratified matter would be found, nor would water make a constituent part of the rocky body, besides, there could be no masses of combustible substances left in the interior of the globe. Coals, sulphur, and every other body that could be analysed by heat, would all have been evaporated. Fire I am of opinion has contributed no more to it, than to produce such partial alterations as may be assigned to volcanic eruptions.

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ISSN 1750-855X (Print)
ISSN 1750-8568 (Online)

Human sagacity seems capable of comprehending a small part of one physical method, by which such an astonishing change might be produced on this immense world of confusion.

First causes being totally beyond the reach of human reason, fancy must begin by supplying its place.

Let us conceive a heavenly being, by the order of the Deity after he had drawn the grand contour of the universe, handing on an enormous mass of all the variety of matter of which each system is composed, moulding and tempering the sun, planets, and comets, then flinging them from his plastic hands in a state of chaotic turbulence to their appointed stations.

The admixture of all the substances in the globe, might naturally produce fluidity, and after the agitation of its particles for a certain period of time, some inexplicable unity taking place, chaos was destroyed and matter placed itself round the centre according to its relative gravity; and there being a considerable degree of attraction between the rocky body and water, the former, mingled with a certain portion of the latter, probably in substance like a thick paste, lodged itself between the weighty central masses and the yet turbid ocean; the remaining motes of stony and earthy matter left suspended in the liquid, at length by their attraction of composition uniting and crystalizing, became fixed, and thereby acquired sufficient weight and bulk to precipitate through the fluid, and formed laminae of sediment round the more fine and weighty particles of this mass: hence, and from their mutual attraction, is the cause why water is found when we analyse stones, as the interfaces of the particles deposited must be filled therewith.* After the last deposition, the water became transparent, and all the rocky mass perfectly round was covered

* Where a volcano bursts through the surface, either by its intense heat, or by the action of some dissolving substance, it would reduce some parts of the rock on which it could act to a state of fusion. After the sulphurous matter was all exhausted, the fluid cooling, assumed a different contexture from other stones, and contained less moisture. Such as have been changed by heat might, I conceive, through the same.

thereby. At this period fish were created, and the sea became inhabited, but after a lapse of ages, by a general distribution of some matter, or by causes it is in all likelihood impossible for us to discover; they were brought within the sphere of attraction of cohesion, and by a general or quick succession of crystallizations taking place, the whole mass changed its figure. The contraction of the parts still beneath the sea, compelled these now above it to project, and rend its exterior incrustrated shell, (for the water having greater power to act on what was in contact with the coarser sediment, caused it first to concrete.) Thus when the huge body lifted itself through the ocean, some of its fixed insulated parts were raised so high as to become mountains; other matter in a state of softness, forcing up through the chasms to the surface, for causes before explained, brought near the superficies of the world, such a variety of metals and other fossils as the Deity knew would be necessary for the comforts and well being of its intended inhabitants, which would otherwise have lain so deep as to have rendered all human researches to have procured them vain. Respecting the sea, it must be and always was salt, from the quantity of saline matter that was left suspended therein after the deposition of all other bodies, and as it made no inconsiderable part of what was precipitated, by being diffused throughout the whole stony mass, might be the chief cause, at the time of crystallization, of compelling it to change, from round to that figure which it now bears.

On perusing the map of the world, I am inclined to think that the land came first through the water, nearly in one united mass, and that the American continent was torn from this,* for all the lesser rents, whether

process, be again melted, and when congealed, would assume their last character. By this operation, the rocks in their primitive state might be distinguished from those which have since been altered by the action of fire. If volcanoes were so numerous in the early ages, as I shall hereafter give some reasons to suppose them to be, stones that have gone through this change might often be found, but not in regular strata like the general surface.

* Vide Chart hereunto annexed.

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ISSN 1750-855X (Print)
ISSN 1750-8568 (Online)

now seas, bays, lakes or chasms, would not admit of the matter expanding sufficiently, to accommodate itself to the periphery of a larger circle. Had the whole remained united, it is probable, the western part would have been so high, as to have rendered it unfit for the habitation of man: or had it been in such a state of softness, as to admit of its being drawn across the western ocean, there would not have been matter enough to appear above the surface of the water; and as the American continent was higher and exceeded the other in a latitudinal direction, the centrifugal force caused by the motion of the earth on its axis from west to east, makes it more probable, that that continent was torn from this part of the world, to restore the equilibrium.*

The capes of St. Roque and St. Augustine, appear to have been divided from the Gulph of Guinea, as the concave coasts on each side of the Gulph of Mexico, with all its fragments, now islands, were rended from the convex shores of Africa, of which the Cape de Verde is the most prominent part. The remaining part of the American coast of the United Provinces and Labrador, must have been in contact with Europe, to the British islands: after which it seems to have divided in three parts, and left Greenland a central land, the east side of which I conceive, was torn from Norway and Lapland, and the west between Cape Farewell to Cape Bedford, have the features of being drawn from the concave shores of the northern parts of Labrador, and the isle of Good Fortune†. The mo-

* Although the shores of the continents are not at present the exact counterpart of each other, yet they bear strong resemblance; the descending of America to the west, as it rested on a fluid basis, might make some alteration on its outline, and also discompose its surface.

† If the American continent was torn from this, I imagine the water should be much deeper in the Atlantic, than in the great Pacific ocean; as such a reparation would make a deep rent towards the centre and this seems in some measure to be confirmed, by the vast number of islands in the latter sea, which the falling continent might in some degree assist in forcing up. I oftimes think some resemblance might be drawn between the creation of these small islands, and the little lateral icicles that are impelled to shoot from a damp wall by severe frost; as the contraction of the rocky mass under the water, aided by the above circumstance, and the centrifugal force, caused by the motion of the earth on its

tion of the falling land to the westward, would cause the water to rush round the Capes of Good Hope and Horn, into the chasm, while a vast quantity might have rolled back over the surface of the descending continent into the same gulph; that it did pass over the land seems evident, from all the large rivers in America running eastward, from the superior size of the rivers themselves, and from the vast lakes that abound in that country; as the extreme velocity and weight of the water, must force large channels through the land in its passage across it, and tumbling down precipices make huge pits in its surface; some of which are now great lakes.

Here I cannot forbear giving the reins to fancy for a moment, to suppose ourselves then in existence, holding a higher rank in the chain of beings, and at a convenient distance from our globe, with souls sufficiently comprehensive, and eyes capable of extending over it.

At that period what a commotion should we have beheld, to see the immense continent of America falling, falling, falling westward, and driving the sea on heaps before it, in a prodigious state of turbulency; to have observed the violence, with which the latter rallied back into the dreadful chasm, and in all probability, an innumerable number of volcanoes; all bursting forth from different parts of the earth, on the first presentation of the inflammable matter to the atmosphere; and to conceive the finger of God or some superior Being, arresting this astonishing mass in its career, just at a proper height above the water, when restored to its level, to make it fit and convenient for the animals to be created. By such reflections we are lost in wonder, and awed to silence and adoration.

If the fixation of the land, was wrought by means corresponding with the preceding conjectures, I think it probable, that the exterior part only became a firm body, the principal of which is the stony mass, and that all within is now in a state of fluidity; of these ponderous bodies (some of which may have wonderful properties) the electric

axis, might compel some of the fluid matter to rush violently through the rents to a great length before it crystallised.

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and magnetic matter may form a constituent part, and that all this incrustated mass might still be subject to some motion. It seems rational likewise to suppose, that by the jostle caused at the time of crystallization, small portions of those fluids might be caught in the part that became fixed, and perhaps be the reason why mercury, which may constitute a great part of the interior, is found in the crannies of the rock, and the cause why inflammable matter became pent up in the firm part of the globe; which matter it is not unreasonable to suppose, is in a state of fluidity at this time: these ideas might receive some support from the volcanic mountains, which seem to have been more numerous in the earlier ages than at present, probably from the great quantity of such substances being at first caught up, or enclosed in the shell of the earth; many masses of which are now burnt out, or greatly diminished, and from the variation of the needle, by the motion of the magnetic matter: not that I conceive the craters of those volcanoes do communicate with the grand mass of fluids in the center, but with small caverns of inflammable bodies, confined in the exterior cruft, and not so deep as totally to exclude it from the action of the air.

It might be asked, why the highest mountains should emit fire? as it may be thought the vallies, being nearer the centre, should be the volcanoes, and the volatile parts of the combustible matter escape much easier than by forcing up through an immense body of rock; to which I reply, that all mountains, whether formed after the manner observed by those of Dartmoor, or by some parts of the rocky matter, at the time of crystallization, being pushed much higher than the general surface, the former being squeezed up from a more profound depth, are most likely to produce sulphur metals, and other such ponderous bodies as are contained in the bowels of the earth, than any other parts near the surface, and to have their strata more jumbled and broken; the layer also that composes the base of a mountain produced by the latter means, it is probable, is of the same nature as would be found by digging in the

neighbouring plain, a depth equal to the perpendicular height thereof; and from the broken strata, and wide fissures of the most elevated mountains, the air can more easily gain admission to any inflammable bodies therein, than through the horizontal laminae of earths and clays, which cover the general surface, or less broken strata of the inferior hills.

But to return to that state of the globe in which it was left when the water became pellucid, and fit to be inhabited with all the stony and earthy mass round and beneath its surface.

When God saw it was an element fit to support life, he re-animated and caused the sea to be filled with the first parents of the present occupiers ; and as the chief part of the surface within the arctic and antarctic circles, when the water covered the face of the globe, was soon conglaciated by the intenseness of the cold, and remained a firm body, I think it not without the reach of probability to suppose, that there might be a creation of amphibious animals, if not a few land quadrupeds, to prowl over those regions, to devour the carcases of dead fish, with which the polar circles are known to abound: I am led to this remark chiefly by observing the attention of the Deity, to permit nothing to take place without turning it to some advantage towards the wonderful work of creation: the plum, peach, and other fruits, we are informed by naturalists, are worlds to some sort of animalcule, and the remotest island, rising from the middle of the ocean, has its inhabitants of some kind or other; but if there were any quadrupeds in those parts, which certainly must be few, and in all likelihood very large, they were all destroyed at the time of crystallization; as the lands of ice must be overwhelmed, and others rush tumultuously into their place. Of those animals, the huge bones found petrified in the northern parts of Siberia, might be the remains, as they are larger, and differ from the bones of any creature we know of in existence.

How long this globe remained with its watery face, revolving round the sun, the inheritance only of fish, and perhaps a few polar am-

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ISSN 1750-855X (Print)
ISSN 1750-8568 (Online)

phibious animals, before crystallization, will for ever remain unknown to us; but when that great event took place, the grand field for animation was laid open before that vivifying Being, on which he so liberally displayed his wonderful power, by giving form and existence to the multifarious creation, from the man to the meanest insect, with all the vegetable kingdom, an immense and graduated chain of life; and this so wonderfully varied and contrived, that the grand decompounder Death, seems to be compelled to repair his own ravages; for in destroying the living faculty in one large animal, he supplies the means of its support for thousands of smaller creatures, and thus in the very act of destruction, gives new life to the animal, and vigour to the vegetable world. He cloathed and armed each, according to his necessities, and that this great work should not lay unadmired, he raised the mental powers of one species of mortal beings so high, as to be capable of feeling astonishment and pleasure in contemplating the wondrous scene, and gave them minds so capacious, as to conceive, that there must exist a great Power who did all these marvellous things.

CHAP. IV.

The chief phenomena within my sphere of information which appears to militate against this theory, and seems hardly to be reconciled to any at first view, is that of trees and other vegetables being found beneath layers of marine productions, sands and pebbles, which apparently had been rounded by the sea; but even this, I flatter myself, might be reconciled thereto: this strange arrangement of stratified matter may, in some places, owe its position to land slips: it has often happened that the sides of hills have slid down into the plain, and covered all the subjacent surface. Here if men should chance to dig some centuries subsequent to such a circumstance, they would find under the first vegetable earth, the gravel, sand, or whatsoever matter originally composed the side of that hill; then the wreck of the trees, or other plants, that heretofore occupied the level surface; and as the sliding down of the sides might have happened more than once, they would on digging further, find the remains of trees, probably covered with earths of a different kind with the former.

Earthquakes also, might in some measure have contributed to these extraordinary arrangements, and as we do not know the age of the world, nor number of places that have been subject to those convulsions, we shall not exceed probability in supposing such a catastrophe to have happened, where some of those phenomena are found; and it is reasonable to conjecture, that such did often occur in the earliest ages.

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ISSN 1750-855X (Print)
ISSN 1750-8568 (Online)

But the chief part of them, I conjecture, might be produced by the following causes, after the earth had affirmed its new form, and when the most fruitful and best adapted parts were covered with vegetation: for I am of opinion, at that time the contexture of the superficial part of the earth was less firm than now, and but partially covered with plants, as a considerable portion thereof might not be in a proper state to receive them. At that period also, new springs might arise, and rivers unrestrained by firm banks, would sometimes change their courses, and make irruptions over plains they never before had visited; besides sapping the foundations of the rising grounds through which they passed, and rolling its earths away with them, would throw down much of the vegetation on the low lands; might sometimes cover it with a layer of the shells, and other marine productions, they had overwhelmed in their course, that certainly must be left by the sea on different parts of the surface in large loose masses, or with the sands or earth that composed a particular part where a violent storm had spent its fury, with which the waters must be fully laden: a stratum would be deposited also, before each impediment the torrent met with, in running to the ocean; as these new formed layers would be soon cloathed with verdure, fresh irruptions of the waters might quickly overlay them with fresh matter; and in the most depressed places this would be repeated, by depositing sediment after sediment, until it was raised equal to the general surface of the land*; as the world increased in age and vegetation, trees, and a variety of other plants, were often hurled down with the stream, and became part of the matter deposited some of which being lodged in beds of fine sands, where water oozing through rocks and earths, which had the qualities of impregnating the stream with such small stony atoms, that by filling up the pores, and decaying parts of the vegetables and interstices of the sands,

* Though, the common mass of matter increases in gravity, as its station is nearer the centre of the globe; yet by this it will appear, that at some places, less firm and lighter strata may be found beneath those of greater weight and density.

cause petrifaction: when these masses were concreted, the exact resemblance of the plant was formed in the stone; and after the world became inhabited, bones might sometimes be blended in the same manner. Rivers, before they had cut themselves channels sufficiently deep, as to contain a large portion of their waters, must commit such ravages, and produce such changes on a new formed soil, as we cannot without some consideration conceive a proper idea of.

Why the rocky matter of particular sorts should lay in masses, and be covered with earths and sands of different kinds and complexions, seems difficult to be accounted for, as we may conceive, that bodies of the same nature and gravity, would precipitate in laminae all round the globe, like the coats of an onion; yet when the immense extent of the world be considered, it is as reasonable to conclude, that it should lay in masses. But if it was deposited in laminae, by the jostle and confusion caused at the time of crystallization, it is probable, all the variety of rocks and soils which are now found, would be produced by the bursting of the exterior, and tumbling down into the chasms, with the boiling and squeezing up of the interior from various depths; and I believe, the chief cause of the variety of the thin soils which compose the sur face of the land, arises from its partaking, in a greater or lesser degree, of the nature of the rock beneath, in proportion to its hardness, by the dissolution of its parts by the atmosphere.

I hope I shall not be considered as a man who wishes to depreciate the account of the creation and flood, as given us in the sacred writings; particularly so, when I declare my sentiments to be, that the universality of the idea among mankind of a general deluge, might be attributed to the earth arising through the water in the manner I have attempted to set forth; the story of a deluge, I have been informed, is among the traditions of all nations, and is supported by writers sacred and prophane: it would be barely reasonable to ascribe the originality of the thought to be conveyed to all nations by the Jewish history, as a great part of the Jews

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ISSN 1750-855X (Print)
ISSN 1750-8568 (Online)

do not know anything of it, or even of the people which it commemorates; but the first race of men, wheresoever they walked, looked, or dug in the ground, must see that the whole had been covered by the sea: thus it became natural for them to conclude, that the world and all that was in it had been drowned: — a story was consequently founded thereon. This tradition descended from one generation to another, the appearance of the earth in those early ages, bearing testimony to the narration, and I conceive it must be some hundreds of years before the atmosphere had so changed the face of the world, and consumed the exuviæ of the inhabitants of the water, as not to give ample proof to the man with mental powers, even beneath mediocrity, that the ground on which he stood had once been beneath the ocean.

Although there may be phenomena in nature not immediately reconcilable to this hypothesis, still I flatter myself they will be found to be as few as to any other; for we should consider, that effects are often produced by causes to which they never would have been attributed, had not experience taught us how to expound them: we often find it difficult to account for the situation and appearance of some trifling things produced by a convulsion or disaster a little out of the ordinary way. If a person, on leaving an island in the West Indies, who had never heard of, nor seen the effects of a hurricane, and one should have happened in his absence, on viewing the devastation made thereby on his return, would find it no easy task to account for all the changes that had taken place, as he would see a great many which he might think almost impossible to be accomplished by the action of the air. Surely then it will not appear strange, if there be found some difficulty in reconciling every minutia produced by the vast justle and confusion created from the great change of some, and agitation of all the matter of this globe.

Since the preceding pages were written, I have spent some months in North Wales, where the fractures in the mountains, wide fissures, and general appearance of the country, have more impressed me with the pro-

bability of this theory, all here being on a larger scale than any thing I had hitherto seen; and I believe, that by attention to the widest and most interesting views possible to be attained of the grand outline of the face of the earth, equally just conclusions of the manner of its creation could be drawn, as by any chemical process that might be wrought on its parts.

Fresh matter for observation is continually crowding on my mind, but the difficulty I find in transmitting them to paper, in a manner any way likely to be understood, induces me to say no more on the subject, but to leave this little pamphlet, with all its absurdities and blunders on its head to the mercy of the public, and the more extensive exposure of them, to the Reviewers.

ERRATA

Page 22, l. 9, for re-animated, read animated matter.
Page 23, l. 10, for thousand, read thousands.
Page 26, l. 17, for tumbling down, read tumbling it down.
Page 26, l. the last, for the Jews, read them.
Page 28, l. 8, for them, read it.

ERRATA

P. Sandford, Printer, Shrewsbury.

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ISSN 1750-855x