PROOFS

OF THE

THEORY OF THE EARTH.

ARTICLE VIII.

Of Shells, and other productions of the Sea, found in the Interior Parts of the Earth.

I Have often examined quarries, the ſtones of which were full of ſhells. I have ſeen whole hills compoſed of ſhells, and chains of rocks intermixed with ſhells through their whole extent. The quantity of ſhells, and other productions of the ſea, is, in many places, ſo prodigious, that it is difficult to believe any more of them exiſted in their natural element. It is from this enormous quantity that no doubt remains of the earth's having continued for a very long time under the waters of the ſea. The number of ſea-ſhells found in a foſſil or petrified ſtate is ſo amazing, that were it not for this

this circumſtance, we never ſhould have had a proper idea of the ſurpriſing quantities of thoſe animals to which the ocean gives birth. We muſt not, therefore, imagine, like thoſe who talk and reaſon concerning things they never ſaw, that ſhells are only to be found ſcattered here and there by chance, or in ſmall heaps, like thoſe of oyſters thrown from our doors. They appear, on the contrary, in maſſes like mountains, in banks of 100 or 200 leagues in length. They may often be traced through whole provinces, and in maſſes of 50 or 60 feet thick. It is only after having learned theſe facts that a man is entitled to reaſon on this ſubject.

The ſhells of Turenne may ſerve as a ſtriking example. Let us attend to the deſcription given of them by the hiſtorian of the Academy*.

'Though figured ſtones, and even foſſil ſhells 'found in the bowels of the earth were remark-'ed in all ages and nations, they were generally 'conſidered, even by philoſophers, as luſus na-'turæ; the production of them was aſcribed 'to chance, or to ſome unaccountable and for-'tuitous train of circumſtances; and, of courſe, 'this wonderful phænomenon added nothing 'to the ſtock of knowledge. An ignorant pot-'ter in Paris†, who knew neither Greek nor 'Latin, about the end of the 16th century, was 'the

* Année 1720, p. 5.

† The correſpondence of Paliſſy's ideas with thoſe of the ancients, is worth remarking. 'Conchulas, arenas, buccinas, 'calculos

'the first man who ventured, in opposition to 'all the learned, to affirm, that fossil shells were 'real shells originally deposited by the sea, in 'those places were they are found; that real 'animals, and particularly fishes, bestowed on fi- 'gured stones their various forms, &c. and he 'boldly defied the whole school of Aristotle to 'invalidate his proofs. His name was Bernard 'Palissy; and he was perhaps the most conspi- 'cuous example of a philosophical genius, un- 'improved by art or learning. His system, 'however, has lain dormant for near a century, 'and even his name has almost been forgot. 'At last, several philosophers revived Palissy's 'ideas; and science has derived great advantage 'from all the fossil shells and figured stones 'which have appeared in the earth: They are 'now, perhaps, become too common, and the 'consequences drawn from them too incon- 'testible.

'But Reaumur's late observations on the sub- 'ject are astonishing. He discovered a mass 'below ground of 130,680,000 cubic fathoms 'of shells, either whole or in fragments, with- 'out the least mixture of stone, earth, sand, or 'other foreign matter. Before this remarkable 'instance, fossil shells never appeared in such 'enormous quantities, nor without being mixed

'calculos varie infectos, frequenti solo, quibusdam etiam in mon- 'tibus reperiri, certum signum maris alluvione eos coopertos 'locos volunt Herodotus, Plato, Strabo, Seneca, Tertullianus, 'Plutarchus, Ovidius, et alii;' Vide Dausqui, Terra et aqua, p. 7.

'with

'with other bodies. This prodigious mass lies 'in Turenne, more than 36 leagues from the 'sea. It is of great service to the peasants of 'that province; they use the shells for marl in 'fertilizing their lands, which would otherwise 'be perfectly barren.

'What the peasants dig out of the earth, to 'the depth of eight or nine feet, consists only 'of fragments of shells; but these fragments are 'easily recognised to be those of real shells; for 'they still retain their original channels or fur- 'rows, and have only lost their lustre and var- 'nish, as most shells do, after having remained 'long under ground. The smallest fragments 'are only dust; but we know them to be the 'dust of shells, because they consist of the very 'same matter with the larger fragments, and 'the entire shells, which are sometimes found. 'The species both of the large fragments and 'of the entire shells, are easily distinguishable. 'Some of these species belong to the coast of 'Poitou, and others of them to foreign shores. 'This mass likewise furnishes corals, and other 'productions of the sea. *Falun* is the name by 'which this matter is distinguished in that pro- 'vince; and it is found, wherever the ground 'is dug, through an extent of about nine leagues 'square. The peasants never dig deeper than 'about 20 feet; because, says Reaumur, they 'imagine that the expence of labour would ex- 'ceed the value of the commodity. They might,

'however,

‘ however, dig deeper. But our calculation of ‘ 130,680,000 cubic fathoms proceeds upon the ‘ ſuppoſition of only 18 feet deep, and 2200 ‘ fathoms to the league. Every article, there- ‘ fore, is undervalued, and this maſs of ſhells ‘ muſt greatly exceed the above calculation; if ‘ the quantity be only doubled, this wonderful ‘ phænomenon will be greatly augmented.

‘ In phyſical facts, there are little circum- ‘ ſtances, often overlooked by the bulk of man- ‘ kind, which are, notwithſtanding, of great ‘ conſequence in illuſtrating the ſubject. M. de ‘ Reaumur has remarked, that all the fragments ‘ of ſhells lie horizontally in the great maſs; from ‘ which he concludes, that the fragments were ‘ not depoſited at the ſame time with the entire ‘ ſhells which originally formed this maſs; be- ‘ cauſe, ſays he, the ſuperior ſhells would, by ‘ their weight, have broken the inferior ones, ‘ and the fragments, in that caſe, would neceſ- ‘ ſarily have been diſpoſed in a thouſand differ- ‘ ent directions. The whole, therefore, whether ‘ entire or broken, muſt have been gradually ‘ tranſported thither by the ſea, and, of courſe, ‘ their poſition muſt have been horizontal. But, ‘ though time alone was ſufficient to break them ‘ down, and even to calcine them, it could not ‘ vary their original poſition. Their tranſport- ‘ ation muſt have been gradual; for, it is im- ‘ poſſible that ſuch an immenſe number of ſhells ‘ could be ſuddenly crouded together, and yet

‘ preſerve

‘ preſerve a poſition uniformly horizontal; and ‘ their being aſſembled in one place, demonſtrates ‘ this place to have once been the bottom of a ‘ gulf or baſon.

‘ Though there are many veſtiges of the uni- ‘ verſal deluge which is recorded in ſcripture, yet ‘ the maſs of ſhells at Turenne could not be an ef- ‘ fect of this deluge. Perhaps ſuch an amazing ‘ maſs is no where to be found, even in the bot- ‘ tom of the ſea. But, ſuppoſing the deluge to ‘ have forced ſuch a quantity from the ocean, ‘ they would neceſſarily be carried off with vio- ‘ lence and precipitation; and, conſequently, ‘ could never have been depoſited in the ſame ‘ poſition. They muſt have been tranſported, ‘ ſlowly floating in the waves; and, of courſe, ‘ their accumulation would require a much ‘ longer time than a year.

‘ Upon the whole, it is plain, that, either be- ‘ fore or after the deluge, the earth, at leaſt ſome ‘ parts of it, muſt have been in a very different ‘ ſituation from what it now appears; that the ‘ ſea and land muſt have had a different arrange- ‘ ment; and that there was formerly a great ‘ gulf in the middle of Turenne. The changes ‘ recorded in hiſtory, or even in ancient fable, ‘ are inconſiderable; but they give us ſome idea ‘ of what might be produced in a long ſeries of ‘ ages. M. de Reaumur conjectures, that Tu- ‘ renne was formerly a gulf of the ſea, and that ‘ the ſhells were tranſported by a current. But

'this is only a mere conjecture, thrown out to 'ſupply the place of a fact as yet imperfectly 'known. Before any certain concluſion can 'be drawn, we muſt have geographical charts of 'all thoſe places where ſhells are found below 'the ſurface of the earth. To accompliſh this, 'much time and numberleſs obſervations are 'requiſite. Science, however, may in time be 'carried thus far.'

An attention to the following circumſtances will leſſen our ſurpriſe at this great collection of ſhells: 1. Shell-fiſh multiply prodigiouſly, and arrive at maturity in a very ſhort time. The multitude of individuals in every ſpecies is a demonſtration of their amazing fertility. In a ſingle day, for example, a maſs of oyſters, of ſeveral fathoms in thickneſs, is often raiſed; the rocks to which they are attached, diminiſh conſiderably in a ſhort time; and ſome banks are entirely exhauſted. The following year, however, furniſhes an equal quantity, and not the ſmalleſt diminution appears. It is even doubted, whether a natural bed of oyſters was ever entirely exhauſted. 2. The ſubſtance of ſhells is analogous to that of ſtone; they are long preſerved when immerſed in ſoft matter; and they eaſily petrify when connected with matter naturally hard; theſe foſſil ſhells, therefore, and other productions of the ſea found on land, being the ſpoils of many ages, muſt neceſſarily have accumulated into large maſſes.

We have already remarked the prodigious quantities of ſhells preſerved in marble, lime-ſtone, chalk, marl, &c. They appear in maſſes like hills or mountains; and they often compoſe more than one half of the bodies in which they are contained. Sometimes they appear entire, and at other times in fragments, but large enough to enable us to diſtinguiſh their reſpective ſpecies. Here our knowledge of this ſubject, derived from obſervation, ſtops. But I go farther, and maintain, that ſhells are the medium employed by nature in the formation of moſt ſtones; that chalk, marl, and lime-ſtone, conſiſt entirely of the duſt or fragments of ſhells; and, conſequently, that the quantity of decompoſed ſhells is infinitely greater than that of thoſe which have been preſerved. Theſe poſitions ſhall be fully eſtabliſhed in the ſection upon minerals; and I ſhall only here exhibit the point of view in which the different ſtrata of the earth ought to be conſidered. The firſt bed, in which nothing of the original ſtructure appears, is compoſed of mud depoſited by dews, rains, and ſnow, and of particles of animal and vegetable ſubſtances. The inferior beds of chalk, marl, lime-ſtone, and marble, are compoſed of the ſpoils of ſhells and other ſea-bodies, mixed occaſionally with entire ſhells or fragments of them. But clay and vitrifiable ſand are the materials which compoſe the internal parts of the globe. Theſe ſubſtances were

vitrified at the time the earth aſſumed its figure, which neceſſarily implies, that the whole was then in a melted ſtate. The different ſpecies of granite, flint, free-ſtone in large maſſes, ſlate, and coal, derive their origin from ſand and clay, and are alſo diſpoſed in beds. But tufa and pumice, free-ſtone and flint in ſmall or detached pieces, cryſtals, metals, pyrites, moſt minerals, ſulphurs, &c. are matters, the formation of which is recent, when compared with that of marble, calcinable ſtones, chalk, marl, and other ſubſtances that are diſpoſed in horizontal beds, and contain ſhells, or other relics of the ocean.

As the terms I have employed may appear obſcure or ambiguous, it is neceſſary to explain them. By *clays*, I mean not only the white and yellow clays, but likewiſe the blue, the ſoft, the hard, the laminated, &c. which I conſider to be the ſcoriæ of glaſs, or the decompoſitions of glaſs. By *ſand*, I always underſtand vitrifiable ſand; and I comprehend, under this denomination, not only the fine ſand which produces free-ſtone, and which I maintain to be the powder of glaſs, or rather of tufa, but alſo that ſand rubbed off free-ſtone, and the ſtill groſſer kind reſembling ſmall gravel, proceeding from granite and rock-ſtone, and which is brittle, angular, and reddiſh, and generally found in the beds of thoſe rivers which deſcend precipitantly from hills or mountains compoſed of granite

or common rock. The river Armanſon, which runs by Semur in Auxois, where all the ſtones are of common rock, carries down great quantities of this groſs, rough, and brittle ſand. It is of the ſame nature with rock-ſtone, of which it is only ſmall portions, as calcinable gravels are only particles of free-ſtone. Beſides, rock-ſtone and granite are the ſame ſubſtances; but I have uſed both terms, becauſe they are conſidered by ſome as different ſpecies. The ſame may be remarked of flints and of free-ſtone in large maſſes: Theſe alſo are ſpecies of granite; and I call them flints in large maſſes, becauſe, like calcinable ſtones, they are diſpoſed in beds, and alſo to diſtinguiſh them from flints and free-ſtone in ſmall maſſes, as the round flints and ſand-ſtones, which have no continuation, or are not found in beds of any extent. Theſe are recent productions, and have not the ſame origin as flint and free-ſtone in large maſſes, which form regular and extenſive ſtrata. Under *ſlate* I comprehend the blue, the white, the gray, the reddiſh, and all the plated ſtones. Theſe bodies are generally found below laminated clay, and ſeem to be nothing elſe but clay hardened into thin ſtrata by drying; and this is the reaſon of ſo many cracks or fiſſures remarkable in ſuch ſubſtances. Coal and jet are likewiſe referable to clay, and are found under the laminated clays or ſlate. By *tufa* I mean not only the common pumice which is

full of holes, and has an organized appearance, but all beds of ſtone formed by the ſediments of running waters, all the ſtalactites, incruſtations, and every kind of ſtone that diſſolves by fire. It does not admit of a doubt that all theſe are new ſubſtances, and that they are conſtantly growing. Tufa is only a maſs of ſtony matter, not diſtinguiſhed by regular ſtrata. This matter is commonly found in ſmall hollow cylinders, is regularly ſhaped, formed by rills or percalations at the foot or upon the declivities of hills, and conſiſting of coats of marl or calcareous earth. The cylindric form is the ſpecific character of this kind of tufa, and it is always either oblique or ſtraight, according to the direction of the rills by which it is produced. The extent of theſe ſpurious quarries is inconſiderable, and generally proportioned to the height of the mountains which furniſh the materials of their growth. The intervals between the cylinders of the tufa, by the daily addition of freſh ſtony matter, are at laſt filled up, and the whole aſſumes a compact and ſolid form; but it never acquires the hardneſs of ſtone, and, for that reaſon, is denominated by Agricola, *marga tofacea fiſtuloſa*. In the tufa are often found impreſſions of the leaves of ſuch trees and plants as grow in the neighbourhood; land-ſhells, well preſerved, are likewiſe frequently found in the tufa, but never ſea-ſhells; it is, therefore, a recent production, and ought to be ranked with

ſtalactites,

ſtalactites, incruſtations, &c. All theſe new ſubſtances are a kind of ſpurious ſtones, formed by the waſting of others, but never arrive at the conſiſtence of real petrifaction.

Cryſtal, precious ſtones, every ſtone that has a regular figure, and even flints in ſmall maſſes, and conſiſting of concentric coats, whether found in the perpendicular fiſſures of rocks, or elſewhere, are only exudations, or the concreting juices of flint in large maſſes; they are, therefore, new and ſpurious productions, the genuine ſtalactites of flint or of granite.

Shells are never found in common rock or granite, nor in free-ſtone, although they often appear in vitrifiable ſand, from which free-ſtone derives its origin. This circumſtance ſeems to indicate, that ſand, unleſs when perfectly pure, cannot unite into free-ſtone or granite; and that a mixture of ſhells, or of other heterogeneous bodies, totally prevents it from cementing. I have often examined thoſe ſmall round ſtones, found in beds of ſand which are mixed with ſhells, and never could diſcover in them a ſingle ſhell. Theſe round ſtones are true concretions of free-ſtone, formed in thoſe places where the ſand is pure, and not mixed with heterogeneous matter; which is the reaſon why no larger maſſes are produced.

We formerly remarked, that, at Amſterdam, which is a very low country, ſea-ſhells were found 100 feet below the ſurface, and at Marly-

la-Ville, 6 leagues from Paris, at the depth of 75 feet. They have alſo been found in mines below beds of rock of 50, 100, 200, and even of 1000 feet thick, as is apparent in the Alps and Pyrennees, where ſhells and other ſea-bodies are found in the inferior ſtrata of immenſe rocks, which have been cut through in a perpendicular direction. But to proceed in order: Shells are found in the mountains of Spain, France, and England, in all the marble quarries of Flanders, in the mountains of Gueldres, in all the hills round Paris, in thoſe of Burgundy and Champagne; in a word, in all places where the baſis is not compoſed of free-ſtone or tufa; and, in all theſe places, the ſubſtance of the ſtones conſiſts more of ſhells than of any other matter. By ſhells, I mean not only the remains of ſhell-fiſh, but likewiſe thoſe of cruſtaceous animals, the briſtles of ſea-hedge-hogs, and all the productions of ſea-inſects, as corals, madrepores, aſtroites, &c. Any man may be convinced, by the evidence of his own eyes, that, in moſt marbles and calcinable ſtones, the proportion of ſea-bodies is ſo great, as to exceed the matter by which they are united.

But, farther, ſea-bodies are found even on the tops of the higheſt mountains of the Alps; for example, on the top of Mount Cenis, in the mountains of Genes, in the Apennines, and in moſt of the ſtone and marble quarries of Italy. They appear in the ſtones of which the moſt ancient

ancient buildings in Rome are conſtructed, in the mountains of Tirol, in the centre of Italy, on the top of Mount Paterne near Boulogne, in the hills of Pouille, in thoſe of Calabria, in many parts of Germany and of Hungary, and, laſtly, in all the high grounds of Europe*.

In Aſia and Africa, travellers have obſerved ſea-ſhells in ſeveral places; for example, 'upon 'the Caſtravan mountains, above Baruth,' ſays Shaw†, 'where there is a curious bed of whitiſh 'ſtone, but of the ſlate-kind, which contains, in 'every fleak of it, a great number and variety 'of fiſhes. Theſe, for the moſt part, lie ex-'ceedingly flat and compreſſed, like the foſſil 'fern plants; yet, at the ſame time, they are ſo 'well preſerved, that the ſmalleſt ſtrokes and 'lineaments of their fins, ſcales, and other ſu-'perficial diverſities, are eaſily diſtinguiſhed.' Between Cairo and Suez, and particularly upon all the hills of Barbary, ſays the ſame author, are many petrified ſhells and echini; moſt of them exactly correſpond with the different ſpecies ſtill exiſting in the Red Sea. As to Europe, petrified fiſhes are to be met with in Switzerland, Germany, the quarry of Oningen, &c.

Foſſil ſhells, ſays M. Bourguet, are to be found in the long chain of mountains ſtretching from Portugal to the moſt eaſterly parts of China, in the valleys of Europe, and in all the

* See Steno, Ray, Woodward, &c.

† See Shaw's Travels, p. 344.

mountains

mountains of Africa and America; and hence, he remarks, we may conclude, that they alſo exiſt in thoſe parts of the globe with which we are ſtill unacquainted.

The iſlands of Europe, of Aſia, and of America, wherever men have had occaſion to dig, whether in the mountains or in the valleys, furniſh many ſpecimens of foſſil ſhells; and this circumſtance demonſtrates, that iſlands are analogous in ſtructure and formation to their neighbouring continents*.

Theſe facts are ſufficient to prove, that foſſil ſhells, petrified fiſhes, and other productions of the ocean, exiſt in great quantities in almoſt every place where proper inveſtigations have been made. 'It is true,' ſays Tancrid Robinſon, 'that ſea-ſhells are diſperſed occaſionally 'on the earth by armies, and by the inhabitants 'of towns and villages. La Loubere relates, in 'his voyage to Siam, that the monkeys of the 'Cape of Good Hope perpetually amuſe themſelves by tranſporting ſhells from the ſhores of 'the ſea to the tops of the mountains. But this 'is no ſolution to the queſtion, why theſe ſhells 'are diſperſed through every climate of the 'earth, or why they are found in the bowels of 'the higheſt mountains, and diſpoſed in beds, 'like thoſe in the bottom of the ocean.'

Upon peruſing an Italian letter, printed at Paris in the year 1746, concerning the changes

* See Lettres philoſoph. ſur la formation des ſels, p. 205.

this

this globe has undergone, I was aſtoniſhed to find a repetition of Loubere's ſentiments. Petrified fiſhes, in the opinion of this writer, are always of rare ſpecies, which were rejected from the Roman tables, becauſe they were not eſteemed to be wholeſome: And as to foſſil ſhells, he ſays, that the pilgrims brought from Syria, in the time of the cruſades, thoſe ſhells peculiar to the Levant, which are now found petrified in France, in Italy, and in other parts of Chriſtendom. Why did he not add, that the monkeys tranſported ſhells to the tops of the higheſt mountains, which never were inhabited by men? This he might have done with great facility, and it would have given an air of credibility to his hypotheſis! How ſhould men, who pretend to philoſophy, differ ſo widely in their opinions? It is not ſufficient, it would appear, to find foſſil ſhells in almoſt every part of the earth where pits have been dug, nor to have quoted the teſtimonies of natural hiſtorians, as theſe authors may, according to certain ſyſtems, have imagined that ſhells exiſted where none were to be found: We ſhall, therefore, to prevent all prejudices of this kind, quote the authority of ſome authors who had no theory to ſupport, and whoſe habits of obſervation could only enable them to recogniſe ſhells that were entire, and in the beſt preſervation. This teſtimony will, perhaps, have greater authority with men who cannot judge of the

facts,

facts, nor know the distinction between real shells and their petrifactions.

Every man may examine with his eyes the banks of shells in the hills round Paris, and especially in the stone-quarries, as at Chaussée near Seve, at Issy, Passy, and other places. A great quantity of lenticular stones are to be found at Villers-Cotterets; the rocks are almost entirely composed of these stones; and they are irregularly interspersed with a kind of cement, by which they are united. At Chaumont, the quantity of shells is so great, that the whole hills, which are pretty high, appear to consist of nothing else. The same phænomenon is exhibited at Courtagnon near Rheims, where there is a bank of shells of about four leagues broad, and the length is still more considerable. I mention these places, because they are famous, and the shells strike the eye of every beholder.

With regard to foreign countries, let us attend to the remarks of travellers.

'In Syria and Phœnicia, in the neighbourhood particularly of Latikea, the rocks are of a hard chalky substance, from whence the adjacent city might borrow the name of the *White Promontory*. The Nakoura, formerly called the *Scala Tyriorum*, is of the same nature and complexion; both of them including a great variety of corals, shells, and other remains of the deluge*.'

* See Shaw's Travels, p. 344.

'But

'But fossil shells, and other the like testimonies of the deluge, are very rare in the mountains near Sinai, the original menstruum, perhaps, of these marbles, being too corrosive to preserve them. Yet, at Corondel, where the rocks approach nearer to our free-stone, I found a few chamæ and pectunculi, and a curious echinus of the discoid kind. The ruins of the small village at Ain-el-Mousa, and the several conveyances we have there for water, are all of them full of fossil shells. The old walls of Suez, and the remains that are left us of its harbour, are likewise of the same materials, all of them probably from the same quarry. Between Suez and Cairo, likewise, and all over the mountains of Lybia, near Egypt, every little rising ground and hillock discovers great quantities of the echini, as well as of the bivalve and turbinated shells, most of which exactly correspond with their respective families still preserved in the Red Sea*.'

The moving sand in the neighbourhood of Raz Sem, in the kingdom of Barca, covers many palm-trees, echini, and other petrifactions. *Raz Seme* signifies *the head of a fish*, and is the name of what is called the petrified village, where it has been alledged, that men and women, with their children, cattle, furniture, &c. may be seen converted into stone. 'But,' says Mr. Shaw, 'all this is mere fiction, as I learned not only

* Shaw's Travels, p. 444.

'from

'from Mr. Mair, Conſul at Tripoli, who ſent ſe-
'veral people to examine into the fact, but alſo
'from men of credit and learning who had been
'on the ſpot.'

Near the Pyramids Mr. Shaw diſcovered ſome ſtones which had been hewn by workmen, and were mixed with little round bodies like lentils, and ſome of them reſembled barley half peeled. 'Theſe,' he ſays, 'were ſuppoſed to have been 'fragments of victuals left by the workmen, 'and are now petrified. But this account ap-'pears to be very improbable,' &c. Theſe lentils and grains of barley are nothing but petrified ſhells, known to every naturaliſt by the name of lentil-ſtones.

'Many foſſil ſtones,' ſays Miſſon *, 'are 'found in the neighbourhood of Maeſtricht, 'eſpecially near the village of Zichen or Tichen, 'and in the mountain called the *Huns*.

'In the environs of Sienne, near Certaldo, 'are many mountains of ſand filled with differ-'ent kinds of ſhells. Monte-mario, about a 'mile from Rome, is alſo full of them. I have 'remarked them in the Alps, in France, and 'in other places. Orlearius, Steno, Cambden, 'Speed, and many other writers, have related 'the ſame phænomena †.

'The iſland of Cerigo,' ſays Thevenot ‡, 'was called *Porphyris* by the ancients, on ac-

* See Voyage de Miſſon, tom. 3. p. 109.
† Ibid. tom. 2. p. 312.
‡ Voyage de Thevenot, tom. 1. p. 25.

'count

'count of the quantities of porphyry found in 'it.' Now, porphyry, as obſerved above, is compoſed of the prickles of the echinus, or ſea-hedge-hog, united by a very hard ſtony cement.

'Oppoſite to Inchené, a village on the eaſt 'bank of the Nile, I found petrified plants 'growing naturally on a piece of ground about 'two leagues in length, and of an inconſiderable 'breadth. This is one of the moſt ſingular 'productions in nature. The plants reſembled 'the white corals which grow in the Red Sea *.'

'There are ſeveral ſpecies of petrifaction on 'Mount Libanus, and, among others, flat ſtones 'which contain the ſkeletons of fiſhes entire, 'and well preſerved; cheſnuts, and ſmall 'branches of coral, of the ſame ſpecies with 'what grows in the Red Sea, are likewiſe found 'on this mountain †.'

'In mount Carmel,' ſays Shaw, 'we gather a 'great many hollow ſtones, lined in their inſides 'with a variety of ſparry matter, which, from 'ſome diſtant reſemblance, are ſaid to be petri-'fied olives, melons, peaches, and other fruit. 'Theſe are commonly beſtowed upon pilgrims, 'not only as curioſities, but as antidotes againſt 'ſeveral diſtempers: The olives, which are '*lapides Judaici*, as they are commonly called, 'have been always looked upon, when diſſolved 'in the juice of lemons, as an approved medi-

* See Voyage de Paul Lucas, tom. 2. p. 380.
† Ibid. tom. 3. p. 326.

'cine

'cine againſt the ſtone and gravel *.' Theſe *lapides Judaici* are the points of the echinus.

'M. la Roche, a phyſician, gave me ſome 'petrified olives, called *lapides Judaici*, which 'grow in great quantities upon the mountains, 'where are to be found, according to my in-'formation, other ſtones, which in their inſide 'contain perfect repreſentations of the natural 'parts of men and women †. Theſe are the 'hyſterolithes.'

'In going from Smyrna to Tauris,' ſays Tavernier, 'when we came to Tocat, the heat was 'exceſſive; we therefore left the common road 'to the north of us, and went by the mountains, 'where there are always ſhade and cool breezes. 'In many places we found ſnow; and, upon the 'tops of ſome of theſe mountains, we ſaw ſhells 'reſembling thoſe upon the ſea-ſhore, which is 'an extraordinary phænomenon.'

Let us attend to what Olearius ſays concerning the petrified ſhells he obſerved in Perſia, and in the rocks where the ſepulchres have been cut near the village Pyrmarus.

'Three of us aſcended, by mutually aſſiſting 'each other, the moſt frightful precipices, and 'at laſt gained the ſummit, where we found 'four large chambers, with ſeveral niches cut 'out of the ſolid rock: But what ſtruck us moſt 'was, to find in this vault, on the top of the 'mountain,

* See Shaw's Travels, p. 444.

† Voyag. de Monconys, p. 334.

'mountain, muſcle-ſhells; and in ſome parts 'they appeared in ſuch quantities, that this 'whole rock ſeemed to conſiſt of nothing but 'ſand and ſhells. In returning from Perſia, 'we perceived ſeveral of theſe ſhelly mountains 'upon the coaſts of the Caſpian Sea.'

To theſe authorities many others might be added, were I not apprehenſive of tiring thoſe who need no additional proofs on this ſubject, and who have perceived with their eyes, as I have done, the exiſtence of ſhells in all places where they have been ſearched for.

In France, we find not only the ſhells belonging to our own coaſts, but thoſe which never appeared in our ſeas. Some philoſophers even alledge, that the number of foreign petrified ſhells greatly exceed thoſe of our own climate. But this opinion ſeems not to be well founded; for, independent of ſuch ſhells as lie in the bottom of deep water, and are ſeldom brought up by fiſhers, and, of courſe, are regarded by us as foreigners, though they may exiſt in our ſeas, I find, upon compariſon, that more of the petrified ſhells belong to our own ſhores than to any other. For example, all the pectines, moſt cockles, muſcles, oyſters, trumpet-ſhells, ear-ſhells, limpets, nautili, ſtars, tubulites, corals madrepores, &c. which are found ſo univerſally, are really produced in our ſeas: And, though many ſea-bodies appear, which are either foreign or unknown, as the cornu ammonis, the la-

pides Judaici, the large ſcrew, the buccinum, called *abajour*, &c. yet I am convinced, by repeated obſervation, that the number of theſe ſpecies is inconſiderable, when compared with the ſhells which belong to our own coaſts. Beſides, the madrepores, aſtroites, and all thoſe ſea-bodies formed by inſects, conſtitute the baſis of our marbles and lime-ſtone; for the ſhells, however abundant, make but a ſmall part of theſe ſtones, and many of them are produced in our own ſeas, and particularly in the Mediterranean.

The Red Sea produces corals, madrepores, and ſea-plants, more abundantly than any other. The port of Tor furniſhes an amazing quantity. In calm weather, the quantity exhibited is ſo great, that the bottom of the ſea reſembles a foreſt. Some of the branched madrepores riſe from eight to ten feet high. They are alſo very common in different parts of the Mediterranean; and are to be found in all gulfs, iſlands, &c. of every temperate climate, where the ſea is not very deep.

Mr. Peyſſonel was the firſt who diſcovered that coral, madrepores, &c. were not plants, but that they derived their origin from animals. The truth of this diſcovery was long doubted. Some naturaliſts at firſt rejected it with diſdain. But it ſoon gained univerſal aſſent; and every man is now ſatisfied, that what was formerly called ſea-plants, are nothing but hives, or rather lodges, formed by inſects for their own habitation.

habitation. Theſe bodies were originally claſſed with minerals, then with plants, and now they muſt for ever be recogniſed as the genuine operation of animals.

Many ſhell-fiſh inhabit the deepeſt parts of the ocean, and are never thrown upon the coaſts; authors have, therefore, termed them *Pelagiæ*, to diſtinguiſh them from the other kinds, which they call *Littorales*. It is probable that the cornu ammonis, and ſome other ſpecies, found only in a petrified ſtate, belong to the former, and that they have been impregnated with ſtony matter in the very places where they are diſcovered. It is alſo probable, that the ſpecies of ſome animals have been extinguiſhed, and that theſe ſhells may be ranked among their number. The extraordinary foſſil bones found in Siberia, in Canada, in Ireland, and ſeveral other places, ſeem to confirm this conjecture; for no animal has hitherto been diſcovered to whom bones of ſuch enormous ſize could poſſibly belong.

Foſſil ſhells, ſays Woodward, are found from the top to the bottom of quarries, in pits, and in the deepeſt mines of Hungary: And we are informed by Mr. Ray, that they are found in the rocks on the ſhores of Calda, and in Pembrokeſhire, at the depth of 200 fathoms*.

Shells not only appear in a petrified ſtate at great depths, and on the tops of the higheſt mountains, but they are alſo found in their na-

* See Ray's diſcourſes, p. 178.

tural condition, having the colour, luſtre, and lightneſs of ſea-ſhells; ſo that, to be fully ſatiſfied on this ſubject, nothing farther is requiſite than to compare them with the ſhells found on the ſhores of the ſea. The ſlighteſt examination will convince us, that petrified and foſſil ſhells are preciſely the ſame with thoſe of the ocean; for they are marked with the ſame furrows and articulations, however minute; and, in the gloſſopetri and other teeth of fiſhes, which are ſometimes found adhering to the jaw-bone, it is obvious, that the teeth are worn and poliſhed at the extremities, and that they have been uſed by the living animals.

Foſſil ſhells are almoſt every where to be met with; and, of thoſe of the ſame ſpecies, ſome are ſmall, others large, ſome young, others old, ſome entire, others imperfect; and ſometimes young ones appear adhering to the old.

The ſhell-fiſh called *Purpura* has a long tongue the extremity of which is ſo ſharp and oſſeous, that it pierces the ſhells of other fiſhes, in order to extract nouriſhment from them. Shells pierced in this manner are often found in the bowels of the earth; which is an inconteſtible proof that they were formerly inhabited by living fiſhes, and that they exiſted in the ſame places with the purpura*.

The obeliſks of St. Peter's at Rome, according to John of Latran, were ſaid to have been

* See Woodward, p. 296. 300.

brought

brought from the Egyptian pyramids: They conſiſt of a red granite, which, as formerly remarked, contains no ſhells. But the ancient marbles of Africa and Egypt, and the porphyry ſaid to have been brought from Solomon's temple, and the palaces of the Egyptian kings, and employed in ſeveral of the Roman buildings, are full of ſhells. Red porphyry is compoſed of an infinite number of the prickles of that ſpecies of echinus called a ſea-cheſnut; they are placed very near each other, and form the white points of the porphyry. Each of theſe points have a black ſpeck in the middle, which is the ſection of the longitudinal tube of the prickle of the echinus. At Ficin in Burgundy, three leagues from Dijon, there is a red ſtone ſo ſimilar to porphyry, that it differs only in denſity, not being harder than marble: It is entirely compoſed of the points or prickles of the echini, and the ſtratum of it is conſiderable both in thickneſs and extent. Many excellent pieces of workmanſhip are made of it in this province, and particularly the ſteps which lead to the pedeſtal of the equeſtrian ſtatue of Louis le Grand, at Dijon. This ſpecies of ſtone is alſo found in Montbard in Burgundy; it is ſofter than marble; but it contains ſtill more prickles of the echini, and a ſmaller proportion of red matter. Thus the ancient porphyry of Egypt, and the porphyry of Burgundy, differ only in the degree of hardneſs, and in the quantity of

prickles or points of the echinus contained in them.

With regard to what is called green porphyry, I imagine it to be rather a granite than a porphyry. It is not, like the red porphyry, compoſed of the prickles of the echinus; and its ſubſtance has a greater reſemblance to that of common granite. The ancient walls of Volatera in Tuſcany have been built of ſtones in which are many ſhells, and theſe walls were erected 2500 years ago*. Moſt marbles, porphyries, and other ſtones employed in the buildings of the ancients, contain ſhells and other productions of the ocean, in the ſame manner as ſome of our modern marbles. Hence we may conclude, that, independent of the teſtimony of holy writ, the earth, before the deluge, was compoſed of the ſame materials as at preſent.

Upon the whole, it is apparent, that petrified ſhells are found in Europe, in Aſia, in Africa, and in every place where proper reſearches have been made. They are alſo found in America, in the Braſils, for example, in Tucumana, in Terra Magellanica, and in ſuch vaſt quantities in the Antilles, that what the inhabitants call lime, which lies immediately below the ſoil, is nothing but a congeries of ſhells, corals, madrepores, aſtroites, and other ſea-bodies. Theſe inconteſtible facts would have led me to conclude, that petrified ſhells, and other productions of the

* See Steno de ſolido intra ſolidum, p. 63.

ocean,

ocean, were to be found through the whole continent of America, and eſpecially in the mountains, as Woodward affirms. But M. de la Condamine, who lived ſeveral years in Peru, aſſures me, that he was never able to diſcover any of them in the Cordeliers, although he had diligently ſearched for them. This phænomenon would indeed be ſingular, and would lead to concluſions ſtill more uncommon. But, I confeſs, the teſtimony of this celebrated obſerver notwithſtanding, I am ſtrongly inclined to believe that there is, in the mountains of Peru, as well as every where elſe, petrified ſhells and other ſea-bodies, although they have not yet been diſcovered. In matters which depend on teſtimony, the poſitive evidence of two witneſſes is a complete proof; but the evidence of ten thouſand witneſſes, who only declare in the negative, that they never obſerved a particular appearance, gives riſe to nothing more than a ſlight doubt. Thus reaſon, joined to the force of a general analogy, obliges me to perſiſt in believing that foſſil ſhells will ſtill be found in the mountains of Peru, eſpecially if they are ſearched for in the ſides, and not on the very ſummits.

The tops of high mountains are generally compoſed of granite, free-ſtone, and other vitrifiable materials, which never contain ſhells. Theſe matters were all formed out of beds of ſand, when they were covered by the ſea. But, when the waters left the mountains, they would

carry off the ſand, and other light bodies, into the plains, and leave nothing on their tops but thoſe beds of rock which had been formed below the ſtratum of ſand. At two, three, or four hundred fathoms below the ſummit of theſe mountains, we often find marbles and other calcinable matters, diſpoſed in parallel beds, and containing ſhells and other ſea-bodies. Hence, if M. de la Condamine examined only the moſt elevated places, which conſiſt of granite, of free-ſtone, or of vitrifiable ſand, it is not ſurpriſing that he did not find foſſil ſhells. But he ought to have explored the lower parts of the Cordeliers, and he would unqueſtionably have diſcovered beds of marble, earth, &c. mixed with ſhells; for ſuch beds have been found in every part of the world that has undergone a proper examination.

But, ſuppoſing it to be a fact, that there are no productions of the ocean in the mountains of Peru, nothing could be concluded from it which could affect our theory. Some parts of the globe, and particularly places of ſuch elevation as the Cordeliers, might never have been covered with the ſea. Theſe mountains, however, would be an ample field for curious obſervation. They would not, in that caſe, conſiſt of parallel beds. Their materials would be very different from all others: They would have no perpendicular fiſſures: The ſtructure of the ſtones and rocks would have no reſemblance to thoſe of other

other countries: *Laſtly*, Theſe mountains would exhibit the ancient ſtructure of the earth before it was changed by the motion of the waters; they would diſcover the primitive ſtate of the globe, its original form, the natural arrangement and connection of its parts. But this notion is ſupported by too ſlender a foundation; and it is more conſonant to the rules of philoſophy to believe that foſſil ſhells exiſt in the mountains of Peru, in the ſame manner as they exiſt every where elſe.

With regard to the poſition of ſhells in beds of earth or of ſtone, let us attend to the following paſſage of Woodward: 'All the ſhells that 'are found in numberleſs ſtrata of earth, and 'rocks, in the higheſt mountains, and in the 'moſt profound quarries and mines, in flint, 'cornelian, agate, &c. and in maſſes of ſulphur, 'marcaſites, and other mineral and metallic bo-'dies, are filled with the ſame ſubſtances that 'compoſe the ſtrata in which they are included, 'and never with any heterogeneous matter;' p. 206. &c.——'We now find in the ſand-'ſtone of all countries, (the ſpecific gravity of 'the ſeveral ſorts whereof is very little different, 'being generally to water as $2\frac{1}{2}$ or $\frac{9}{10}$ to 1) 'only thoſe conchæ, pectines, cochleæ, and 'other ſhells that are nearly of the ſame gra-'vity, viz. $2\frac{1}{2}$ or $2\frac{5}{8}$ to 1. But there are ordi-'narily found encloſed in it prodigious num-'bers; whereas, of oyſter-ſhells, (which are in

'gravity

'gravity but as about 2¼ to 1) of echini, (which 'are but as 2 or 2½ to 1) or the other lighter 'kinds of ſhells, ſcarce one ever appears therein. 'On the contrary, in chalk (which is lighter 'than ſtone, being but as about 2$\frac{1}{10}$ to 1) there 'are only found echini, and the other lighter 'ſorts of ſhells;' p. 32, 33.

It muſt here be remarked, that what Woodward ſays with reſpect to ſpecific gravity, is not univerſally true; for ſhells of different ſpecific gravities are often found in the ſame matters; ſhells of cockles, of oyſters, and of echini, for example, are found in the ſame bed of ſtones or of earth. In the cabinet of the French King, there is a cockle petrified in a cornelian, and echini petrified in an agate. Hence the difference in the ſpecific gravity of ſhells has had leſs influence upon their poſition in the ſtrata of the earth than Woodward would have us to believe. The reaſon why the ſhells of the echini, and others of a light texture, abound ſo much in chalk, is owing to this circumſtance, that chalk itſelf is only decompoſed ſhells; thoſe of the echini being lighter and thinner than others, would be moſt eaſily reduced to powder or chalk; and hence beds of chalk could exiſt only in thoſe places where were formerly collected by the ſea great quantities of light ſhells, the deſtruction of which would form that chalk in which we ſtill find ſhells that have reſiſted the operation

operation of time, either in an entire ſtate, or in fragments ſufficient to diſcover their ſpecies.

This ſubject ſhall be more fully treated of in the article concerning Minerals. I ſhall here only obſerve, that Woodward's expreſſions are often too general. He appears to aſſert, that ſhells are found as frequently, and in as great abundance, in flints, cornelians, chalcedonii, ores, and ſulphur, as in other matters. But the fact is, that ſhells are a very rare phænomenon in vitrifiable or purely inflammable ſubſtances; and, in chalk, marl, and marbles, the quantity of them is ſo prodigious, that it is impoſſible to affirm that the lighter and heavier ſhells are uniformly found in ſtrata correſponding to their ſpecific gravities, though, in general, this may be the caſe, oftener than otherwiſe. They are all impregnated with the bodies in which they are immerſed, whether in the horizontal beds, or in the perpendicular fiſſures; becauſe the whole has been affected by the operation of water, though at different times and in different manners. Thoſe found in the horizontal beds of ſtone, marble, &c. have been tranſported and depoſited by the waves of the ſea; and thoſe found in flints, cornelians, and other matters, peculiar to the perpendicular fiſſures, were formed by rills of water impregnated with lapidific or metallic ſubſtances. In both caſes, the matter that fills the ſhells has been in the ſtate of a fine impalpable

pable powder; becauſe every pore of them is completely filled, and the moulds of them are as exact as the impreſſions of a ſeal upon wax.

It is, therefore, apparent, that, in ſtone, marble, &c. there are multitudes of ſhells ſo entire, and ſo well preſerved, that they may be compared with thoſe in our cabinets, or upon the ſhores of the ſea.

'There being, I ſay, beſides theſe, ſuch vaſt 'multitudes of ſhells contained in ſtone, &c. 'which are entire, fair, and abſolutely free from 'any ſuch mineral contagion; which are to be 'matched by others at this day found upon our 'ſhores, and which do not differ in any reſpect 'from them; being of the ſame ſize that thoſe 'are of, and the ſame ſhape preciſely; of the 'ſame ſubſtance and texture, as conſiſting of the 'ſame peculiar matter, and this conſtituted and 'diſpoſed in the ſame manner as is that of their 'reſpective fellow-kinds at ſea; the tendency 'of the fibres and ſtriæ the ſame; the compoſition of the lamellæ, conſtituted by theſe 'fibres, alike in both; the ſame veſtigia of tendons (by means whereof the animal is faſtened and joined to the ſhell); in each the ſame 'papillæ; the ſame ſutures, and every thing 'elſe, whether within or without the ſhell, in 'its cavity, or upon its convexity, in the ſubſtance, or upon the ſurface of it. Beſides, 'theſe foſſil ſhells are attended with the ordi-

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'nary accidents of the marine ones, *ex. gr.* they 'ſometimes grow to one another, the leſſer ſhells 'being fixed to the larger: They have the balani, tubuli vermiculares, pearls, and the like, 'ſtill actually growing upon them. And, which 'is very conſiderable, they are moſt exactly of 'the ſame ſpecific gravity with their fellow-kinds 'now upon the ſhores. Nay farther, they anſwer all chymical trials in like manner as the 'ſea-ſhells do; their parts, when diſſolved, have 'the ſame appearance to view, the ſame ſmell 'and taſte*.'

I have often obſerved, with aſtoniſhment, whole mountains, chains of rocks, and extenſive quarries, ſo full of ſhells, and other ſea-bodies, that there was hardly ſpace left for the matters in which they are depoſited.

I have ſeen ſome arable fields ſo full of petrified cockles, that they might be picked up by a blind man, others entirely covered with cornu ammonis, and others with cardites; and the more this ſubject is inquired into, we ſhall be the more thoroughly convinced, that the number of petrifactions is infinite, and that it was abſolutely impoſſible that all the animals which inhabited theſe ſhells could exiſt at the ſame time.

I have farther remarked, that the ſtones of thoſe arable lands which abound with petrified ſhells in an entire form, well preſerved, and detached from all other matter, are frittered down

* Woodward, p. 23, 24.

by

by froſt, which deſtroys ſtones, but has little effect upon petrified ſhells.

Theſe immenſe quantities of petrified ſea-bodies, found in ſo many different places and ſituations, prove, that they could not be tranſported and depoſited by the waters of the deluge; for the greateſt part of them, inſtead of being found in the bowels of the earth, and in ſolid marble at the depth of ſeven or eight hundred feet, muſt have remained on the ſurface.

In all quarries, petrified ſhells form part of the internal ſtructure of the ſtone, the ſurface of which is often covered with ſtalactites, a matter much leſs ancient than the ſtone that contains the ſhells. Another proof that theſe ſhells could not be derived from the deluge is, that the bones, horns, claws, &c. of land-animals, are ſeldom found in a petrified ſtate, and are never incorporated in marble, or other hard ſtones; whereas, if theſe effects had been produced by the deluge, the remains of land-animals would have been found in marbles, as well as thoſe of fiſhes.

To alledge, that the earth was entirely diſſolved at the time of the deluge, is a mere gratuitous ſuppoſition, which required a ſecond miracle in order to give water the power of an univerſal diſſolvent. Beſides, it infers an evident contradiction; for, if water was then an univerſal menſtruum, how could ſhells have been preſerved in the entire ſtate in which we find them? This

This is an evident demonſtration, that no ſuch diſſolution took place, and that the parallel ſtrata were not formed in an inſtant, but were gradually produced by ſucceſſive ſediments; for, it is apparent to every obſerver, that the diſpoſition of all the materials compoſing the earth has been occaſioned by the operation of water. The only queſtion, therefore, that remains, is, Whether this arrangement of parts was produced all at once, or in a ſucceſſion of time? Now, it has already been ſhown, that it could not poſſibly happen at one time; becauſe the materials are not diſpoſed according to their ſpecific gravities, and becauſe they never ſuffered a general diſſolution. This arrangement, therefore, muſt have originated from ſucceſſive ſediments. Any other cauſe, or particular revolution, would have given riſe to an arrangement totally different. Beſides, particular revolutions, or accidental cauſes, could never have produced a uniform diſpoſition of horizontal and parallel ſtrata throughout the whole globe.

Let us attend to what the hiſtorian of the Academy * has ſaid upon this ſubject.

'The many marks of extenſive inundations, 'and the manner in which mountains muſt be 'conceived to have been produced, demonſtrate, 'that the ſurface of this earth has ſuffered great 'revolutions. However deep we penetrate in-

* Année 1718, p. 3.

'to

'to the globe, we diſcover nothing but ruins, 'bodies of different kinds amaſſed and incor-'porated without any order or apparent deſign. 'If there be any regularity in the ſtructure of 'the earth, it lies too deep for our reſearches; 'we muſt, therefore, confine ourſelves to the 'ruins of the external cruſt, which will be ſuf-'ficient to occupy the attention of philoſophers.

'M. de Juſſieu diſcovered, in the neighbour-'hood of St. Chaumont, a great quantity of 'ſlaty or laminated ſtones, every lamina of 'which was marked with the impreſſion of a 'ſtem, leaf, or other portion of ſome plant. 'The impreſſions of leaves were uniformly 'extend'. as if they had been ſtretched in 'the ſtones by the hand; a clear demonſtration, 'that they had been tranſported by water, 'which always keeps leaves in that poſition: 'their ſituations were various, and ſometimes 'they lay acroſs each other.

'It is natural to imagine, that a leaf depoſited 'by water upon ſoft mud, and then covered 'by a ſimilar layer of mud, would impreſs 'upon the undermoſt layer the figure of its one 'ſide, and upon the uppermoſt the figure of its 'oppoſite ſide; and, after theſe layers hardened 'and petrified, that they would each bear an 'impreſſion of a different ſide of the leaf. But 'this ſuppoſition, however natural, does not 'take place: the two laminæ of ſtone uni-'formly

'formly bear the impreſſion of the ſame ſide 'of the leaf, the one in alto, the other in baſs-'relief. For this obſervation, with regard to 'the figured ſtones of St. Chaumont, we are in-'debted to M. de Juſſieu; but we leave the ex-'plication of it to himſelf, and ſhall proceed to 'remarks of a more general and intereſting na-'ture.

'All the impreſſions on the ſtones of Saint 'Chaumont are of foreign plants, which are 'not to be found in any part of France; they 'are natives either of the Eaſt Indies, or of the 'warmer climates of America. Moſt of them 'belong to the capillary tribes, and they are ge-'nerally particular ſpecies of ferns, the cloſe 'texture of which enables them both to make 'deep impreſſions, and to remain long in a ſtate 'of preſervation. M. Leibnitz was aſtoniſhed 'to find the impreſſions of the leaves of a few 'Eaſt India plants upon ſome ſtones in Ger-'many: In the example under conſideration, 'the wonder is greatly augmented; for, by 'ſome unaccountable deſtination of nature, it 'would appear, that, in all the ſtones of Saint 'Chaumont, not a ſingle impreſſion of a native 'plant is to be found.

'From the number of foſſil ſhells in the 'mountains and quarries exhibited in this coun-'try, as well as in many others, it is apparent, 'that it muſt have formerly been covered with

'the ſea. But how could the American or In-
'dian oceans come hither?

'To ſolve this and other ſurpriſing phæno-
'mena, we may ſuppoſe, with much probabi-
'lity, that the ſea originally covered the whole
'globe. But this ſuppoſition will not anſwer;
'becauſe no terreſtrial plants could then exiſt:
'The plants of one country, therefore, could
'only be tranſported to another by great inun-
'dations.

'M. de Juſſieu imagines, that, as the bed of
'the ſea is always riſing higher by means of the
'mud and ſand inceſſantly carried into it by the
'rivers, the ſea, at firſt confined by natural dikes,
'might at laſt ſurmount them, and ſpread over
'the land to great diſtances; or, which would
'produce the ſame effect, the dikes might in
'time be rendered ſo thin, by the conſtant ope-
'ration of the water, that they would at laſt
'give way. Soon after the formation of the
'earth, when nothing had aſſumed a regular
'or ſettled form, ſudden and prodigious revo-
'lutions might then be produced, of which we
'have now no examples, becauſe every thing
'is in ſuch a fixed and permanent ſtate, that
'only ſlow and inconſiderable changes can take
'place: It is for this reaſon that we find a dif-
'ficulty in crediting revolutions more ſudden
'and tremendous.

'By

'By ſome of theſe great revolutions the Weſt
'or Eaſt Indian Oceans might have been poured
'in upon Europe: In their journey, they would
'tear up foreign plants, carry them off floating
'on the waves, and gently depoſit them in
'ſhallow places, from which the waters would
'ſoon evaporate.'