

Occasionally, I believe, there is an appearance of stratification in these deposits. But this by no means contradicts the hypothesis here offered. It might very well happen that a cave of this sort would be frequented by different genera of beasts of prey in succession—the cave-bear, hyæna, and tiger—each of which might occupy it exclusively for a lengthened period, and bring in different kinds of soil, as it sought its prey in the marshes, the meadows, the woods, or on the mountain-side. And, in M. Fontan's account, there seems to be proof that something of this kind had happened, for he found loamy sand in the upper cave, and a blackish earth in the lower,—a distribution of material very well agreeing with the view here taken, but not quite consisting with the notion of deposit by water; as sand and loam are usually heavier substances than black earth, and would rather than the latter have been left on the lower level.

I think, then, that the deposits of the open caverns may be ascribed for the most part to the carnivora frequenting them, which must have brought in, adhering to their own feet and fur, and to those of their prey, a prodigious quantity of earth and stones, which we must needs believe would remain where they left it, mixed with the fragments of the bones they gnawed, unless we are prepared to say that the floods washed all that out first to make way for a similar deposit brought from somewhere else.

CORRESPONDENCE.

CREATION BY LAW.

SIR,—I make no excuse for offering to the intelligent readers of the "GEOLOGIST"—a periodical in which the freest discussion has been invited and carried on respecting the "*Origin of Species*"—the remarks which a careful perusal of the latest published works on the subject have led me to express. I allude chiefly to Professor Owen's "*Palaontology*," a second edition of which has recently been given to an admiring world, and to the excellent little work by Mr. David Page, which you noticed in the "GEOLOGIST" for September.

In both these works there is a strong appeal made in favour of a "constantly operating secondary law," by which the several species of animals have been called into being. Prof. Owen's generalizations are as follows:—

"*Palaontology* has yielded most important facts to the highest range of knowledge to which the human intellect aspires. It teaches that the globe

allotted to man has revolved in its orbit through a period of time so vast, that the mind, in the endeavour to realize it, is strained by an effort like that by which it strives to conceive the space dividing the solar system from the most distant nebulae.

"Palæontology has shown that, from the inconceivably remote period of the deposition of the Cambrian rocks, the earth has been vivified by the sun's light and heat, has been fertilized by refreshing showers, and washed by tidal waves; that the ocean not only moved in orderly oscillations regulated, as now, by sun and moon, but was rippled and agitated by winds and storms; that the atmosphere, besides these movements, was healthily influenced by clouds and vapours, rising, condensing, and falling in ceaseless circulation. With such conditions of life, palæontology demonstrates that life has been enjoyed during the same countless thousands of years; and that with life, from the beginning, there has been death. The earliest testimony of the living thing, whether coral, crustacean, or shell, in the oldest fossiliferous rock, is at the same time proof that it died. At no period does it appear that the gift of life has been monopolized by contemporary individuals through a stagnant sameness of untold time, but it has been handed down from generation to generation, and successively enjoyed by the countless thousands that constitute the species. Palæontology further teaches, that not only the individual, but the species perishes; that as death is balanced by generation, so extinction has been concomitant with the creative power which has produced a succession of species; and furthermore, that, in this succession, there has been 'an advance and progress in the main.' Thus we learn that the creative force has not deserted the earth during any of the epochs of geological time that have succeeded to the first manifestation of such force; and that, in respect to no one class of animals, has the operation of creative force been limited to one geological epoch; and perhaps the most important and significant result of palæontological research has been the establishment of the axiom of the continuous operation of the ordained becoming of the species of living things." ("Palæontology," 2nd edition, p. 2.)

In a diagram illustrating the above generalizations, the genetic succession of animal life is summed up. It appears from this corrected statement of the latest discoveries in palæontology, that the class of fishes makes its first appearance in the Upper Silurian strata, and Prof. Owen draws the conclusion that "those species which are most useful to man have immediately preceded him in the order of creation," and that they "have superseded species which, to judge by the bony garpikes (*Lepidosteus*) were much less fitted to afford mankind a sapid and wholesome food."

The earliest known reptile is found, not, as generally supposed, in the Devonian age, but in the Coal measures, and all the earliest created forms belong to the lowest or Ganocephalous group, analogous to the *Lepidostirens*, or mud-fishes, which attracted so much attention at the Crystal Palace some time ago. It is not until the Tertiary times that the reptiles approach in organization to those of the present day.

The class birds is represented by footprints in the Upper Trias, in which stratum, however, no evidence has yet been found of actual bones, which more conclusive proof is not found below the Lower Chalk. All the earliest created birds exhibit the characters of the order *Cursores*, "characters of the embryo or immature individuals of the "higher orders of birds, and are consequently placed at the lowest step of the scale of ornithic organization.

In the higher class mammalia it is most interesting to find again that the greatest part of the earliest created mammalia belong to the lowest orders of the class. We find marsupials in the Upper Trias (*Microlestes*), and in the Oolitic beds. We find a solitary small vegetable feeding pachyderm *Stereognathus* in the Oolite, and a doubtful cetacean in the Greensand. But it is not till the Eocene division of tertiary time that we find the class reach its culminant development. The earliest created mammals were the nearest to the ideal archetype. The fossil *Anoplotheres* and *Paleotheres* resembled each other in their dentition more than the existing musk-deer and tapirs. The former extinct animals, however, gave

place in the Miocene to true ruminants, and to mammalia more closely resembling the existing fauna. It is not until the Pliocene period that we find mammalia of the same species as the present. Some of the extinct forms, as the rhinoceros, elk, and hayna of Europe, lived down to the period when man existed with, and probably extirpated them. At Abbeville, in France, and Köstritz, in Saxony, the remains of man are found in the same strata as the remains of those animals which are now confined to more tropical regions. The antiquity of the human race, as proved by the discoveries of M. Boucher de Perthes, is thus thrown back to a historically distant period, though a recent one geologically. As Prof. Owen says, "There seems to have been a time when life was not; there may therefore be a period when it will cease to be" (p. 412).

Professor Owen, after recapitulating the order in which animal life made its appearance upon earth, devotes much space to the subject of the extinction of species, and points out many species of animals which are vanishing before the onward march of civilized man. The dodo has disappeared from the Mascarene Islands within the last two hundred years. The beaver, once common in Wales in the historical period, survives still in the back woods of America, and is rapidly becoming extinct. The chase in Europe has almost extirpated the races of bears, wild boars, wolves, elks, and wild oxen, which peopled our English plains within historic times. The aurochs, descendant of the once formidable *Bison prisus*, is only preserved in Lithuania through the careful protection of the Emperor of Russia. The author of the present paper has been personally assured by an intelligent Moor, Hadj Arábi Ben-Is, that the breed of lions is rapidly verging towards extinction on the slopes of the greater and lesser Atlas. The elephants and rhinoceroses of Abbeville were contemporary with man, and most probably were extirpated by him. In the last century a colossal cetacean existed in enormous shoals in Behring's Straits, but has since succumbed to the ravages of the whalers. On the other hand, many species of domestic animals, as, *e. g.*, the horse, ox, sheep, &c., have been introduced by man into geographical situations remote from their original habitat.

With respect to the momentous subject of the "mysterious coming into being" of species, which has been canvassed amongst scientific men for the last hundred years, it is my object to endeavour to lay the present state of the question clearly before your readers.

The position in which the contending forces of special creationists and progressionists rest at present has little changed from those occupied by the great chiefs and antagonists of past science, Cuvier and Geoffroy St. Hilaire amongst palæontologists, Lyell and Sedgwick amongst geologists. The same creeds and watchwords are maintained by the hierarchs and generals of the day. But they are professed and given by different disciples, and by less obedient and even more mutinous sentinels. It is impossible for the most "prepossessed uniformitarian" to contend that there is not springing up at the present day a vast section of geologists who agree with Baden Powell in his memorable declaration that "while those arguments most commonly relied upon against transmutation are completely refuted, there is still no positive evidence to establish it as a demonstrated theory. Yet, as a mere philosophical conjecture, the idea of transmutation of species, under adequate changes of condition, and in incalculably long periods of time, seems supported by fair analogy and probability." Whether obscured by the dazzling sophisms of over-zealous teleologists, or mutilated in the corrupt elementary treatises of the day, the great morphological principles of *unity of, and adherence to, archetype, and successional development* throughout geological time, proclaimed by Owen, St. Hilaire, and De Blainville, seem fairly to have maintained their claim to be treated as legitimate postulates. The successive and special creations, "invented by Cuvier as Ovid invented metamorphoses," are no longer universally regarded as the way by which the enormous phenomena of living beings have been produced. The belief is rapidly increasing amongst biologists that the true appreciation of the causes which have originated such changes is to be arrived at by a careful examination of the phenomena exhibited by the lower animals, *e. g.*, *parthenogenesis*, and the alternation

of generations. To form a just conception of the whole animal kingdom, such whole should be regarded in its most simple aspect, and it is not by a pertinacious negation of all theories, and by "an ossification of the organs of intelligence," that science will be advanced. While, on the other hand, any proofs which transmutationists may adduce should alone rest upon a studious regard of the phenomena of embryology, and upon a synthetic mode of treating nature.

The fact is now more clearly understood that "the types of animals first developed are more like the embryonic forms of their respective groups, and the progression observed is from those general types to forms more highly specialized." (Owen.) Thus the embryo ruminants *Anoplotherium* and *Dichodon* of the Eocene period appeared before the present stags and antelopes, and, in common with nearly all the Eocene mammalia, maintained their typical dentition of forty-four teeth, which has since given place to the more specialized and modified dentition of the forms of the present day. The lowest organized mammalia appeared first on our planet. At least four-fifths of the Secondary mammalia belong to the lower sub-classes *Lyn-* and *Lissen-cephala*, bearing close analogy, and perhaps affinity to the oviparous vertebrata. "In all the orders of ancient animals, there is an ascending gradation of character from first to last." Professor Owen has proved that "there are traces in the old deposits of the earth of an organic progression among the successive forms of life." "Man, the last created, whose organization is regarded as the highest, departs most from the vertebrate archetype." We must regard it as an event depending upon some higher law than that of mere empirical coincidence, that the most typical animals should be found first in the scale, and the most specialized last. These remarkable coincidences, coupled with the astonishing facts revealed to us by the labours of those naturalists who have by their researches on the changes and metamorphoses of the lower animals, discovered the great law of *Parthenogenesis*, by which successive alternate generations of animals are produced by and from some animals in no way resembling them, such produced animals, or their descendants, in turn reverting back to the original form (e. g., the tape-worm), seem to "impress upon the minds of the most exact reasoners in biology a conviction of a constantly operating secondary creational law." (Palæontology, p. 407.)

I have the greatest doubt myself whether "natural selection" is this *vera causa*—this secondary law which has produced species. At the British Association last September, Prof. Babington said:—

"Nothing could be more disastrous for science than the giving up the study of individual forms. If the Darwinian theory led to the abandonment of our present idea of a species, it ought to lead us to be much more exact in the study of individual forms."

Dr. Lankester, at the same meeting, expressed his belief that:—

"Those who had supported Mr. Darwin had done so rather on the ground that his hypothesis had been a method of eliciting, arranging, and classifying a certain set of facts, than as believing that those facts led to the necessary acceptance of the hypothesis. There had never been an accepted theory of the origin of species; Mr. Darwin's strongest opponent could not pretend the contrary. Persons were getting too much to mis-estimate the value of forms. They did not recollect that every departure had been produced by some physical law—by some force operating upon that particular form; and that it was necessary to study what had been the external circumstances producing that change, whether the distinct origin of species was believed in or not. A great naturalist, who was still a friend of Mr. Darwin, once said to him (Dr. Lankester), 'The mistake is, that Darwin has dealt with origin. Why did he not put his facts before us, and let them rest?' He believed that that was where the public were in error—in supposing that those facts explained the origin of species."

Whilst condemning the universal application of the selective principle as an active agent capable of producing the complicated fauna of geological ages, let me express my admiration for those convincing passages in which Mr. Darwin offers a solution of the curious fact of the presence of wingless birds, e. g., the *Apteryx* of New Zealand, the Dodo of Mauritius, the *Nesiotis* of *Tristo da Cunha*, in islands remote from the great continents. Natural Selection here may modify a bird's wings, where no functional requirement for their development exists, but it can never, in my humble opinion, produce an *Ornithorhynchus* or a whale from any bird or Cetiosaurian.

My readers will have read the chapters in which Mr. Darwin lays stress upon the enormous lapse of time required for the deposition of the geological strata. However they, like Professors Phillips and Thomson, may impugn the exact details of his statistics, they rise from the perusal of these chapters with the full conviction that the time required must have been immense. They can only comprehend such arithmetical amount by a comparison with those results which astronomical or mathematical science has arrived at, as to the vast distance between our globe and the solar or sidereal systems. In this extensive field they must reflect that the small portion of space in time which falls under their immediate cognizance and observation is not sufficient to enable them to pronounce with any certainty as to the vast laws which may govern the whole. An anonymous writer on the subject, by a direct illustration of the well-known phenomena* of Babbage's calculating machine, lays great stress upon this argument, and I confess I am inclined to regard it as an approach to truth. By some originally conceived law, consonant with the development of the original type, species which invariably propagate descendants immediately resembling themselves through countless ages, may, after the expiration of some given limit of time, or under the influence of some unknown condition, suddenly change their power, and develop organs which are superadded to the distinctive characters of their original type. I can see no other way of accounting for the existence of such exceedingly aberrant forms as the *Pterodactylus* or the *Ornithorhynchus*. Our induction is not sufficiently vast to lay down general rules upon the subject; but I think that if the old principle of "successive" and "special" creations representing the so-called "theological" epoch of thought, be abrogated, the principle of the uniformity of progression by natural selection, representing the equally baneful "metaphysical" stage, cannot erect itself a temple on the ruins of the former. It is only by a regard of the question of the origin of species, as one under the influence of some dynamical law, that a solution of this great problem can be arrived at. (Comte. Philosophie Positive.)

In the words of the eminent writer in the "Edinburgh Review": "Circumstances are conceivable—changes of surrounding influences, the operation of some intermittent law at long intervals, like that of the calculating machine quoted by the author of 'Vestiges,' under which the *monad* might go on splitting up into *monads*, the *gregarina* might go on breeding *gregarinae*, the *cercaria cercariae*, &c., and thus four or five not merely different specific, but different generic and ordinal forms, zoologically viewed, might all diverge from an antecedent quite distinct form."

Mr. David Page, in his recently published little work on the "World's Life-System," exhibited the spirit in which the advanced palaeontologists of the present day have accepted the principle of Creation by Law, while they wisely abstain from defining its method, or fixing the precise process by which new species are originated.

I am glad to see that Professor Owen has elsewhere condemned any imaginary scheme by which some anthropoid ape, *e. g.*, the Gorilla, might, by Mr. Darwin's principle of Natural Selection, become a man. He is too well aware that the species is yet unknown to naturalists which is sufficiently allied to mankind to have served as its immediate ancestor. No person can seriously think that mankind, with its peculiarly developed brain, could have been recruited either from *Gorilla* or *Dryopithecus*.† Those naturalists who assert man's simian origin,

* The statement made in the "Vestiges" with respect to the periodical difference in the results of the calculating process of Babbage's machine is founded on a mistake.—ED. GEOL.

† I am most anxious to avoid introducing anatomical subjects, which would be foreign to the pages of the *Geologist*, but I may take this opportunity of stating my belief based upon constant and careful observation, that the human brain possesses organs—*e. g.*, the "third cerebral lobe," the "posterior cornu," and the "hippocampus minor," which are absent in the brains of the apes. I am aware that several zoologists have lately expressed a contrary opinion, but I cannot refrain from stating the result of my inquiries, although contrary to the theory of transmutation. Truth should be paramount over any preconceived hypothesis.

whilst pledging themselves to the as yet unproved empiric method of Natural Selection, retard the "rapid and right progress" of zoology, unmindful of the Baconian warning that "knowledge, whilst it lies in aphorisms and observations, remains in a growing state; but when once fashioned into methods, though it may be farther polished, illustrated, and fitted for use, it no longer increases in bulk and substance."

The study of the palæontological and biological sciences has revolutionized modern knowledge. The attention to system and detail, which *savans* of a past generation so carefully bestowed upon animals and plants, is now producing its good fruits, and the confused mass of facts and observations which have been collected is now giving place to wide and comprehensive generalizations. The mind of modern scientific men has been "slowly and insensibly withdrawn from imaginary pictures of catastrophes and chaotic confusion, such as had haunted the imagination of the early cosmogonists. Numerous proofs have been discovered of the tranquil deposition of sedimentary matter, and the slow and successive development of organic life." He who has studied the subject with care, quits it with the consciousness that he has learnt the important lesson that, however specialized and modified man's structure, he still retains within him the remnants of the old primæval *idea*, the old patterns, exemplars, and archetypes of being, in whose perfect image he was originally designed; however remote in point of time he may be from the earliest incarnation of life on this globe, he still bears traces in his early career of a close analogy to the lowest organized monad; and, above all, he, from the simple elements of the originally created spinal chord in the lower vertebrata, has developed a complex organ of thought far surpassing that possessed by any other animal form.

I am, Sir, your obedient servant,

CHARLES CARTER BLAKE.

GLACIERS IN WALES.

By PROFESSOR A. C. RAMSAY, F.R.S., F.G.S.

In the year 1851 I read a paper before the Geological Society "On the Superficial Accumulations and Surface-markings in North Wales," in which I attempted to show that there had been two glacier epochs in that country, one before, and the other after the deposition of the boulder drift, which was ploughed out of some of the larger valleys by the secondhand smaller set of glaciers; and in a later work on the old glaciers of North Wales, I went further, showing that cold sufficient to form glaciers lasted during the whole time of submergence and emergence, both when the higher mountain-tops stood out of the sea as a cluster of small islands, and afterwards when the whole land rose out of the water.

The first of these memoirs touched on several subjects not immediately connected with the glaciation of Wales, though bearing in a larger sense on the same Geological period, and on the same set of questions. This the Council of the Geological Society decided not to print in their Journal, on the ground that it was too speculative—an opinion with which, in a great measure, I now coincide. One