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"Thou on my head in early youth didst smile,
And though rebellious and perverse meanwhile,
Thou hast not left me, oft as I left thee ;
On to the close, O Lord, abide with me !

"I need thy presence every passing hour,
What but thy grace can foil the tempter's power ?
Who like thyself my guide and stay can be ?
Through cloud and sunshine, oh abide with me !

"I fear no foe with thee at hand to bless,
Ills have no weight, and tears no bitterness.
Where is death's sting ? Where, grave, thy victory ?
I triumph still, if thou abide with me.

"Hold then thy cross before my closing eyes,
Shine through the gloom and point me to the skies ;
Heaven's morning breaks, and earth's vain shadows flee, —
In life and death, O Lord, abide with me."

This was his last hymn on earth. He reached Nice, and shortly after his spirit entered into rest. He pointed upward as he passed away, and whispered, "Peace, joy !" Thus he went to abide forever with him, who has declared it to be his divine will that his followers be with him where he is, that they may behold his glory.

ARTICLE VIII.

THE RELATIONS OF GEOLOGY TO THEOLOGY.

BY PROF. C. H. HITCHCOCK, NEW YORK CITY.

THE object of the following pages is to present the relations of Geology to the several doctrines of Theology in their natural order. It is not necessary now to apologize for attempting to illustrate revelation by science. Thanks to honored names that battle has been fought, and the natural sciences are now copiously employed for the defence and illustration of religious truth. Few of the sciences afford better illustrations of biblical statement than geology. Its

principles, though recently established, have modified the common interpretation of several passages, and may elucidate them still further in the future. We do not need to come secretly into the cabinet, and stealthily inquire what nature means. The God of nature is the God of grace also; and therefore we may come boldly into the presence of either after converse with the other, for the foundation principles of both governments are the same. We may, therefore, reason from one mode of the divine administration to the other; we may derive stable conclusions from a major scientific and a minor moral premise, and the reverse. We may proceed from cause to effect, rather than reason from the effects to the causes, if thereby we shall acquire more knowledge. So important are the inferences, that we are glad to appeal to induction or deduction, philology, history, ethnology, geology, astronomy, and all the natural sciences. Nor must it be forgotten that light may be given by the Divine Spirit, for we believe that if "any man will do his will he shall know of the doctrine," whether it be religious or scientific. The true philosopher is conscious of the peril of trusting to his own wisdom, and seeks aid from above. May the spirit that inspired the evangelists permeate these inquiries with the leaven of truth! We shall attempt to establish the following proposition in detail: The facts and principles of geology prove, illustrate, and elucidate many of the doctrines of natural and biblical theology.

I. Geology furnishes peculiar arguments for the existence of God. The arguments most relied upon to prove the existence of God are of the *a posteriori* type, and are briefly these: 1. The existence of matter and finite mind proves a *Creator*; 2. The continuance of matter and finite mind proves a *Preserver*; 3. The movements of matter and the action of finite mind prove a *Governor*; 4. Design in the works of nature proves a *Designer*. These arguments are each made more impressive in detail, when it is considered that the world has existed for ages before historic times, sustaining successive tribes of organic life. These have each been created, pre-

served, governed, and fashioned by divine skill. The hand of God may be discerned in the life of every successive period. These views are specially adapted to the understanding of common minds, and may be advantageously employed in popular discourses where *a priori* and abstract discussions may be worse than useless. We will not go over the beaten track of natural theology, but simply specify what peculiar arguments for the existence of God are furnished by geology.

Arguments for a Creator.

We will present arguments for a Creator derived both from the inorganic and organic worlds. And first, the existence of inorganic matter proves a Creator. If matter has existed from eternity, as many philosophers have believed, it has not been created, and therefore its presence does not prove a Creator. The ancients argued for the eternity of matter on the principle *ex nihilo nihil fit*. Their assumption was gratuitous. The time never was when infinite mind did not exist. A power has always existed competent to create matter. Without Deity the conclusion would be correct.

The best proof of the creation of matter, independently of natural science, is the principle that it does not exist of necessity. If not necessary it is not eternal, and therefore had a beginning. Now if we can follow back the history of matter to a time when we understand that its existence is incompatible with its necessary laws, we shall have proof of its creation, and can intelligently reason of its finite nature. We take the ground that the eternal existence of matter is impossible.

1. Organic life had a beginning. Following down the strata into the earth we see the remains of successive races of organisms, each one more simple, till in the oldest stratified rocks upon the globe are found the relics of the very simplest of the organic races. Earlier than the Laurentian no organisms could have existed.

2. Before the creation of life there was only one kingdom

in nature — the mineral or inorganic. This was in the condition of purely igneous fluidity.

3. Still earlier the matter of the earth was in the condition of intensely heated vapor, and according to the hypothesis of La Place the whole solar system was accumulated in one great revolving nebula.

4. The kindling of the nebula fire is supposed to be due to the action of chemical laws, — the atoms united by elective affinity thus producing light and heat. The theory does not necessarily imply that all matter existed originally in the form of uncombined elements, but they must have been more abundant than afterwards. These four points we assume without considering their proofs.

Matter cannot exist without chemical and physical laws. It is made of atoms, simple or compound. The full conception of atoms involves their peculiar affinities, size, and weight; that is, fundamental, chemical, and physical laws. We speak of mere matter or dead matter; but there is no such thing. The expression is figurative, denoting the absence of organisms. Any assemblage of particles in space must be affected by the law of gravity, the atoms must unite into compounds whenever brought near each other. The inevitable consequence of the action of these fundamental laws is revolution upon axis, and around other bodies if they are adjacent, heat, condensation, fusion, the combination of the atoms into crystals and an oblate or prolate sphere. These fundamental laws must continue to work until every atom is joined to its chosen companion, the sphere has become thoroughly cooled and consolidated. This must be the general result, with or without life. Hence the inference, that if matter had been eternal, these results would have been produced ages ago. Matter then is finite, — it was created; and hence there must have been a Creator.

It may be objected to the creation of matter that there has been an eternal succession of worlds and systems; that we see only a part of one great cycle, commencing with chemical action and ending in desolation; and that there is some law

of nature to resolve matter at the end of the cycle into the simple elements, when chemical action will recommence, and the same series of changes will again take place, including the introduction of organisms.

The reply from science to this objection is, that she knows of no law adequate to change the complex compounds at the end of one cycle into the nascent elements of the new series. It would require the superintending hand of a power above nature to effect this result. Moreover, the commencement of the first cycle is not accounted for on the supposition of an infinite series of cycles. The first kindling of the atomic fires still remain for a creative hand.

Paleontological arguments. Three distinct forms of the proof of the existence of a Creator may be derived from the paleontological history of animals.

A. The institution of the animal and vegetable kingdoms in nature proves the existence of a Creator. The distinctions between the inorganic and organic kingdoms are well marked. Except by a power from without, the atoms can never arrange themselves in any higher form than that of crystals. But the principle of life can combine the inorganic elements into substances unknown in the mineral kingdom. Without the life-force carbon would never occur in the condition of coal; it would have remained, invisibly combined in the gas, carbonic acid. The vital forces have decomposed the acid retaining the carbon, and setting free the oxygen. Now what produces this organic power? Is it contained in the atoms like gravity and elective affinity? No. Life is a power superior to the blind forces of matter, and acting in a totally different sphere. Inferior causes do not produce effects above themselves. The vital and physical forces are convertible only through the medium of organisms, and the origin of the vital is utterly beyond the limits of human science.¹ Life, then, had a beginning upon our globe, and it came not from the laws of nature; it was bestowed upon matter by an infinite mind.

¹ American Journal of Science, (2d series), Vol. xxviii. p. 319. Vol. xxx. p. 41.

B. The succession of systems of life evinces the hand of a Creator. Geology teaches that there have been several distinct systems of life and action upon the globe. The oldest economy of which we have traces is that of the Laurentian period in which plants were coupled with the very simplest forms of animal life, inferior even to corallines. In the next system, the Cambrian, there are sea-weeds, worms, and the most inferior of the crustacea. The third shows in comparative profusion crustacea, inferior mollusca, etc. The succeeding systems exhibit marked progress. The higher organisms gradually appeared, essentially in the order of their rank. There were no trees till the Devonian period, and those of low grade. Insects and reptiles came with trees, increasing in perfection equally with the forests. Fishes preceded reptiles and birds, but followed cephalopods. Birds succeeded reptiles, to be followed last of all by mammals. The doctrine of organic progression implies that complexity and perfection of organization increase as we ascend in the rocks, that numerous and successive systems of life, all differing from one another, have occupied the globe, and that these minor systems of life are but harmonious parts of one all-comprehending system of organization, whose culmination is witnessed in existing nature. The fact that each system has been suddenly introduced as a whole, not by single interpolations of species, indicates some general cause for its production, and in our view proves successive creations from an almighty hand. When life had been exterminated, an exigency existed which demanded a being of infinite power to create and adapt to novel circumstances new races. The paleozoic atmosphere was heavily charged with carbonic acid, and the paleozoic animals could breathe it with impunity. Not till the carbon had been condensed into coal-beds was the atmosphere sufficiently purified to allow large air-breathers to flourish. Every economy had its peculiarities to which the several families of animals were skilfully adapted.

C. The creation of man was a divine work. Man the most perfect of the animals was introduced last. He could not

have lived in many of the previous aeons on account of insalubrious climates, disagreeable associations, and unproductive soils. He appears suddenly upon the arena with nothing to connect him physically or mentally with previously existing animals. It is the grandest event in the earth's history. None of the previous races had possessed moral natures, nor mental, except in a limited degree, nor the power of speech. The creation of man, with endowments entirely different from those already existing, demands a divine Creator; for what else could meet the exigency?

Objection to C. Man was developed from the ape by principles of natural selection. The apes began to speak, speech developed mind and soul, and the body was gradually adapted to the wants of the mind.

Answer. The zoological distinctions between man and the apes are greater than can be possible between members of the same family or order. Therefore the one has not been developed from the other.

In the classification of the animal kingdom we have first the five grand types, then the classes, and thirdly the orders. Classes are characterized by the manner in which the plan of the structure of the respective types is executed; orders by the degrees of complication of class structure. The differences between man and the most perfect ape, the gorilla, are those of *degree*. Consequently man constitutes by himself a distinct zoological order, called *Bimana* (Blumenbach), *Archencephala* (Owen), or *Archont* (Dana). Now if man belongs to a distinct order from the apes, you cannot transform one into the other short of a score of gradations, entirely wanting in nature. The ape has four feet resembling hands; man has two hands and two feet. Man is the sole animal that uses only two extremities for locomotion, birds not excepted, because their forward extremities are changed to wings. Man's anterior extremities have been transferred from the locomotive to the *cephalic* series; that is, are made to attend to the wants of the head exclusively, and not to assist in locomotion also, as in the apes. Man's hands supply the

cravings of appetite, and execute the desires of the mind, the latter wants never being attained by the brutes. The anterior extremities of the ape assist in locomotion, not one of them walking erect naturally. And the erect posture of man is the natural effect of his superior physical structure. Now this *cephalization*, this subordination of the members and structure of the anterior part of the body to the head, is a difference in degree, constituting an order. Professor Dana has recently shown¹ that the same cephalic distinctions exist throughout the animal kingdom, and may be made the basis of an improved classification.¹

Objection to B. The principles of variation, natural selection, and other forces in nature will account for the transmutation of the first system of life into the second, the second into the third, and so on. This is the doctrine known as Darwinism, and the development theory. Darwin suggests that each great division of the animal kingdom may have originated in a single progenitor — say four or five in all, — and analogy would lead him one step further to believe “that all animals and plants have descended from some one prototype,” and that “into this one primordial form life was first [created] breathed.”

Answer. To answer this objection in detail would require statements of numerous zoölogical facts not within the proper limits or province of this Article. This theory has found some able advocates, but the weight of authority is against it, and, in our view, as a scientific explanation of all the facts it utterly fails. It comes within our province to allude to the proofs assumed for this theory from geology. Strange to say its advocates admit that most geological facts are pitted against it. Says Darwin: “Why then is not every geological formation and every stratum full of such intermediate links? Geology assuredly does not reveal any such finely graduated organic chain; and this, perhaps, is the most obvious and gravest objection which can be urged

¹ American Journal of Science, (2d series) Vol. xxvi. pp. 321, 440; Vol. xxvii. pp. 10, 157.

against my theory. The explanation lies, as I believe, in the extreme imperfection of the geological record.”¹ “He who rejects these views [the extreme imperfection] on the nature of the geological record will rightly reject my whole theory.”²

The very first evidence in favor of the theory to be expected from geology, is the discovery of the intermediate links, or the animals and plants connecting together different families and orders. There are fully thirty thousand described species of fossil plants and animals, but such links as are required by the development theory to connect any two different classes have never yet been discovered. There are seventeen classes in the animal kingdom, but no two of them have been brought into the chain by the discovery of these thirty thousand forms; therefore there are thirty thousand chances to one that the missing links will never be found. To account for the deficiencies they say that the geological record is imperfect, and that time will produce them. This is very unsatisfactory to the philosopher. The true geological inferences in reference to the origin of the different systems have been stated under B. The little aid afforded Darwinism by paleontology explains why its advocates are chiefly naturalists, not geologists.

But granting the truth of Darwinism, or any judicious modification of its principles, the foundation of our argument is rather strengthened than destroyed. The theory of development may be used like the nebular hypothesis. The latter was devised by La Place to sustain atheism, but after being avoided by theologians as long as possible, has been generally adopted by them, and is turned against its original friends. Hence we say to the development school, go on with your investigations, and if you succeed in establishing your principles we will use your theory for illustrating the argument for the existence of God.

The theory accounts for the origin of the different systems of life by the action of various laws. It is a law of nature

¹ *Origin of Species* (Amer. ed.), p. 246.

² *Origin of Species*, p. 298.

that system shall succeed system, each an improvement upon the preceding, and that all organisms shall be developed in an unbroken series from one or more primordial forms. It is a law that the systems shall be gradually changed into one another without divine interposition. The track has been laid in which the wheels will always run, aided only by the original impetus. A system of progress in which remarkable events of diverse nature are ordained to succeed one another harmoniously, is more wonderful than one where an interposing agency is required to repair damages. When the type have been set up for the printing of a commentary they cannot be used to publish a lexicon without rearrangement. If there was a self-acting machine, capable of rearranging the type in their new combinations at the instant the last sheet of the commentary was struck off, it would be a more wonderful contrivance than the old-fashioned mode of laboriously resetting the type by the interposition of printers. So a system of nature that will provide for all emergencies without interposition is more wonderful, and calls more loudly for a Creator, than the theory which demands occasional aid from a power above law.

Objection to A. There are germs and tendencies in matter to produce organisms, and these will produce others upon Darwinian principles. This objector goes a step further back than Darwin. He makes an assumption without proof. If it were true, with such quantities of matter around us, we should constantly see examples of the production of organisms; and the waste rocks, soils, and reefs that now abound would teem with verdure and life.

To change the inorganic to the organic is a far more difficult task than to develop a monad into an elephant. Physical forces are convertible into vital only through the medium of an organized fabric. Man can produce varieties in organisms, but cannot in any known way create life.

But without further discussion we would say, as in the answer to the previous objection, if it be true that forces adequate to produce organisms reside in matter, and that

life has appeared in consequence of their action, we derive a stronger argument for the existence of God than in any other way. For who endowed matter with those wonderful properties, capable of developing life, reason, and a series of organisms, containing infinite complications, for ages investigated by the mightiest intellects, and not yet wholly comprehended? Whoever endowed matter with these properties also designated the epochs when the forces should operate, some interminably, others intermittently. He arranged for the advent of disturbing forces which remained dormant for millions of years after the beginning of life. And if these arrangements were all provided for in the tendencies of matter, it does not concern the argument for a Creator, if the plan was executed by second causes. God made the forces, and ordained that they should produce life and systems. The work is his, even if deputed to subordinates. This objector cannot urge the eternity of matter, for he assumes a beginning to organic life of necessity, and matter could not have existed always without producing developments; and, as before shown, the world ere this must have passed beyond the organic cycle to inorganic desolation if these tendencies existed.

Arguments from Design.

The adaptation of means to ends observable in the history of the earth, proves the existence of an adapting cause. When we perceive order, harmony, or adaptation of means to ends in any human work, we at once refer the contrivance to mind. Wisdom has suggested and the hands have executed the plan. Hence when we observe order and adaptation in nature, we immediately refer them to the mind of the author of nature. The reference is instinctive, while the ground of the feeling may be in our experience of the origin of human contrivance.

There were thousands of special illustrations of the adaptation of means to ends in the early history of the world. They were in the structure of every animal and plant, in the

fitnesses of each part for its own functions and their relations to the whole body. These illustrations as derived from living examples, have been frequently employed by theologians. Although we might argue from the structure of each fossil in almost the same words, we pass by the readiest elucidations of the argument to notice others peculiar to geology. We shall only attempt to point out a few features of the plan in the physical structure of organisms.

A. All organisms from the very first have been constructed upon the same general uniform plan. We will illustrate from a single division of the animal kingdom. The study of the different vertebrate animals shows a wonderful unity running through the whole series. Every bone has its particular use and shape, varying in the several classes according to the habits and modes of life. The bones of the forward extremities are homologous, the same in number, but of different shape, in the hand of man, the paw of the lion, the wing of the bat and bird, and the paddle of the whale. The whole series is therefore constructed upon a plan, every part adapted to its place in the grand system. It is the discovery of the details of this plan of structure to which the efforts of naturalists are directed. They are striving to attain to the perfection of the divine idea in contriving the system. On account of this uniform plan the paleontologist can refer specimens of the remains of animals to their proper place in the series; and whenever certain parts of animals are brought to him, he can refer them to their appropriate place, even if they are something unexpected. Thus when tracks of gigantic birds were discovered at Northampton by the father of Ichnology, although totally unprecedented, he did not shrink from announcing to the world the existence, in the Triassic period, of birds four times the size of the largest living species. The footprints corresponded to those of birds, therefore the animals that made them must have been birds. There was no other place in the series for them. Guided by the same principles several years later, when Professor Owen received from New Zealand a broken bone a few inches long, he

pronounced it the femur of a gigantic bird like Brontozoum. Its form showed it to belong to that particular place in the series; and his confidence in the uniformity of the plan led him to risk his reputation upon the result, though earnestly entreated by his friends to desist. The Brontozoum and Dinornis are now household names in science.

The study of fossil remains has brought to light curious types of animals now extinct. We have no living representatives of the trilobites, reptilian birds, iguanodon, ichthyosaurus, and whole families of reptiles. These missing forms have their places in the great system; they fill up gaps in the series. To have contrived the intricate structure of the animal kingdom demanded more skill, more discernment of nice adaptation of means to ends, more balancing of delicate adjustments, than any other department of nature. Therefore to have designed a uniform plan in accordance with which all organic beings are constructed must have required infinite skill; and this attribute belongs to mind, not matter.

Objection. The organic chain has been constructed by the laws of nature, one organism developed from another on Darwinism principles.

Answer. The development theory does not oppose our argument. Whence came the laws? Who ordered the system of nature so wondrously that polyp could change to echinus, echinus to mollusk, etc.? Who adapted the system of laws so that these harmonies resulted? It was mind. The development theory presents arguments for the existence of God as forcibly as the idea of progression. To many minds the argument from development would be indicative of more elaborate design.

B. There is a parallelism between the geological succession of animals and plants and their relative standing in classification.¹ This is equivalent to saying that the first organisms were the simplest, and the more complex were gradually introduced in the order of their rank. We may refer for a

¹ Contributions to the Natural History of the United States, by L. Agassiz, Part I. p. 108.

few details upon this subject to the subsequent pages of this Article.

C. Many of the fossil animals combined with their own characteristics some of those of other and higher classes not yet created. Though intermediate, they never occupy the middle point, as they properly belong to one of the two. Thus they were prophetic of the higher classes, and have been called synthetic or comprehensive. All the great vertebrate classes had their prophetic representatives in the age previous to that of their maximum development. The mammals were foreshadowed by the marsupials, who combine avian or reptilian with mammiferous characters, a few of whom lived in Triassic times. Birds were prefigured by the reptilian birds of the Connecticut sandstone. The Dicynodontia were reptiles having a pair of tusks growing downwards from the lower jaw like the mammalian walrus. The ichtyosaurus was reptilian and piscine. The labyrinthodon was batrachian with certain reptilian bones and ganoid teeth. The earliest fishes were sauroid, having reptilian characteristics. The sauroids were Devonian, but true fishes were first seen in mesozoic strata. Some of man's characteristics were foreshadowed in the mammals.

D. The adaptations of the physical world to the structure of the inhabitants in every age were very marked. In the Silurian age the climate was ultra-torrid; there were no mountains, the land was low and marshy, the air was thick with vapors and foul with carbonic acid, winds and storms were scarce. The inhabitants were low algae, corals, shells, and trilobites,—vegetative animals, perfectly adapted to their concomitants.

In the Jurassic period the sun shone, clouds and storms agitated the atmosphere; carbonic acid had been condensed into coal-beds; enormous air-breathing reptiles and voracious birds crowded the air, water, and marshes; carnivorous mollusks and insects peopled the estuaries and thickets. The Jurassic animals could not have flourished in the Silurian age, and most of the Silurian organisms would have fared

poorly in the later period. Every system of creation had its peculiar adaptations to the varying state of the world.

The whole series of systems constituted harmonious parts of one whole, and all the agencies were fitted to accomplish one grand result — preparation of the soil, climate, and surface for the advent of man. Death was present in order to maintain the system of reproduction, and carnivorous animals were nature's police to keep down the excess of population. All the agencies were adapted to accomplish specific purposes; and as we see them one after another, we realize that the fitness of each thing for every other was contrived by an infinite designer.

II. Geology proves and illustrates the natural and moral attributes of God. Certain geological facts may be employed to prove and illustrate such natural attributes as the personality, self-existence, omnipotence, omniscience, omnipresence, unity, immutability, and eternity of God. The argumentation would be similar to that now employed by theologians, and therefore need not be stated here. Under the general term "benevolence" we include all the moral attributes.

Natural evils. Objection is made to the benevolence of God on account of the existence in the pre-adamic world of natural evils, such as death among animals and plants, pain, extremes of climate, deserts, deformity or absence of beauty, earthquakes, and volcanic eruptions. We take the ground that these evils were incidental, and sometimes essential to the stability of the system, with its present laws. Now if we show that these so-called evils are decidedly beneficial to the system, the objection to the divine benevolence is removed. We have no proof of the existence of moral evil or sin in the world before man.

1. *Pain and death.* The amount of susceptibility to pleasure and pain possessed by animals, denotes their relative place in the scale of life. The polyps may lose portions of their bodies, or be divided into fragments, yet the original animal does not appear to notice the injury, and each one of the parts may become a new animal. But man at the other

end of the scale may be killed by the point of a needle. The animals intermediate possess different degrees of susceptibility to pain or pleasure, but the one is always the exact measure of the other. We do not know of any way in which physical pleasure can be enjoyed, without implying the presence of susceptibility to pain. Death existed among the early animals. This is proved by the myriads of their remains in the rocks, by the succession of groups, by the presence of carnivorous animals who could not subsist upon vegetables, and by the discovery of animal food within the bodies of petrified carnivores. Many rocks are, to a great extent, composed of the remains of dead animals. The idea of reproduction implies death. The races when created were directed to increase and multiply, which command involves death. Plants were introduced with seeds in them; this implies the death of the plant. All organic life constitutes a cycle; first the germ or seed, then the embryo, the young, the adult, and then the seed to be developed as before, while the adult soon disappears. There is death during the entire lives of animals. Old matter is thrown away; as in man, the whole body is replaced every seven years. The office of plants is to convert mineral atoms into organic substance. They derive sustenance directly from the mineral kingdom, while animals can obtain their subsistence only from organized matter. Hence the existence of herbivores implies the death of plants.

The plant, as it grows, assimilates carbon from the decomposition of carbonic acid in the atmosphere. When it decays carbonic acid is formed by the union of the carbon with oxygen of the air, exactly as much as was consumed in its growth. Thus the chemical changes exactly balance each other. The same is true of the relations of plant-food to animals. The carbon assists in forming the bulk of animals, and when they decay it combines with the oxygen again. The higher carnivorous quadrupeds and the larvae of insects feed upon other animals, both the living flesh and dead carcasses. The flesh-worms and maggots serve to prevent

putrefaction, and thus the return of the highest organized flesh to the inorganic kingdom in the decline of the cycle is accomplished gradually, just as the ascent through plants and low animals was by degrees. The decomposition of bulky carcasses would render the air and water foul, and destructive to many species, did not the scavengers purify them, both by the removal and subdivision of the filth, so as to be readily assimilated by plants. Thus the carnivores preserve the balance of nature, both by checking excessive multiplication and preparing decaying bodies for plant-food.

Death to animals is a benevolent provision. Those killed by carnivores suffer very little, as their death is not anticipated, and they do not grieve at leaving their companions. Besides there is more pleasure on the whole to many races rapidly succeeding one another than to a few long continued. For the young of all animals enjoy more in the same period of time than their elders, on account of superior health, vigor, and the novelty of the scenes before them; and a succession of races enables a larger number to live in the time of vivid enjoyment, and thus the sum total of happiness is greater. Such are spared the feebleness of old age. Death by violence to unreasoning animals is the easiest of all the modes. If animals were immortal, there would have been little happiness among them as soon as the world was overstocked. There would have been suffering for want of food, and besides, immortality would have been impossible to those who were devoured. Plants are incapable of suffering.

It is difficult to see how occasional death could be avoided in a world like ours where the lightning may strike, the earthquake swallow up, the tornado devastate, tempestuous waves wash up marine animals beyond the reach of returning tides, and the torrents overwhelm. Especially would this be true when changes of level accompanied geological catastrophes. These may or may not have been violent, but their uniform result has been the complete or partial extermination of life. None of these calamities could have been averted without great injury to the earth. Death was an incidental

result of a series of events that were highly beneficial to the earth.

2. *Extremes of climate.* Tropical heat was more common than arctic cold in early times. Both extremes depend upon fundamental laws—heat, the position of the sun, distribution of land and water, and very slightly the internal fires. To have varied these extremes would have made the mean temperature disagreeable. Without arctic dry land we should have warmer winters but colder summers, a sort of Fuegian climate. A warmer air produced from the internal heat would have given a thinner crust with more earthquakes. There were races specially fitted to flourish in both extremes. Cold storms and winds may seem evils, but they are needed for the vegetable kingdom.

3. *Deserts.* It is a law of Meteorology that warm air absorbs more moisture than cold. Warm air in a cold place precipitates its moisture as rain and mist. Cold air carried over a warm region will absorb more moisture. This is the law that gives rain. Upon examination it will prove that most deserts are rendered sterile by the absence of rain. The winds passing over them are colder than the country, and consequently carry away the moisture to discharge it more abundantly elsewhere. This is why northern Africa is sterile and southern Europe fertile. Without this law the whole earth would be a desert. With it the surface is diversified; but evil and good both prevail, the result of a beneficial law, but the good vastly predominates.

4. *Deformity and absence of beauty.* It is rare to find a perfect leaf in nature; fruit is often blasted, many productions are abortive, mineral crystals are the exceptions, while many rocks are crystalline, the great animals have been ugly and fierce, the reptilian age abounded with monsters, etc. Now these are more negative than positive evils, and they exist at the present day as well as previously. We may doubt whether the variations of leaves are evils. Though perfection is rare, the infinite variations produce pleasures. Uniformity might be distressing. Blasted and abortive vegetable pro-

ductions are commonly due to improper situations: a deficiency in air, light, heat, moisture, or fertilizers. Crystalline perfection would have been a practical imperfection; for granite and other rocks would be worthless for building-stones, because rendered brittle. Many animals and plants may seem ugly to us, while they are perfectly adapted to their habitats. A perfect system will be admirable and beautiful as a whole, yet some of its subordinate features may not be so. A bright color upon many defenceless animals would point out their presence to their enemies. As there is always a beauty of adaptation, we do not need in every case to find elegance of form and color. The right thing in the right place is always beautiful to the sense if not the eye, especially since the great majority of animals and plants in all ages of the world have been beautiful and attractive.

5. *Earthquakes.* Earthquakes result from the expansive tendencies of volcanic matter confined beneath the surface. If the lava can discharge itself readily there may be no quakings; but if the proper vents are obstructed the crust may be violently disturbed. The laws that ordain earthquakes have elevated continents and mountains out of the ocean; have permitted the accumulation of stores of coal, limestone, and the metals; have given us streams of water and petroleum, and diversified the surface with scenery.

It appears, then, from a review of the principal physical evils existing before man, that they were involved in the fundamental laws of nature as incidental effects. The design of these laws was to benefit the world, but, as arranged, they cannot be executed without inducing these so-called evils. It is a very simple law that heated bodies will contract upon cooling; but its action has produced faults and foldings in the crust, earthquakes, extremes of climate, and the extermination of systems of life; yet even these evils have produced beneficial results not attainable in any other known way. Hence they cannot be regarded as indicating malevolence or absence of benevolence in Deity. Geology is not concerned to say why a system containing incidental evils should have been employed in preference to others.

Benevolence of God. The past systems of life, like the present, are full of evidences of the benevolence of God. Some of the geological arguments are peculiar, and others are common to all ages and conditions of the world.

A. Pleasure has been the rule and pain the exception in the lives of all the early races. Without appealing to particulars such is the general impression received by every interpreter of nature, whatever his theories.

(a) An incidental design of every bodily contrivance has been to produce happiness. The nerves were designed to make animals perceive objects, to regulate the muscles by the will, to control the action of the different organs, and all these operations are pleasurable. The senses enable timid animals to become aware of and avoid danger. No anatomist can put his finger upon any nerve, muscle, vein, artery, or lymphatic of existing or extinct constitutions, and say this particular organ was designed to produce suffering and derangement in the system. We find instances where there has been suffering, but they were marked exceptions, like the fewness of invalids compared with persons in good health. But some animals were provided with the means of destroying life, others had poisonous fangs and stings. These organs were intended partly to provide sustenance, and partly for self-defence, the only suffering being among the victims. These were exceptions to the general rule, and, as before shown, the pain was slight in the sum total of happiness.

(b) Organic functions have produced pleasure where pain is just as consistent with their perfect action. Consider the action of the senses. Taste, hearing, sight, and smelling were all positively agreeable, and often delightful. Objects offensive to the senses could generally be avoided. Now the senses might have been constructed so that every sound would have been harsh, every mouthful bitter, every odor repulsive, yet the wants of nature would have impelled their exercise. The action of the muscles might have been made painful, and the involuntary movements might have been accompanied with neuralgic twinges; but there is no evi-

dence of pain in the exercise of any organ when in a healthy state.

(c.) A variety of means have been provided for the performance of important animal functions. Most animals have a large number of extremities, so that if one or more of them is injured the power of walking and feeding is scarcely impaired. The crab may lose some of its members in casting the shell, but suffers very little in consequence, as some of the other parts perform the functions of those wanting. Arteries when lacerated can be tied up, and the blood will find its way through the system by other channels. The lower animals can devour food through their mouths, or absorb it through pores in the skin. In case of injury the secretive organs can increase their action so as to afford an unusual supply of new material. Extraordinary provision is made for the reproduction of species. There are no less than five different modes. The higher tribes may use but one, while some of the inferior classes can employ several. And most animals have the ability to adapt themselves to varied circumstances. These proofs, though derived from existing nature, apply with equal force to the early races.

(d.) The successive systems of life have been perfectly adapted to the varying conditions of the globe through every period. No two life-systems could have exchanged places and flourish, on account of the different states of the earth and climate. While animals can adapt themselves to new circumstances to some degree, these limits are not extensive. Slight changes in climate, situation, and food will engulf a whole system in a cataclysm. Therefore great wisdom was required to adapt each system to the varying conditions, and benevolence to order that the delicate machinery of organic structure should be kindly adjusted. A being without benevolence would not have troubled himself to provide for the pleasant adaptation of dumb beasts and worms to the changing climates and variable atmosphere.

B. The natural evils existing in the system have been rendered the means of good to the earth and its inhabitants.

The benefits resulting from some of them have been mentioned. Death was found to be essential to preserve the balance of nature and prevent the over-crowding of the population. The general climate would not have been improved by the abolishment of the extremes. The deserts were the means of rendering large tracts of land more fertile. Deformities and absence of beauty were seen to be harmonious, and earthquakes a benevolent provision because they prevented the occurrence of overwhelming catastrophes. Eruptions from volcanoes were connected with earthquakes, and have been repeatedly quoted to prove the divine benevolence. Besides these, certain other apparent evils evidence benevolence.

(a) The disturbed, broken, and overturned condition of the earth's crust. Investigation proves these disturbances to have been produced according to law. Great lateral forces have pushed up parallel chains of mountains, while subsequent denudation has given the surface its present uneven contour. The overturns of the strata are not obvious without study. Except for these upheavings we should have been without mountains, valleys, and consequently without natural scenery, rain, springs of water, and should have been unable to reach the valuable ores and minerals stored away in the crust. Who, then, will call these commotions evils? They are rather blessings. They have been essential to the fitting up of the earth for the residence of man.

(b) The desolating effects of ice and water in the drift period. In all high northern and southern latitudes the whole surface has been scoured down by ice, ledges have been broken, mountains truncated, and the fragments spread over the low grounds. But this tremendous rasping has been remarkably beneficial. It has produced soils, without which man could not exist. The rocks have been pulverized, fertile elements extracted, long successions of trees and herbs have accumulated vegetable mould, and the apparent decay and ruin speak eloquently of the goodness of God. Without this agency the mountains and hills would have been sur-

mounted with sharp pinnacles, like those of the Alps, and sometimes covered with perpetual snow. There would have been little alluvium in the valleys, their floors would have been bare rocks, upon which trees could hardly find a foothold. The grinding, degrading, and assorting agencies have been necessary to render the world habitable for man. Doubtless similar agencies were employed less energetically to fit the ancient continents for the accommodation of the by-gone systems.

C. Vast cavities in the earth have been filled with immense supplies of metals, coal, petroleum, salt, lime, gypsum, etc., for the benefit of man ages before his existence. This may be called prospective benevolence. These substances were of no use to the primitive inhabitants of the earth; they were designed for the benefit of those who had skill to work the ores, and apply the metals to the wants of every-day life.

(a) *Metals.* These are distributed according to their need. No metal is so useful as iron, and none is so widely distributed through the rocks. It was deposited in every age, and occurs in every condition, from the tough crystalline ores of Lake Champlain to the accumulations in alluvial bogs. The principal iron works of our country are where the ore and the fuel necessary to smelt it occur near together. The ores need to be reduced, and thus there is a requisition upon the inventive genius and practical skill of man to devise the best methods. Perhaps the next valuable metals are lead, copper, and zinc; and these are less commonly diffused than iron, but more abundantly than tin, manganese, mercury, and the precious metals. The latter being universally desirable are widely spread, but in much smaller quantities. Gold, silver, and platinum in the metallic state, both occupy veins in the rocks and are disseminated through beds of gravel. They appear not to have been even injected into the veins till shortly before the advent of man. The precious metals were designed specially for man's benefit, for they were of no use to the fishes, mollusks and crustaceans of early times. When scattered through beds of gravel, machinery can separate

them from the base earth, and thus even the poorest tribes can extract them for the purposes of trade.

(b) *Coal*. If an intelligent being had visited the world in the carboniferous period, and seen the immense forests now converted into coal, he might have asked to what purpose is all this waste, since there are no mental natures to enjoy its beauties? But the nineteenth century can answer his question. The immense forests of sigillariae, lepidodendra, cycads, etc., have not only purified the atmosphere by the withdrawal of a deadly gas, but have been stored up as a fossil fuel for the benefit of factories, steamships, railroads, and dwelling-houses. We are warmed, fed, and clothed by its aid. There are not less than four million millions of tons of coal in North America alone, twenty-one times as much as in Great Britain. Ninety-two million seven hundred and eighty-seven thousand eight hundred and seventy-three tons of coal were raised in Great Britain in 1866; and at the same time the State of Pennsylvania produced twelve million six hundred and ninety-eight thousand five hundred and thirty-two tons. There is enough coal in the world to last for hundreds of thousands of years at the present rates of consumption. Who can doubt that prospective benevolence prepared these immense deposits for the age of mind?

(c) *Petroleum*. As fast as new wants are felt the same kind hand opens new reservoirs of supply. Very much of the material used for illumination had been derived from whales; but these animals are becoming so scarce that the world can no longer depend upon this source. To meet this scarcity, within a few years immense reservoirs of natural oil or petroleum have been discovered west of the Alleghanies. By sinking bore-holes a few hundred feet into the rock in certain localities, streams of oil will spout forth. I have seen such a stream produce two thousand barrels per day, and larger ones have been known. The yield for 1864 in the United States, was eighty-seven million gallons; and for four years, beginning with 1861, two hundred and twenty-one million gallons. The value of that obtained in 1864 is

estimated at forty million three hundred thousand dollars. The annual sales of petroleum in this country equal those of either coal or iron, and there is no reason to expect a serious diminution of the supply at present. Hence this new business must not be considered a financial bubble, ready to burst when monetary difficulties arise.

(d) Similar supplies of limestone, gypsum, rock salt, guano, bitumen, clay, and other substances have been stored in the earth for man's benefit.

(e) *Water*. We should expect such an unstable element as water to be very unequally distributed on the surface, but it abounds wherever man sets up his habitation. The grand source of water is rain. This percolates the earth and either remains upon the surface forming lakes, ponds, and streams, or occupies cavities and particular strata in the earth. The layers, both of the surface deposits and solid rocks, are of two kinds, those pervious and impervious to water. Those that are impervious hold the water trickling down from the surface in natural cisterns at various depths. Man penetrates to these cisterns or wells, and derives from them in purity the element so necessary to his existence. Viewed as conservators of water, the alternations of gravel, sand, and clay, so often exposed in cuttings, and so little esteemed, assume a new importance. They have been arranged in alternating order by an all-wise hand, prospectively for the benefit of man.

D. The general stability and security of the present system of life and action proves the divine benevolence. When one reads of the numerous revolutions in the crust of the earth, its elevations and depressions, the fractures, foldings, and inversions of the strata, the numerous injections of melted lava into fissures and the repeated extermination of life, he is apt to imagine the whole history a "grand tossing, rending, recomposing process, a world rolling down through gulfs and fiery cataclysms." But these striking events were occasional during ages of quiet action, and were manifested more by the changes of life than violent action. And these changes

have been less frequent in the Cenozoic than any of the earlier periods. The present state of the globe is one of permanent stability and security, although there may be slight earthquake-jars, and slow changes of level. The variations in the climate within historic times have been chiefly caused by man's agency, and the surface temperature is not appreciably affected by the internal igneous nucleus. This permanence and security is essential to the existence and well-being of all organic nature. And it must have required infinite wisdom and benevolence so to adjust all the elements of change in the system that they should balance one another and secure a quiet habitation for hundreds of generations. The same benevolence has also thus kindly provided for each of the pre-existing systems similar exemption from evil, till the time came for the introduction of a new dispensation. At present the world contains more organisms of delicate and complicated structure than at any previous period.

These four arguments, each of whose subdivisions is really a separate proof, offer convincing evidence of the existence of benevolence in Deity. They are the more important because drawn from a field at the first view unpromising. Their force will augment with the growing perfection of the sciences.

(To be continued.)