

## CHAPTER IX.

Theory of the progressive development of organic life considered—Evidence in its support wholly inconclusive—Vertebrated animals in the oldest strata—Differences between the organic remains of successive formations—Remarks on the comparatively modern origin of the human race—The popular doctrine of successive development not confirmed by the admission that man is of modern origin—In what manner the change in the system caused by the introduction of man affects the assumption of the uniformity of the past and future course of physical events.

WE have considered, in the preceding chapters, many of the most popular grounds of opposition to the doctrine, that all former changes of the organic and inorganic creation are referrible to one uninterrupted succession of physical events, governed by the laws now in operation.

As the principles of the science must always remain unsettled so long as no fixed opinions are entertained on this fundamental question, we shall proceed to examine other objections which have been urged against the assumption of uniformity in the order of nature. We shall cite the words of a late distinguished writer, who has formally advanced some of the weightiest of these objections. “It is impossible,” he affirms, “to defend the proposition, that the present order of things is the ancient and constant order of nature, only modified by existing laws—in those strata which are deepest, and which must, consequently, be supposed to be the earliest deposited forms, even of vegetable life, are rare; shells and vegetable remains are found in the next order; the bones of fishes and oviparous reptiles exist in the following class; the remains of birds, with those of the same genera mentioned before, in the next order; those of quadrupeds of extinct species in a still more recent class; and it is only in the loose and slightly-consolidated strata of gravel and sand, and which are usually called diluvian formations, that the remains of animals such as now people the globe are found, with others belonging to extinct species. But, in none of these

formations, whether called secondary, tertiary, or diluvial, have the remains of man, or any of his works, been discovered; and whoever dwells upon this subject must be convinced, that the present order of things, and the comparatively recent existence of man as the master of the globe, is as certain as the destruction of a former and a different order, and the extinction of a number of living forms which have no types in being. In the oldest secondary strata there are no remains of such animals as now belong to the surface; and in the rocks, which may be regarded as more recently deposited, these remains occur but rarely, and with abundance of extinct species;—there seems, as it were, a gradual approach to the present system of things, and a succession of destructions and creations preparatory to the existence of man\*.”

In the above passages, the author deduces two important conclusions from geological data; first, that in the successive groups of strata, from the oldest to the most recent, there is a progressive development of organic life, from the simplest to the most complicated forms;—secondly, that man is of comparatively recent origin. It will be easy to shew that the first of these propositions, though very generally received, has no foundation in fact. The second, on the contrary, is indisputable, and it is important, therefore, to consider how far its admission is inconsistent with the assumption, that the system of the natural world has been uniform from the beginning, or rather from the era when the oldest rocks hitherto discovered were formed.

We shall first examine the geological proofs appealed to in support of the theory of the successive development of animal and vegetable life, and their progressive advancement to a more perfect state. No geologists, who are in possession of all the data now established respecting fossil remains, will for a moment contend for the doctrine in all its detail, as laid down by the great chemist to whose opinions we have referred. But naturalists, who are not unacquainted with recent discoveries, continue to defend the ancient doctrine in a somewhat modified form. They say that, in the first period of the world, (by which they mean the earliest of which we have yet procured

\* Sir H. Davy, *Consolations in Travel*, Dialogue 3, “The Unknown.”

any memorials,) the vegetation consisted almost entirely of cryptogamic plants, while the animals which co-existed were almost entirely confined to zoophytes, testacea, and a few fish. Plants of a less simple structure succeeded in the next epoch, when oviparous reptiles began also to abound. Lastly, the terrestrial flora became most diversified and most perfect when the highest orders of animals, the mammifera and birds, were called into existence.

Now, in the first place, we may observe, that many naturalists have been guilty of no small inconsistency in endeavouring to connect the phenomena of the earliest vegetation with a nascent condition of organic life, and at the same time to deduce, from the numerical predominance of certain types of form, the greater heat of the ancient climate. The arguments in favour of the latter conclusion are without any force, unless we can assume that the rules followed by the Author of Nature in the creation and distribution of organic beings were the same formerly as now; and that as certain families of animals and plants are now most abundant, or exclusively confined to regions where there is a certain temperature, a certain degree of humidity, intensity of light, and other conditions, so also the same phenomena were exhibited at every former era. If this postulate be denied, and the prevalence of particular families be declared to depend on a certain order of precedence in the introduction of different classes into the earth, and if it be maintained that the standard of organization was raised successively, we must then ascribe the numerical preponderance in the earlier ages of plants of simpler structure, *not to the heat*, but to those different laws which regulate organic life in newly created worlds. If, according to the laws of progressive development, cryptogamic plants always flourish for ages before the dicotyledonous order can be established, then is the small proportion of the latter fully explained; for in this case, whatever may have been the mildness or severity of the climate, they could not make their appearance. Before we can infer an elevated temperature in high latitudes, from the presence of arborescent Ferns, Lycopodiaceæ, and other allied families, we must be permitted to assume, that at all times, past and future, a heated and moist atmosphere pervading the northern hemisphere has a tendency to produce in the vegetation a predominance of analogous

types of form. We grant, indeed, that there may be a connexion between an extraordinary profusion of monocotyledonous plants, and a youthful condition of the world, if the dogma of certain cosmogonists be true, that planets, like certain projectiles, are always red hot when they are first cast ; but to this arbitrary hypothesis we need not again revert.

Between two and three hundred species of plants are now enumerated as belonging to the carboniferous era, and, with very few exceptions, not one of them are dicotyledonous\*. But these exceptions are as fatal to the doctrine of successive development as if there were a thousand, although they do not by any means invalidate the conclusion in regard to the heat of the ancient climate, for that depends on the numerical relations of the different classes.

The animal remains in the most ancient series of European sedimentary rocks (from the graywacke to the coal inclusive), consist chiefly of corals and testacea. Some estimate may generally be formed of the comparative extent of our information concerning the fossil remains of a particular era, by reference to the number of species of shells obtained from a particular group of strata. Some of the rarest species cannot be discovered, unless the more abundant kinds have been found again and again ; and if the variety brought to light be very considerable, it proves not only great diligence of research, but a good state of preservation of the organic contents of that formation. In the older rocks, many causes of destruction have operated, of which the influence has been rendered considerable by the immense lapse of ages during which they have acted. Mechanical pressure, derangement by subterranean movements, the action of chemical affinity, the percolation of acidulous waters and other agencies, have obliterated, in a greater or less degree, all traces of organization in fossil bodies. Sometimes only obscure or unintelligible impressions are left,

\* Fragments of dicotyledonous wood which have evidently belonged to at least two different species of trees, have been obtained from the coal-field of Fife, by Dr. Fleming, of Flisk, and the same gentleman has shewn me a large dicotyledonous stem which he procured from the graywacke of Cork. See a memoir by Dr. Fleming on the neighbourhood of Cork. (Trans. of Wern. Soc. Edin.) I am informed also by Dr. Buckland, that he has received from the coal-field of Northumberland another specimen of dicotyledonous wood, which is now in the Oxford Museum.

and the lapidifying process has often effaced not only the characters by which the species, but even those whereby the class might be determined. The number of organic forms which have disappeared from the oldest strata, may be conjectured from the fact, that their former existence is in many cases merely revealed to us by the unequal weathering of an exposed face of rock, by which certain parts are made to stand out in relief. As the number of species of shells found in the English series, from the graywacke to the coal inclusive, after attentive examination, amounts only to between one and two hundred species, we cannot be surprised that so few examples of vertebrated animals have as yet occurred. The remains of fish, however, appear in one of the lowest members of the group \*, which entirely destroys the theory of the precedence of the simplest forms of animals. The vertebra also of a saurian, as we before stated, has been met with in the mountain limestone of Northumberland †, so that the only negative fact remaining in support of the doctrine of the imperfect development of the higher orders of animals in remote ages, is the absence of birds and mammalia. The former are generally wanting in deposits of all ages, even where the highest order of animals occurs in abundance. Land mammifera could not, as we have before suggested, be looked for in strata formed in an ocean interspersed with isles, such as we must suppose to have existed in the northern hemisphere, when the carboniferous rocks were formed.

\* Numerous scales of fish have been found by Dr. Fleming in quarries of the old red sandstone at Clashbinnie in Perthshire, where I have myself collected them. These beds are decidedly older than the coal and mountain limestone of Fifeshire.

† I do not insist on the abundant occurrence of the scales of a tortoise nearly allied to *Trionyx*, in the bituminous schists of Caithness, and in the same formation in the Orkneys in Scotland, as another example of a fossil reptile in rocks as old as the carboniferous series; because the geological position of those schists is not yet determined with precision. Professor Sedgwick and Mr. Murchison indeed infer, that they alternate with a sandstone of the age of the old red sandstone; but this opinion wants confirmation. The numerous fish, and the tortoise of Caithness, are certainly in strata older than the lias, for that rock rests upon them unconformably; but as the strata between the schists and the granite contain no organic remains, and as no fossils of the carboniferous era have yet been found in the Caithness beds, the relative date of the tortoise cannot be determined with confidence. It might possibly be of the age of our magnesian limestone. See Geol. Trans. second series, vol. iii., part 1, p. 144, and for a representation of the scales of the *Trionyx*, plate 16 of the same part.

As all are agreed that the ancient strata in question were subaqueous, and for the most part submarine, from what data we may ask do naturalists infer the non-existence or even the rarity of warm-blooded quadrupeds in the earlier ages? Have they dredged the bottom of the ocean throughout an area co-extensive with that now occupied by the carboniferous rocks, and have they found that with the number of between one and two hundred species of shells they always obtain the remains of at least one land quadruped? Suppose our mariners were to report that on sounding in the Indian ocean near some coral reefs, and at some distance from the land, they drew up on hooks attached to their line portions of a leopard, elephant, or tapir; should we not be sceptical as to the accuracy of their statements; and if we had no doubt of their veracity, might we not suspect them to be unskilful naturalists? or, if the fact were unquestioned, should we not be disposed to believe that some vessel had been wrecked on the spot? The casualties must be rare indeed whereby land quadrupeds are swept by rivers and torrents into the sea, and still rarer must be the contingency of such a floating body not being devoured by sharks or other predaceous fish, such as were those of which we find the teeth preserved in some of the carboniferous strata\*. But if the carcass should escape and should happen to sink where sediment was in the act of accumulating, and if the numerous causes of subsequent disintegration should not efface all traces of the body included for countless ages in solid rock, is it not contrary to all calculation of chances that we should hit upon the exact spot,—that mere point in the bed of the ancient ocean, where the precious relic was entombed? Can we expect for a moment that when we have only succeeded amidst several thousand fragments of corals and shells, in finding a few bones of *aquatic* or *amphibious* animals, that we should meet with a single skeleton of an inhabitant of the land?

Clarence, in his dream, saw “in the slimy bottom of the deep,”

— a thousand fearful wrecks;

A thousand men, that fishes gnaw'd upon;

Wedges of gold, great anchors, heaps of pearl.

Had he also beheld amid “the dead bones that lay scatter'd

\* I have seen in the collection of Dr. Fleming, the teeth of carnivorous fish from the mountain limestone of Fife, which alternates with the coal.

by," the carcasses of lions, deer, and the other wild tenants of the forest and the plain, the fiction would have been deemed unworthy of the genius of Shakspeare. So daring a disregard of probability, so avowed a violation of analogy, would have been condemned as unpardonable even where the poet was painting those incongruous images which present themselves to a disturbed imagination during the visions of the night. But the cosmogonist is not amenable, even in his waking hours, to these laws of criticism; for he assumes either that the order of nature was formerly distinct, or that the globe was in a condition to which it can never again be reduced by changes which the existing law of nature can bring about. This assumption being once admitted, inexplicable anomalies and violations of analogy, instead of offending his judgment, give greater consistency to his reveries.

The organic contents of the secondary strata in general consist of corals and marine shells. Of the latter, the British strata (from the inferior oolite to the chalk inclusive) have yielded about six hundred species. Vertebrated animals are very abundant, but they are almost entirely confined to fish and reptiles. But some remains of cetacea have also been met with in the oolitic series of England \*, and the bones of two species of warm-blooded quadrupeds of extinct genera allied to the Opossum †. The occurrence of one individual of the higher classes of mammalia, whether marine or terrestrial, in these ancient strata, is as fatal to the theory of successive development, as if several hundreds had been discovered.

The tertiary strata, as will appear from what we have already stated, were deposited when the physical geography of the northern hemisphere had been entirely altered. Large inland lakes

\* On the authority of Dr. Buckland. Trans. Geol. Soc. vol. i. part 2, second series, p. 394.

† The mammiferous remains of the Stonesfield slate, near Oxford, consist of three or perhaps four jaws, one of which, now in the Oxford Museum, has been examined by M. Cuvier, and pronounced to belong to a species of *Didelphis*. Another of these valuable fossils in the possession of my friend Mr. Broderip, appears to be not only specifically, but generically distinct, from that shewn to M. Cuvier. See Observations on the Jaw of a fossil Mammiferous Animal found in the Stonesfield Slate, by W. J. Broderip, Esq., Sec. G.S., F.R.S., F.L.S., &c., Zool. Journ., vol. iii., p. 408; 1827.

had become numerous as in central France and many other countries. There were gulfs of the sea into which large rivers emptied themselves, where strata were formed like those of the Paris basin. There were then also littoral formations in progress, such as are indicated by the English *Crag*, and the *Faluns* of the Loire. The state of preservation of the organic remains of this period is very different from that of fossils in the older rocks, the colours of the shells, and even the cartilaginous ligaments uniting the valves being in some cases retained. No less than twelve hundred species of testacea have been found in the beds of the Paris basin, and an equal number in the more modern formations of the Subapennine hills; and it is a most curious fact in natural history, that the zoologist has already acquired more extensive information concerning the testacea which inhabited the ancient seas of northern latitudes at that era, than of those now living in the same parallels in Europe. The strata of the Paris basin are partly of fresh-water origin, and filled with the spoils of the land. They have afforded a great number of skeletons of land quadrupeds, but these relics are confined almost entirely to one small member of the group, and their conservation may be considered as having arisen from some local and accidental combination of circumstances. On the other hand, the scarcity of terrestrial mammalia in submarine sediment is elucidated, in a striking manner, by the extremely small number of such remains hitherto procured from the Subapennine hills. The facilities of investigation in these strata, which undergo rapid disintegration, are perhaps unexampled in the rest of Europe, and they have been examined by collectors for three hundred years. But, although they have already yielded twelve hundred species of testacea, the authenticated examples of associated remains of terrestrial mammalia, are extremely scanty; and several of those which have been cited by earlier writers as belonging to the elephant or rhinoceros, have since been declared, by able anatomists, to be the bones of whales and other cetacea. In about five or ten instances, perhaps, bones of the mastodon, rhinoceros, and some other animals, have been observed in this formation with marine shells attached. These must have been washed into the bed of the ancient sea when the strata



were forming, and they serve to attest the contiguity of land inhabited by large herbivora, which renders the rarity of such exceptions more worthy of attention. On the contrary, the number of skeletons of existing animals in the upper Val d'Arno, which are usually considered to be referrible to the same age as the Subapennine beds, occur in a deposit which was formed entirely in an inland lake, surrounded by lofty mountains.

The inferior member of our oldest tertiary formations in England, usually termed the plastic clay, has hitherto proved as destitute of mammiferous remains, as our ancient coal strata; and this point of resemblance between these deposits is the more worthy of observation, because the lignite, in the one case, and the coal in the other, are exclusively composed of terrestrial plants. From the London clay we have procured three or four hundred species of testacea, but the only bones of vertebrated animals are those of reptiles and fish. On comparing, therefore, the contents of these strata with those of our oolitic series, we find the supposed order of precedence inverted. In the more ancient system of rocks, mammalia, both of the land and sea, have been recognized, whereas in the newer, if negative evidence is to be our criterion, nature has made a retrograde, instead of a progressive, movement, and no animals more exalted in the scale of organization than reptiles are discoverable.

Not a single bone of a quadrumanous animal has ever yet been discovered in a fossil state, and their absence has appeared, to some geologists, to countenance the idea that the type of organization most nearly resembling the human came last in the order of creation, and was scarcely perhaps anterior to that of man. But the evidence on this point is quite inconclusive, for we know nothing, as yet, of the details of the various classes of the animal kingdom which inhabited the land up to the consolidation of the newest of the secondary strata; and when a large part of the tertiary formations were in progress, the climate does not appear to have been of such a tropical character as seems necessary for the development of the tribe of apes, monkeys, and allied genera. Besides, it must not be forgotten, that almost all the animals which occur in subaqueous deposits

are such as frequent marshes, rivers, or the borders of lakes, as the rhinoceros, tapir, hippopotamus, ox, deer, pig, and others. On the other hand, species which live in trees are extremely rare in a fossil state, and we have no data as yet for determining how great a number of the one kind we ought to find, before we have a right to expect a single individual of the other. If, therefore, we are led to infer, from the presence of crocodiles and turtles in the London clay, and from the coconuts and spices found in the isle of Sheppey, that at the period when our older tertiary strata were formed, the climate was hot enough for the quadrumanous tribe, we nevertheless could not hope to discover any of their skeletons until we had made considerable progress in ascertaining what were the contemporary Pachydermata; and not one of these, as we have already remarked, has been discovered as yet in any strata of this epoch in England\*.

It is, therefore, clear, that there is no foundation in geological facts, for the popular theory of the successive development of the animal and vegetable world, from the simplest to the most perfect forms; and we shall now proceed to consider another question, whether the recent origin of man lends any support to the same doctrine, or how far the influence of man may be considered as such a deviation from the analogy of the order of things previously established, as to weaken our confidence in the uniformity of the course of nature. We need not dwell on the proofs of the low antiquity of our species, for it is not controverted by any geologist; indeed, the real difficulty which we experience consists in tracing back the signs of man's existence on the earth to that comparatively modern period when species, now his contemporaries, began to predominate. If there be a difference of opinion respecting the occurrence in certain deposits of the remains of man and his works, it is always in reference to strata confessedly of the most modern order; and

\* The only exception of which I have heard is the tooth of an Anoplotherium, mentioned by Dr. Buckland as having been found in the collection of Mr. Allan, labelled "Binstead, Isle of Wight." The quarries of Binstead are entirely in the lower fresh-water formation, and such is undoubtedly the geological position in which we might look for the bones of such an animal. My friend Mr. Allan has shewn me this tooth, to which, unfortunately, none of the matrix is attached, so that it is still open to a captious sceptic to suspect that a Parisian fossil was so ticketed by mistake.

it is never pretended that our race co-existed with assemblages of animals and plants, of which *all the species* are extinct. From the concurrent testimony of history and tradition, we learn that parts of Europe, now the most fertile and most completely subjected to the dominion of man, were, within less than three thousand years, covered with forests, and the abode of wild beasts. The archives of nature are in perfect accordance with historical records; and when we lay open the most superficial covering of peat, we sometimes find therein the canoes of the savage, together with huge antlers of the wild stag, or horns of the wild bull. Of caves now open to the day in various parts of Europe, the bones of large beasts of prey occur in abundance; and they indicate, that at periods extremely modern in the history of the globe, the ascendancy of man, if he existed at all, had scarcely been felt by the brutes\*.

No inhabitant of the land exposes himself to so many dangers on the waters as man, whether in a savage or a civilized state, and there is no animal, therefore, whose skeleton is so liable to become imbedded in lacustrine or submarine deposits; nor can it be said, that his remains are more perishable than those of other animals, for in ancient fields of battle, as Cuvier has observed, the bones of men have suffered as little decomposition as those of horses which were buried in the same grave. But even if the more solid parts of our species had disappeared, the impression would have remained engraven on the rocks as have the traces of the tenderest leaves of plants, and the integuments of many animals. Works of art, moreover, composed of the most indestructible materials, would have outlasted almost all the organic contents of sedimentary rocks; edifices, and even entire cities have, within the times of history, been buried under volcanic ejections, or submerged beneath the sea, or engulfed by earthquakes; and had these catastrophes been repeated throughout an indefinite lapse of ages, the high antiquity of man would have been inscribed in far more legible characters on the frame-work of the globe, than are the forms of the ancient vegetation which once covered the isles of the

\* We shall discuss in a subsequent chapter, when treating of animal remains in caves, the probable antiquity assignable to certain human bones and works of art found intermixed with remains of extinct animals in the cavern of Bize, and in several localities in the department of Herault, in France.

northern ocean, or of those gigantic reptiles, which at later periods peopled the seas and rivers of the northern hemisphere.

Assuming, then, that man is, comparatively speaking, of modern origin, can his introduction be considered as one step in a progressive system by which, as some suppose, the organic world advanced slowly from a more simple to a more perfect state? To this question we may reply, that the superiority of man depends not on those faculties and attributes which he shares in common with the inferior animals, but on his reason by which he is distinguished from them.

If the organization of man were such as would confer a decided pre-eminence upon him, even if he were deprived of his reasoning powers, and provided only with such instincts as are possessed by the lower animals, he might then be supposed to be a link in a progressive chain, especially if it could be shewn that the successive development of the animal creation had always proceeded from the more simple to the more compound, from species most remote from the human type to those most nearly approaching to it. But this is an hypothesis which, as we have seen, is wholly unsupported by geological evidence. On the other hand, we may admit, that man is of higher dignity than were any pre-existing beings on the earth, and yet question whether his coming was a step in the gradual advancement of the organic world: for the most highly civilized people may sometimes degenerate in strength and stature, and become inferior in their physical attributes to the stock of rude hunters from which they descended. If then the physical organization of man may remain stationary, or even become deteriorated, while the race makes the greatest progress to higher rank and power in the scale of rational being, the animal creation also may be supposed to have made no progress by the addition to it of the human species, regarded merely as a part of the organic world. But, if this reasoning appear too metaphysical, let us waive the argument altogether, and grant that the animal nature of man, even considered apart from the intellectual, is of higher dignity than that of any other species; still the introduction at a certain period of our race upon the earth, raises no presumption whatever that each former exertion of creative power was characterized by the successive development of *irrational*

animals of higher orders. The comparison here instituted is between things so dissimilar, that when we attempt to draw such inferences, we strain analogy beyond all reasonable bounds. We may easily conceive that there was a considerable departure from the succession of phenomena previously exhibited in the organic world, when so new and extraordinary a circumstance arose, as the union, for the first time, of moral and intellectual faculties capable of indefinite improvement, with the animal nature. But we have no right to expect that there were any similar deviations from analogy—any corresponding steps in a progressive scheme, at former periods, when no similar circumstances occurred.

But another, and a far more difficult question may arise out of the admission that man is comparatively of modern origin. Is not the interference of the human species, it may be asked, such a deviation from the antecedent course of physical events, that the knowledge of such a fact tends to destroy all our confidence in the uniformity of the order of nature, both in regard to time past and future? If such an innovation could take place after the earth had been exclusively inhabited for thousands of ages by inferior animals, why should not other changes as extraordinary and unprecedented happen from time to time? If one new cause was permitted to supervene, differing in kind and energy from any before in operation, why may not others have come into action at different epochs? Or what security have we that they may not arise hereafter? If such be the case, how can the experience of one period, even though we are acquainted with all the possible effects of the then existing causes, be a standard to which we can refer all natural phenomena of other periods?

Now these objections would be unanswerable, if adduced against one, who was contending for the absolute uniformity throughout all time of the succession of sublunary events—if, for example, he was disposed to indulge in the philosophical reveries of some Egyptian and Greek sects, who represented all the changes both of the moral and material world as repeated at distant intervals, so as to follow each other in their former connexion of place and time. For they compared the course of events on our globe to astronomical cycles, and not only did they consider all sublunary affairs to be under the

influence of the celestial bodies, but they taught that on the earth, as well as in the heavens, the same identical phenomena recurred again and again in a perpetual vicissitude. The same individual men were doomed to be re-born, and to perform the same actions as before ; the same arts were to be invented, and the same cities built and destroyed. The Argonautic expedition was destined to sail again with the same heroes, and Achilles with his Myrmidons, to renew the combat before the walls of Troy.

Alter erit tum Tiphys et altera quæ vehat Argo  
Dilectos heroas ; erunt etiam altera bella,  
Atque iterum ad Trojam magnus mittetur Achilles\*.

The geologist, however, may condemn these tenets as absurd, without running into the opposite extreme, and denying that the order of nature has, from the earliest periods, been uniform in the same sense in which we believe it to be uniform at present. We have no reason to suppose, that when man first became master of a small part of the globe, a greater change took place in its physical condition than is now experienced when districts, never before inhabited, become successively occupied by new settlers. When a powerful European colony lands on the shores of Australia, and introduces at once those arts which it has required many centuries to mature ; when it imports a multitude of plants and large animals from the opposite extremity of the earth, and begins rapidly to extirpate many of the indigenous species, a mightier revolution is effected in a brief period, than the first entrance of a savage horde, or their continued occupation of the country for many centuries, can possibly be imagined to have produced. If there be no impropriety in assuming that the system is uniform when disturbances so unprecedented occur in certain localities, we can with much greater confidence apply the same language to those primeval ages when the aggregate number and power of the human race, or the rate of their advancement in civilization, must be supposed to have been far inferior.

If the barren soil around Sidney had at once become fertile upon the landing of our first settlers ; if, like the happy isles

\* Virgil, *Ecol.* 4. For an account of these doctrines, see Dugald Stewart's *Elements of the Philosophy of the Human Mind*, vol. ii. chap. 2, sect. 4, and Prichard's *Egypt. Mythol.*, p. 177.

whereof the poets have given us such glowing descriptions, those sandy tracts had begun to yield spontaneously an annual supply of grain, we might then, indeed, have fancied alterations still more remarkable in the economy of nature to have attended the first coming of our species into the planet. Or if, when a volcanic island like Ischia was, for the first time brought under cultivation by the enterprise and industry of a Greek colony, the internal fire had become dormant, and the earthquake had remitted its destructive violence, there would then have been some ground for speculating on the debilitation of the subterranean forces, when the earth was first placed under the dominion of man. But after a long interval of rest, the volcano bursts forth again with renewed energy, annihilates one-half of the inhabitants, and compels the remainder to emigrate. Such exiles, like the modern natives of Cumana, Calabria, Sumbawa, and other districts, habitually convulsed by earthquakes, would probably form no very exalted estimate of the sagacity of those geological theorists, who, contrasting the *human* with antecedent epochs, have characterized it as *the period of repose*.

In reasoning on the state of the globe immediately before our species was called into existence, we may assume that all the present causes were in operation, with the exception of man, until some geological arguments can be adduced to the contrary. We must be guided by the same rules of induction as when we speculate on the state of America in the interval that elapsed between the period of the introduction of man into Asia, the cradle of our race, and that of the arrival of the first adventurers on the shores of the New World. In that interval, we imagine the state of things to have gone on according to the order now observed in regions unoccupied by man. Even now, the waters of lakes, seas, and the great ocean, which teem with life, may be said to have no immediate relation to the human race—to be portions of the terrestrial system of which man has never taken, nor ever can take, possession, so that the greater part of the inhabited surface of the planet remains still as insensible to our presence, as before any isle or continent was appointed to be our residence.

The variations in the external configuration of the earth, and the successive changes in the races of animals and plants inha-

biting the land and sea, which the geologist beholds when he restores in imagination the scenes presented by certain regions at former periods, are not more full of wonderful or inexplicable phenomena, than are those which a traveller would witness who traversed the globe from pole to pole. Or if there be more to astonish and perplex us in searching the records of the past, it is because one district may, in an indefinite lapse of ages, become the theatre of a greater number of extraordinary events, than the whole face of the globe can exhibit at one time. However great the multiplicity of new appearances, and however unexpected the aspect of things in different parts of the present surface, the observer would never imagine that he was transported from one system of things to another, because there would always be too many points of resemblance, and too much connexion between the characteristic features of each country visited in succession, to permit any doubt to arise as to the continuity and identity of the whole plan.

“In our globe,” says Paley, “new countries are continually discovered, but the old laws of nature are always found in them: new plants perhaps, or animals, but always in company with plants and animals which we already know; and always possessing many of the same general properties. We never get amongst such original, or totally different modes of existence, as to indicate that we are come into the province of a different Creator, or under the direction of a different will. In truth, the same order of things attends us wherever we go\*.” But the geologist is in danger of drawing a contrary inference, because he has the power of passing rapidly from the events of one period to those of another—of beholding, at one glance, the effects of causes which may have happened at intervals of time incalculably remote, and during which, nevertheless, no local circumstances may have occurred to mark that there is a great chasm in the chronological series of nature’s archives. In the vast interval of time which may really have elapsed between the results of operations thus compared, the physical condition of the earth may, by slow and insensible modifications, have become entirely altered, one or more races

\* Natural Theology, Chap. xxv.



of organic beings may have passed away, and yet have left behind, in the particular region under contemplation, no trace of their existence. To a mind unconscious of these intermediate links in the chain of events, the passage from one state of things to another must appear so violent, that the idea of revolutions in the system inevitably suggests itself. The imagination is as much perplexed by such errors as to time, as it would be if we could annihilate space, and by some power, such as we read of in tales of enchantment, could transfer a person who had laid himself down to sleep in a snowy arctic wilderness, to a valley in a tropical region, where on awaking he would find himself surrounded by birds of brilliant plumage, and all the luxuriance of animal and vegetable forms of which nature is there so prodigal. The most reasonable supposition, perhaps, which a philosopher could make, if by the necromancer's art he was placed in such a situation, would be, that he was dreaming; and if a geologist forms theories under a similar delusion, we should not expect him to preserve more consistency in his speculations, than in the train of ideas in an ordinary dream.

But if, instead of inverting the natural order of inquiry, we cautiously proceed in our investigations, from the known to the unknown, and begin by studying the most modern periods of the earth's history, attempting afterwards to decipher the monuments of more ancient changes, we can never so far lose sight of analogy, as to suspect that we have arrived at a new system, governed by different physical laws. In more recent formations, consisting often of strata of great thickness, the shells of the present seas and lakes, and the remains of animals and plants now living on the land, are imbedded in great numbers. In those of more ancient date, many of the same species are found associated with others now extinct. These unknown kinds again are observed in strata of still higher antiquity, connected with a great number of others which have also no living representatives, till at length we arrive at periods of which the monuments contain exclusively the remains of species with many genera foreign to the present creation. But even in the oldest rocks which contain organic remains, some genera of marine animals are recognized, of which species still exist in our seas, and these are repeated

at different intervals in all the intermediate groups of strata, attesting that, amidst the great variety of revolutions of which the earth's surface has been the theatre, there has never been a departure from the conditions necessary for the existence of certain unaltered types of organization. The uniformity of animal instinct, observes Mr. Stewart \*, pre-supposes a corresponding regularity in the physical laws of the universe, "insomuch that if the established order of the material world were to be essentially disturbed, (the instincts of the brutes remaining the same,) all their various tribes would inevitably perish." Now, any naturalist will be convinced, on slight reflection, of the justice of this remark. He will also admit that the same species have always retained the same instincts, and therefore that all the strata wherein any of *their* remains occur, must have been formed when the phenomena of inanimate matter were the same as they are in the actual condition of the earth. The same conclusion must also be extended to the extinct animals with which the remains of these living species are associated; and by these means we are enabled to establish the permanence of the existing physical laws, throughout the whole period when the tertiary deposits were formed. We have already stated that, during that vast period, a large proportion of all the lands in the northern hemisphere were raised above the level of the sea.

The modifications in the system of which man is the instrument, do not, in all probability, constitute so great a deviation from analogy as we usually imagine; we often, for example, form an exaggerated estimate of the extent of the power displayed by man in extirpating some of the inferior animals, and causing others to multiply; a power which is circumscribed within certain limits, and which, in all likelihood, is by no means exclusively exerted by our species. The growth of human population cannot take place without diminishing the numbers, or causing the entire destruction of many animals. The larger carnivorous species give way before us, but other quadrupeds of smaller size, and innumerable birds, insects, and plants, which are inimical to our interests, increase in spite of us, some attacking our food, others our raiment and persons, and others interfering with our agricultural and horticultural

\* Phil. of the Human Mind, vol. ii., p. 230.

labours. We force the ox and the horse to labour for our advantage, and we deprive the bee of his store; but, on the other hand, we raise the rich harvest with the sweat of our brow, and behold it devoured by myriads of insects, and we are often as incapable of arresting their depredations as of staying the shock of an earthquake, or the course of a stream of burning lava. The changes caused by other species, as they gradually diffuse themselves over the globe, are inferior probably in magnitude, but are yet extremely analogous to those which we occasion. The lion, for example, and the migratory locust, must necessarily, when they first made their way into districts now occupied by them, have committed immense havoc amongst the animals and plants which became their prey. They may have caused many species to diminish, perhaps wholly to disappear; but they must also have enabled some others greatly to augment in number, by removing the natural enemies by which they had been previously kept down. It is probable from these, and many other considerations, that as we enlarge our knowledge of the system, we shall become more and more convinced, that the alterations caused by the interference of man deviate far less from the analogy of those effected by other animals than we usually suppose. We are often misled, when we institute such comparisons, by our knowledge of the wide distinction between the instincts of animals and the reasoning power of man; and we are apt hastily to infer, that the effects of a rational and an irrational species, considered merely as *physical agents*, will differ almost as much as the faculties by which their actions are directed. A great philosopher has observed, that we can only command nature by obeying her laws, and this principle is true even in regard to the astonishing changes which are superinduced in the qualities of certain animals and plants by domestication and garden culture. We can only effect such surprising alterations by assisting the development of certain instincts, or by availing ourselves of that mysterious law of their organization, by which individual peculiarities are transmissible from one generation to another.

We are not, however, contending that a real departure from the antecedent course of physical events cannot be traced in the introduction of man. If that latitude of action which

enables the brutes to accommodate themselves in some measure to accidental circumstances, could be imagined to have been at any former period so great, that the operations of instinct were as much diversified as are those of human reason, it might perhaps be contended, that the agency of man did not constitute an anomalous deviation from the previously established order of things. It might then have been said, that the earth's becoming at a particular period the residence of human beings, was an era in the moral, not in the physical world—that our study and contemplation of the earth, and the laws which govern its animate productions, ought no more to be considered in the light of a disturbance or deviation from the system, than the discovery of the satellites of Jupiter should be regarded as a physical event in the history of those heavenly bodies, however influential they may have become from that time in advancing the progress of sound philosophy among men, and in augmenting human resources by aiding navigation and commerce. The distinctness, however, of the human, from all other species, considered merely as an efficient cause in the physical world, is real, for we stand in a relation to contemporary species of animals and plants, widely different from that which other irrational animals can ever be supposed to have held to each other. We modify their instincts, relative numbers, and geographical distribution, in a manner superior in degree, and in some respects very different in kind from that in which any other species can affect the rest. Besides, the progressive movement of each successive generation of men causes the human species to differ more from itself in power at two distant periods, than any one species of the higher order of animals differs from another. The establishment, therefore, by geological evidence of the first intervention of such a peculiar and unprecedented agency, long after other parts of the animate and inanimate world existed, affords ground for concluding that the experience during thousands of ages of all the events which may happen on this globe would not enable a philosopher to speculate with confidence concerning future contingencies. If an intelligent being, therefore, after observing the order of events for an indefinite series of ages had witnessed at last so wonderful an innovation as this, to what extent would his belief in the regularity of the system

be weakened?—would he cease to assume that there was permanency in the laws of nature?—would he no longer be guided in his speculations by the strictest rules of induction? To this question we may reply, that had he previously presumed to dogmatize respecting the absolute uniformity of the order of nature, he would undoubtedly be checked by witnessing this new and unexpected event, and would form a more just estimate of the limited range of his own knowledge, and the unbounded extent of the scheme of the universe. But he would soon perceive that no one of the fixed and constant laws of the animate or inanimate world was subverted by human agency, and that the modifications produced were on the occurrence of new and extraordinary circumstances, and those not of a *physical*, but a *moral* nature. The deviation permitted, would also appear to be as slight as was consistent with the accomplishment of the new *moral* ends proposed, and to be in a great degree temporary in its nature, so that whenever the power of the new agent was withheld, even for a brief period, a relapse would take place to the ancient state of things; the domesticated animal, for example, recovering in a few generations its wild instinct, and the garden-flower and fruit-tree reverting to the likeness of the parent stock.

Now, if it would be reasonable to draw such inferences with respect to the future, we cannot but apply the same rules of induction to the past. It will scarcely be disputed that we have no right to anticipate any modifications in the results of existing causes in time to come, which are not conformable to analogy, unless they be produced by the progressive development of human power, or perhaps from some other new relations between the moral and material worlds. In the same manner we must concede, that when we speculate on the vicissitudes of the animate and inanimate creation in former ages, we have no ground for expecting any anomalous results, unless where man has interfered, or unless clear indications appear of some other *moral* source of temporary derangement. When we are unable to explain the monuments of past changes, it is always more probable that the difficulty arises from our ignorance of all the existing agents, or all their possible effects in an indefinite lapse of time, than that some cause was formerly in operation which has ceased to act; and if in any part of

the globe the energy of a cause appears to have decreased, it is always probable, that the diminution of intensity in its action is merely local, and that its force is unimpaired, when the whole globe is considered. But should we ever establish by unequivocal proofs, that certain agents have, at particular periods of past time, been more potent instruments of change over the entire surface of the earth than they now are, it will be more consistent with philosophical caution to presume, that after an interval of quiescence they will recover their pristine vigour, than to regard them as worn out.

The geologist who yields implicit assent to the truth of these principles, will deem it incumbent on him to examine with minute attention all the changes now in progress on the earth, and will regard every fact collected respecting the causes in diurnal action, as affording him a key to the interpretation of some mystery in the archives of remote ages. Our estimate, indeed, of the value of all geological evidence, and the interest derived from the investigation of the earth's history, must depend entirely on the degree of confidence which we feel in regard to the permanency of the laws of nature. Their immutable constancy alone can enable us to reason from analogy, by the strict rules of induction, respecting the events of former ages, or, by a comparison of the state of things at two distinct geological epochs, to arrive at the knowledge of general principles in the economy of our terrestrial system.

The uniformity of the plan being once assumed, events which have occurred at the most distant periods in the animate and inanimate world will be acknowledged to throw light on each other, and the deficiency of our information respecting some of the most obscure parts of the present creation will be removed. For as by studying the external configuration of the existing land and its inhabitants, we may restore in imagination the appearance of the ancient continents which have passed away, so may we obtain from the deposits of ancient seas and lakes an insight into the nature of the subaqueous processes now in operation, and of many forms of organic life, which, though now existing, are veiled from our sight. Rocks, also produced by subterranean fire in former ages at great depths in the bowels of the earth, present us, when upraised by gradual movements, and exposed to the light of heaven,

with an image of those changes which the deep-seated volcano may now occasion in the nether regions. Thus, although we are mere sojourners on the surface of the planet, chained to a mere point in space, enduring but for a moment of time, the human mind is not only enabled to number worlds beyond the unassisted ken of mortal eye, but to trace the events of indefinite ages before the creation of our race, and is not even withheld from penetrating into the dark secrets of the ocean, or the interior of the solid globe; free, like the spirit which the poet described as animating the universe,

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ire per omnes

Terrasque tractusque maris, cœlumque profundum.

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